The European Proceedings of
Social & Behavioural Sciences
EpSBS

Future Academy ISSN: 2357-1330

http://dx.doi.org/10.15405/epsbs.2017.07.02.20

RRI 2016
International Conference «Responsible Research and Innovation»

INNOVATION NETWORKS: PROBLEMS AND PROSPECTS (RUSSIAN CASE STUDY)

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Abstract

The topologies of innovation network development in Russia are described in this article. Study was conductedin one of the Russian industrial leader JSC Academician M.F. Reshetnev “Information Satellite Systems”. Theoretical approaches to the network nature and classification are revealed herein. Some characteristics of innovation network as relatedness, centrality, and intensity were discussed in the article.“Information Satellite Systems” has a lot of branch and subsidiaries which form the innovation network of this enterprise. Research methodology consists of head of companies’ survey and interview and analyses of open information of firm functioning. Results of research show the vertical hierarchal-oriented innovation network with a low-degree of relatedness. Also anchor company ISS has a distinct network landscape with a focus on large vertically integrated, with a low degree of network connectivity, with the unexpressed (weak) links, where a key type of partnership is scientific collaboration with the base (dependent) subsidiary companies, universities and research institutes.

Keywords: Innovation networks, cluster, innovation regional system.

1. Introduction

In recent decades, networking has become the object of the scientific and business community attention (Pittaway et al, 2004; Dhanaraj, Parkhe, 2006; Ozman, 2009; Parmigiani, Rivera-Santos, 2011; Leyden et al., 2014.). It is caused by the increasing dynamics and uncertainty of the external environment, as well as changes in inter-firm relationships considering understanding of the importance of cooperation

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eISSN: 2357-1330

among business executives (Zaheer et al., 2000; Helfat, Peteraf, 2009; Chesbrough, 2003). Smorodinskaya (2014) noted that the modern evolutionary theory of the innovation process constantly moving towards a model of networking participants, based on the principles of collaboration (the process of formal and informal agreements between participants of innovation processes, during which they establish joint rules and organizations to manage their interactions and directions activities or decide to combine their tasks). Network model Peter Gloor (2006) suggests a transition from producer innovation (Schumpeter, 1934) and the end-user (von Hippel, 1985) to the open innovation (Chesbrough, 2003) and network collaborations (Gloor, 2006). That is why the aim of this article is to analyze what kind of network topology in one of the vertically integrated company to reveal the peculiarities and specifics of innovation collaboration process in space industry.

2. Literature review

Herstad, Alsenen, & Ebersberger (2014) claimed that in recent years, there has been a shift from a global production network paradigm (involving marketing move and optimal placement of production) to the global innovation network (GIN). In addition, according to Salavisa, Sousa, & Fontes, (2012) networking provides its participants with the probability of the business development, reduces the degree of uncertainty and risk, and accelerates the collection of information on resource capacity and quality (thus reducing transaction costs). Finally, the network can be used to facilitate access to the actual resources. The growth of scientific knowledge contributes to more rapid appearance of knowledge and technology from the outside rather than inside the company (Huber, 2004). To improve the competitiveness, enterprises have to establish an active relationship outside the company, to gain access to new knowledge and exploit new business opportunities. Among researchers and CEOs, there is a conviction that the key advantage of networking is connection ideas and resources received from the outside, through various forms of collaboration and the emergence of the added value through the recombination of bonds.

There are some theoretical presuppositions for understanding of the mechanism of transfer of information, knowledge and technology among participants in the innovation process (including within the cluster). Definite problems for improving the competitiveness of the companies are high transaction costs (access to information, compliance with the rules of transactions, etc.) and difficulties in obtaining tacit knowledge. So, inter-firm networking (addition competencies) and shared understanding of the processes and external situations that arise as a result of co-lived experience of collaboration, trust and cooperation, can reduce barriers to the exchange of knowledge and to enhance the benefits of network communication (Powell, & Grodal, 2005). Research shows that firms have much to gain from collaboration with various partners, such as customers, suppliers, intermediaries, and even competitors.

The study (Jensen, & Schott, 2016) conducted in the framework of Global Entrepreneurship Monitor found a positive correlation between participation in networking and increasing the number of production and industrial innovation, produced in businesses within the cluster. At the same time, the network collaboration abroad often supported by the necessary institutional environment, which is reflected in a high level of confidence in the state actors and to each other.
In the case of the formation of stable inter-firm networking, the task is further complicated because the

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network is a complex system of explicit and implicit contracts between the formally independent economic agents in order to optimize the combination and use of resources, with the dominance of relational contract with an indefinite life (Bergenholtz, & Waldstrøm, 2011). This implies the establishment, maintenance and development of the relationship, allowing coordinating the interests of individual members to adjust their individual strategies and coordinate actions to achieve the common goal for all participants.

3. Methods and Discussions

It is interesting to study the phenomena of networking in Russian innovation companies to estimate the networking potential.

Hypothesis 1. Networking in Russia in large integrated companies has a vertical systemic nature, has a low degree of relatedness, which indicates its low efficiency. The study was conducted in one of the large companies operating in the field of information and space engineering industry, which has a major share of the state order, and a lot of branch companies (from the Soviet Union), a network of subsidiaries. Currently, this company is one of Anchor Company in the cluster in one of the largest regions of the country. The method of studying was a survey and an interview with managers of the enterprise and its subsidiaries, as well as partner companies. Calculation of individual networking indicators was held in this study.

According to the degree of formalization of relations (Rosenfeld, 2013), we identified the soft and hard networks. Soft networks consist of more than 3 organizations cooperate informally, such as the division of the information, the acquisition of new staff skills (skills), joint problem-solving. Hard networks cooperate in the framework of a clear contractual relationship for co-production and joint distribution.

Analysis of the survey results allows drawing some conclusions about the topology of the network considering the heterogeneity of the various actors of the innovation process. The use of different classifications gives opportunity to describe the nature of networking and makes it possible to design network landscape JSC "ISS", including the assessment of the different profiles.

A general scheme of interaction between enterprises and organizations is described herein. The chart reflects R&D interactions of JSC "ISS" and its subsidiaries. Networking involves 11 Higher schools, 4 R&D institutes, 7 medium and small business enterprises, 6 organizations of innovation infrastructure and large enterprises as JSC "Krasmash" and GC "Roskosmos" and others. Innovative networks of JSC "ISS" have vertical nature, that is allowed us to give recommendations to establish and develop suitable horizontal communication between the subsidiaries and divisions of JSC "ISS".

Such networks with vertical nature and without horizontal links could be illustrated as the graph type of "tree" (Figure 1).

Let us reveal the main characteristics of the innovation network. To describe the degree of intensity of innovative network communications, it is proposed to estimate the ratio of the actually existing ties number to the total possible number.

$$I = \frac{S_f}{S} = \frac{2 \cdot S_f}{N \cdot (N-1)}, \quad (1)$$

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where I –the degree of intensity of relations,

Sf – the number of actually existing relations,

S = (N (N-1)) /2 - the total number of possible connections of N - number of participants in the network.

The network interactions provided the total number of network participants N = 39 and the number of actually existing links Sf = 43, respectively, and the total number of possible connections S = (N (N-1)) = 741 /2.

Also, the network is represented by a number of organizations associated with only anchor enterprise JSC "ISS", so that in the scheme of interaction with a sufficiently large number of participants is relatively little actual relationships between them. That is why it is interesting to consider the interaction between groups of companies of the same type and the anchor.

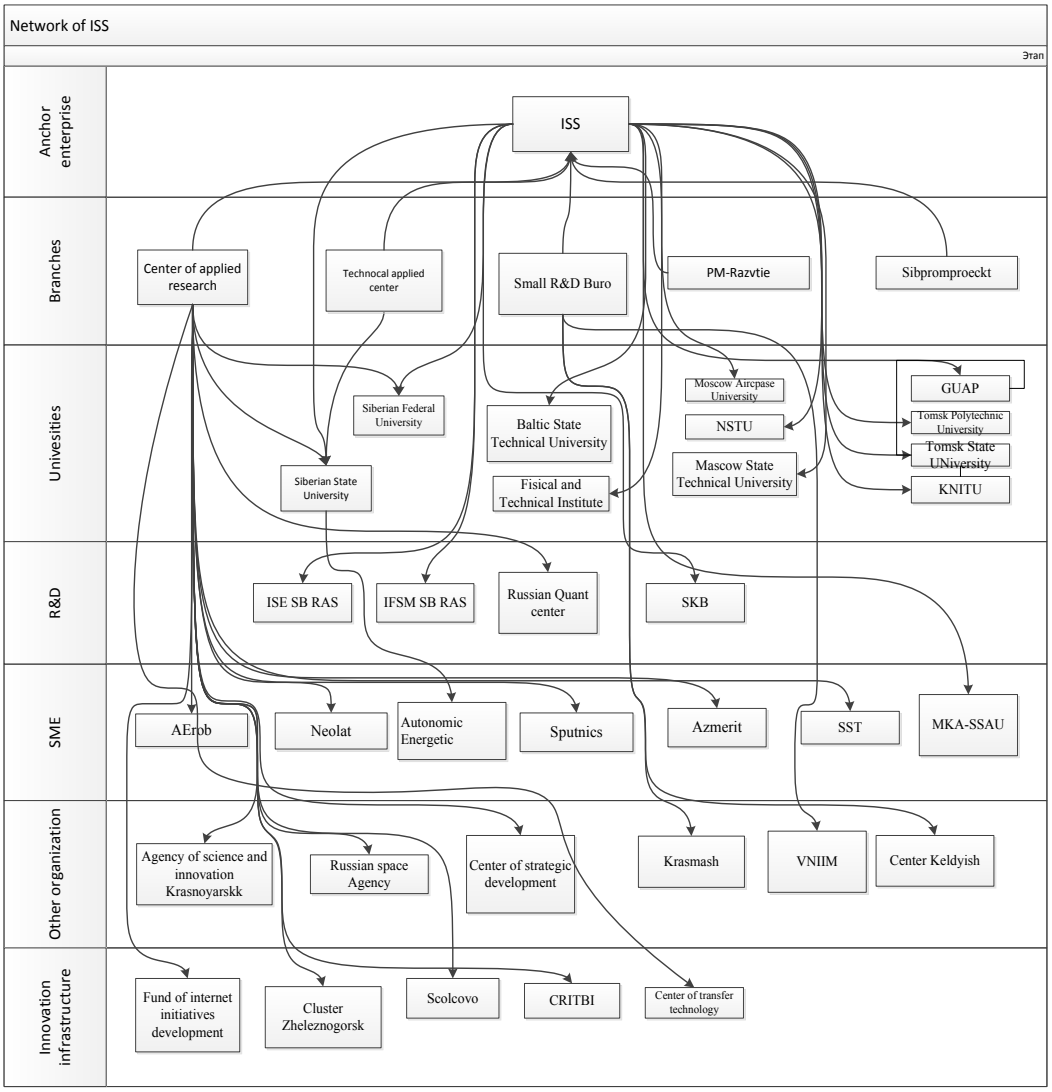

Fig. 1. The frequency and structure of the network of contacts.

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The degree of centralization of ISS could be calculated as the ratio of the number of network interactions of one actor to the total number of network participants (Bergenholtz, Waldstrom, 2011):

$$C_i = \frac{S_i}{N-1}, \quad (2)$$

where Ci - the degree of centralization of the innovation network i-th participant,

Si - the number of network interactions of the innovation networki-th participant.

The number of interaction is 20, respectively, and the degree of centralization of the network is 52.6%.

Thus, this network is characterized by the average degree of centralization, the anchor company communicates directly with a little more than half of the members of the network. With the rest participants of the innovation network,the anchor company communicates indirectly through subsidiaries.

Let us analyze the interaction between the anchor company, its subsidiaries and group companies of the same type. Network is non-oriented because it has a lot of mutual cooperation between the parties. The graph corresponding to this network is connected; the fins weight corresponds to the generalized frequency of interactions between organizations (frequency of interaction is calculated from the results of the questionnaire).

Figure 2 shows that the anchor enterprise interacts with R&D institutes more directly than it does through subsidiaries. At the same time, theanchor enterprise interacts with organizations of the innovative infrastructure and other organizationsonly indirectly.

It was revealed that theamount of total interaction with external organizations for R&D purpose is carried out three times more intensely than that between ISS and subsidiaries.Relationship with foreign enterprises makes up about two percent of the total frequency of connections. In this network, the number of participants is N = 10 and the number of actual interactions between them is Sf = 15, the number of interactions of ISS within the network SISS = 7

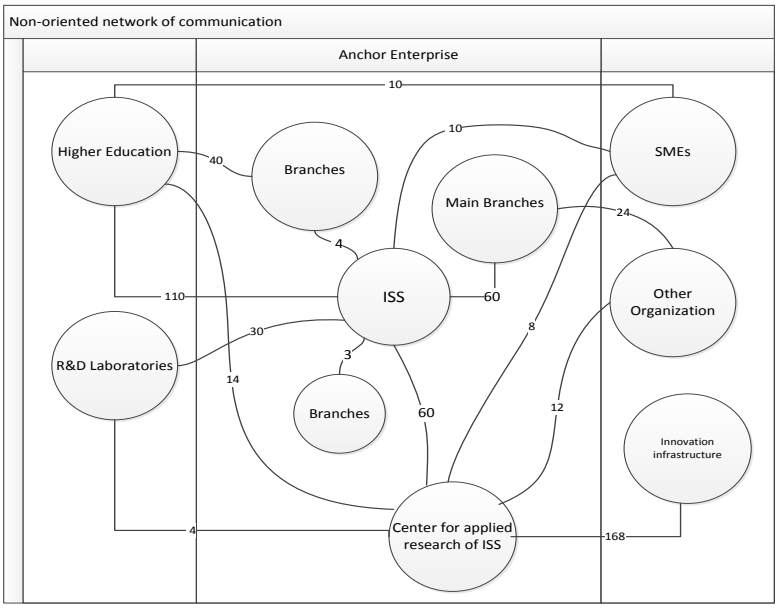

Fig. 2. Non-oriented network of communication

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For the innovation network in Figure 2, where the edges of the weight corresponds to the frequency of interaction, the total weight of the network communications of ISS (DISS = 277), the total weight of all the interactions in the network, the D = 557. The modified degree of centralization of the ISS is equal to:

$$C`_{ISS} = \frac{D_{ISS} \cdot S_{ISS}}{D \cdot (N-1)} = \frac{277 \cdot 7}{577 \cdot 9} = 0,387. \quad (3)$$

The modified index is twice less than the initial degree of centralization of the ISS, indicating that the frequency relationships through ISS directly held approximately half of all the considered network.

For innovation network as a whole, the total weight of the network communications of ISS is DISS = 420, the total weight of all the interactions in the network is D = 430, respectively.

$$\Gamma`_{ISS} = \frac{D_{iss}}{(N-1) \cdot \frac{D}{S_f}} = \frac{D_{iss} \cdot S_f}{(N-1) \cdot D} = \frac{420}{(6-1) \cdot \frac{430}{6}} = \frac{420 \cdot 6}{(6-1) \cdot 430} = 1,172.$$

(4)

The result is logic for this level of mainly vertical consolidation and interconnections of networks and could be easily illustrated as tree ties. That proves our hypothesis about networks inthe large integrated Russian company.

4. Results

Analysis of networking, carried out in the framework of the ISS and other actors, including all participants (suppliers and consumers), leads to the conclusion that this network has the following structural characteristics:

1) network is large (big), because it consists of more than 10 actors, with different types of interaction (ranging from training, and the joint R&D), with both horizontal relationships with partners, and vertically integrated relationships, with small and medium-sized businesses (including spin-off companies), universities, infrastructure organizations;

2) the network was formed by the top-down scheme. Considering the vertical character of integration relations in the ISS, which are, as practice shows, effective for the formation of an innovative policy of large companies, it reduces the flexibility and adaptability of enterprises to changing environmental conditions;

3) the network with a low degree of relatedness. Even the anchor company can have a low degree of relatedness, which is proved by the fact that even regular contacts within the scientific and resource interactions can occur with no more than five market participants. With regard to subsidiaries and associates, relations with external partners are extremely rare and do not possess a high degree of stability.

The results of the survey show that ISS has virtually no formal and informal contacts with other major participant in the cluster of Zheleznogorsk. In addition, in fact ISS serves as the innovation hub for the

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established network of partner organizations, participants of the innovation process, but the implementation of these functions is rather unsystematic and forced.

5. Conclusion

As for the behavioral characteristics of the network, one can draw the following conclusions:

1) considering the types of communication, network communication in ISS is most powerful for the individual items (for example, the interaction of the anchor companies with subsidiary or affiliate company) and weak by the most of the contacts, as shown by the poll results.

2) according to the role of network actors, participants play its usual role: the anchor company ISS, universities and research institutes, enterprises, suppliers and consumers, small and medium-sized businesses, and others.

Thus, anchor company ISS has a distinct network landscape with a focus on a large, vertically integrated one with a low degree of network connectivity, with the unexpressed (weak) links, where a key type of partnership is scientific collaboration with the base (dependent) subsidiary companies, universities and research institutes. A horizontal network integration within this network, and even within the cluster, unfortunately, is not possible.

As a future research it could be interesting to investigate different innovation network in various branch of economy to reveal dependencies on innovation network topology, heterogeneity of actors, level of centrality and intensity in various types of industries.

References

Bergenholtz, C., Waldstrom, C. (2011). Inter-Organizational Network StudiesA Literature Review*Industry and Innovation*, 18(6), 539-562.

Chesbrough, H.W. (2003). *Open Innovation: The New Imperative for Creating andProfiting from Technology*. Harvard Business Press, Boston.

Dhanaraj, C., Parkhe, A., (2006). Orchestrating innovation network. *Academy of Managing Review*, *31*(3), 659-669.

Helfat, C.E., Peteraf, M.A. (2009). Understanding dynamic capabilities: progressalong a development path. *Strategy of Organization*7, 91–102.

Herstad, S.J., Alsenen, H.W. & Ebersberger, B. (2014). On industrial knowledge basis, commercial opportunities and global innovation network linkages. *Research Policy,* 43, 495-504

Huber, G.P. (2004). The Necessary Nature of Future Firms: Attributes of Survivors in a Changing World. *Sage, Thousand Oaks.*

Leyden, D., Link, A., Siegel, D., (2014). A theoretical analysis of the role of socialnetworks in entrepreneurship.*Research Policy*43, 1157–1163

Ozman, M., (2009) Inter-firm networks and innovation: a survey of literature.*Economic Innovation and New Technology* 18, 39–67.

Gloor, P.A. (2006). *Swarm Creativity: Competitive Advantage through Collaborative Innovation* Network. New York: Oxford University Press,

Parmigiani, A., Rivera-Santos, M., (2011). Clearing a path through the forest: ameta-review of interorganizational relationships. *Journal of Management* 37, 1108–1136.

Pittaway, L., Robertson, M., Munir, K., Denyer, D., Neely, A., (2004). Networking andinnovation: a systematic review of the evidence. *International Journal of Management 56*, 137–168.

Salavisa, I., Sousa, C., Fontes, M. (2012). Topologies of innovation network in knowledge-intensive sectors: Sectoral differences in the access to knowledge and complementary assets through formal and informal ties, *Technovation*, 32, 380-399.

http://dx.doi.org/10.15405/epsbs.2017.07.02.20
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eISSN: 2357-1330

Schott, T., Jensen, K.W. (2016). Firms innovation benefiting from networking and institutional support: A global analysis of national and firm effects, *Research Policy,* 45, 1233–1246.

Zaheer, A., Gulati, R., Nohria, N. (2000). Strategic networks. *Strategic Management Journal,21*(3), 203-205.