

Spin-Off Phenomenon as a Factor of University Clusters Competitiveness Increasing: A Methodological Proposal

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Abstract. In the modern economic reality the level of competitiveness of entire countries and national economies highly depends on innovative activity in the industry and technology. The present article analyzes the diffusion of a cluster model in international experience and the spread of spin-offs model as an effective solution for clusters' efficiency increasing and a promising organizational form for successful functioning of ICT industry. The description of new approaches aimed to powering of links between industry and educational bodies in Russia is delivered too. A methodological proposal for evaluating of clusters' competitiveness is formulated.

Keywords: university clusters, spin-offs, innovation.

1 Introduction

Modern Russian economy faces a challenge linked to a transition to innovative way of development. It means not only the growth of innovative activity but the qualitative changes in the major part of spheres of economy. The directions of these changes are represented by forming of groups of the enterprises – clusters consisting of small innovative enterprises. Problems of their functioning and possibilities to form the clusters are an actual topic of research.

The main condition of successful development of business is the open access to resources, information and credits. The number of small enterprises in Russia in 2010 constituted hardly more than 1 million, the contribution to gross national product was equal to 12% (for comparison, in Europe about 20 million small and medium scale enterprises contributed to gross national product by more than 60%). In the USA more than 15 million of small enterprises contributed by 40% to gross national product [13]. Such insignificant number of small enterprises, in comparison to developed countries, is caused by considerable number of unresolved problems of small and medium business. The most important among them are problems of the State control and supervision, consisting in excessive checks and in all kinds of administrative barriers and infrastructural restrictions.

In the conditions of market economy and globalization the necessity to increase the competitiveness of the country's separate regions arises. In this context clusters become a reserve of growth of competitiveness at regional level as the accounting entities connected among themselves by close economic mutual relations and

supplementing each other. In the course of placing of production and development of regional economy there were various forms of the territorial organization [17]. Industrial areas, agglomerations, industrial knots, territorial and production complexes are traditionally allocated there.

Clusters represent the modern, quickly extending form of the territorial organization of regional economy. Problems of clusters formation and realization of regional competitive advantages as a rule are considered at level of regions. The author's approach to concept determination «regional cluster» is based on theoretical concepts like placing theories. Porter's determination of cluster focuses attention on its three properties: geographical localization, interrelation between the enterprises and technological coherence of industries.

Different authors [1, 5, 11-14, 16] consider the achievement of possible synergetic effect as the consequence of interaction, influence on innovative development of region, long-term alliances in the field of production. The analysis of the basic approaches to determination of clusters has shown that in the scientific literature, as a rule, two moments are reflected: territorial localization of the interconnected companies and their possession of competitive advantages implemented in frameworks of cluster model of the territorial organization of economy.

The international experience shows that namely small innovative enterprises represent the element that links together research and industry [1, 2, 6, 18]. They can assume the risk of transforming of business idea into industrial prototypes realization, without which it is impossible to evaluate how perspective the research idea will be on the market and if it's worth commercial realization. This mechanism is realized by means of spin-offs companies.

2 Clusters Model Description

Under regional cluster we understand group of the interconnected companies localized in a certain region and the organizations cooperating with each other in the course of production and realization of the goods and services within the limits of a uniform chain of creation of cost for achievement of concrete economic effect and implementing competitive advantages of given territory. Unlike other forms of the territorial organization of economy, cluster is distinguished by market interaction between participants of the consolidations, based on a competition and cooperation, capability of adaptation to changing environmental conditions. Clusters are formed in the conditions of market economy when the enterprises are interested in strengthening of the competitive advantages and in reception of profits on joint activity in certain territory.

Thus, regional cluster as a form of the territorial organization of economy is developed not only in the industries, but also in service trade. The cluster approach to the territorial organization of economy of region is directed on studying of operating conditions of the concrete enterprises and the organizations.

International experience witnesses that cluster approach to regional growth assumes character of national strategy of economic policy of competitiveness increasing [5, 12, 14, 15, 18]. In the world practice three main models are known: North American, European and Asian, that are conditioned by traditions of economy

development of the different countries, security factorial conditions, branch structure of economy, a reservoir of the national and regional markets and a State role in economy.

The North American model is characterized by small intervention of the federal government in process of regional clusters developments. The European region shows an active role of the federal authority in the course of realization of regional clusters development principles, determining methodical bases, promoting organizational development, performing financial support. It is connected to dependence on external deliveries of strategic kinds of resources, narrowness of national market outlets. If in the USA they are separated from each other, in Europe the state cooperates with businessmen, but without direct penetration into structures of large private industrial firms that distinguishes it from the Asian model of relations "state-business". On the basis of the analysis of the experience the leading role of clusters in stimulation of regional growth, an improvement in employment, growth of budgetary incomes, investment attraction becomes crucial. The companies which form clusters have higher financial indicators, labor efficiency, sales volume.

The main research problems to be discussed consist in the theoretical justification and development of methodical approaches for forming of strategic development for economic clusters for large technology like oil and gas complex in the conditions of forming of national innovative system.

So, the principal factors for universities research parks competitiveness treated as an innovation cluster around the universities should be investigated. In «new economy» the level of competitiveness of any country depends on innovative activity in industry and technology. In particular, the global problem of Russia which slows the development of innovations is the absence of history of success. In the international practice it is widely accepted that before placing investments into realization of new products and technologies the foreign companies analyze not only financial and economic conditions of separate subjects of national economy, but also take into consideration the number of successful innovative enterprises or businessmen grown in a certain country. In 2010 in Russia only 4-5% of industrial organizations developed and implemented innovative developments (in the USA this indicator exceeds 35%) in the activity, in small-scale business the innovative enterprises constitute less than 1% against 4-5% in the USA [3]. Research and technological parks represent the platform which allows initiating innovations, in its frameworks conditions for motivation of the enterprises and people to the creation of innovations, for their transformation into successful products and, hence, successful companies.

3 Spin-Offs as an Efficient Organizational Business Form

Innovative cluster is the localized set of industrial companies, the research centers, individual businessmen, high schools and other organizations with motivated and steady formal communications. From the point of view of the innovative clusters theory founder M. Porter [5, 16], clusters assume various forms depending on the depth and complexity, but the majority include: the companies of a "ready" product or service, suppliers of factors of production, financial institutions, firms in

accompanying industries. In a cluster, also, the firms working with sales channels or consumers, manufacturers of by-products, specialized providers of an infrastructure, the governmental and other organizations providing special training, formation, information receipt, carrying out of researches and giving technical support (universities, advanced training structures) often enter. The governmental structures, making essential impact on clusters, can be considered as its part. Many clusters include enterprise consolidations and other joint structures of a private sector, the organization on the cooperation, supporting members of cluster. Character of communications between the enterprises forming a cluster, can be both vertical and horizontal. Cluster can include itself the enterprises of one industry or different industries [5].

The analysis of international experience shows the broad diffusion of spin-offs phenomenon all over the world [6]. So, in Australia the growth of spin-off firms is being verified since the beginning of 80s and the peaks of activity were registered few times since 80s until 2000; the financing of spin-offs in Australia is distributed in the following way: 33% falls onto the research bodies, 23% onto privates and 15% is delivered by venture funds. Less than 15% don't obtain financing and the investing in their activity is limited by the obtaining of technological license.

In Canada, according to the data of National Research Council of Canada in 80s 205 such firms and 444 in 90s were opened on the base of 45 leading universities. The program of new industrial applications sustaining covered with proper financing 40% of opened spin-offs on the universities base. The equity share of research bodies amounted to 50% and large universities can permit themselves to have proper funds to develop such enterprises.

French experience shows that in 80s 387 spin-off firms were opened (including those opened by professors, researchers and students). The peak of spin-offs had fallen onto the end of '80 and beginning of '90, but after that, in the 2000s the reduction of their number was registered. In France the financing of spin-offs is the combination of proper funds of the universities, private funds, banks, venture capital and capital of other firms.

In Italy regional and national institutions are increasingly becoming aware of the importance of supporting innovation and research. Fiscal incentives and programs like "Industria 2015"¹ are among the numerous possibilities of co-financing. Still, Italy is experiencing a significant lack of venture capital activity and the industry is not as developed compared to ones of other European countries. However, venture capital in Italy is starting to grow.

The Italian experience is particularly interesting because of the dominated presence of SMEs in the industrial tissue of the country [14]. A very interesting example of spin-off successful functioning and of the synergy between universities (in particular public resources and funds) industry and finance is the PharmEste Ltd, a spin-off of

¹ "Industria 2015" is the name of the synthetic Bill (proposed law) aimed to enhance the competitiveness and industrial policy, approved on 22 September 2006 by the second government lead by Romano Prodi. Industry 2015 provides the strategic lines of the Italian industrial policy, basing them on a conception of industry which integrates not only the manufacturing but also advanced services and new technologies in the medium-long term (2015).

the University of Ferrara. PharmEste, founded as a USOs of the University of Ferrara is a private drug development biopharmaceutical company based on a unique Transient Receptor Potential (TRPs) ion channel technology platform that brings together strong expertise on TRPs area and industrial competences in research & development process applied to small molecule therapeutics [11].

Another Italian reality, famous for its synergy between research and industry is Etna Valley, a large conglomerate of small innovative enterprises (electronics and semiconductors) concentrated in Catania area in Sicily. In 1997, in Catania the new ST Microelectronics factory was opened (the multinational microchip firm created by the merger between SGS Italiana and the components sector of the French enterprise Thomson). Only few years after a solid group of horizontally and vertically integrated firms emerged from just one firm, representing a positive reference point on the Italian and European industrial panorama. Recent developments were caused by the decision of several large companies to establish important production divisions and research centers in the Etna Valley. Vodafone, Nokia, IBM, Nortel and Sicos have all set up business in Catania.

Meanwhile the side industries generated by ST Microelectronics have prompted the development of hundreds of small and very small firms, supplying the microelectronic giant with components and equipment previously imported from abroad. There are also other sectors with a high technological content - but outside the area of electronics, information and communication technology - which find an area for potential development on the slopes of Etna. This particularly applies to Wyeth Lederle, a leading European pharmaceutical firm carrying out important research in the vaccine sector. In just seven years, the Etna Valley has become an essential reference point in Italian economic system: more than 1,200 firms, one thousand of them resulting from initiatives by very young local entrepreneurs; about 200 national firms which have chosen Catania to develop their businesses; and 23 multinationals. This has also resulted from the strong integration which has taken place across firms, local institutions and universities. It has allowed the companies established in the area to identify young people who are adequately trained, as well as providing incentives for new infrastructure and a drastic simplification of the administrative procedures necessary in the establishment of new firms [19]. Even in crisis times this reality showed a stable growth: +14,3% of export in January-September of 2011 [15].

In order to facilitate the transition from bench to market and with the aim of providing brilliant academic scientists with the necessary instruments to best use their innovative ideas and translate them in commercial technologies, 90.7% of the Italian universities are now flanked by a Technology Transfer Office (TTO), each staffed with an average of 4 people (an increase of one employee from 2003). TTOs' main objective is to accelerate the creation of entrepreneurial activities, by offering assistance and valuable instruments to spin-offs venture capital investments in Italy are far less than the US's, but are growing. According to AIFI, the Italian Private Equity and Venture Capital Association, in the first six months of 2010 early stage investments accounted for 51 deals (€41 million), on par to surpass the number of deals registered in 2009 [4].

The spin-offs are majorly diffused in the USA and all the information is gathered by the Association of University Technology Managers. The companies, founded by professors or researchers has no status of spin-off company. By the end of '90s the

average number of new companies a year reached 281 firms. From this point of view the example of “Hewlett-Packard” company is rather demonstrative. Almost 90% of all research is being developed in the laboratories of the company itself and only 10% are placed in the university laboratories. The most important here is that HP, for sure, would have been able to fulfill all the tasks independently, but the cooperation with the universities brings other very important advantages. It is the possibility to exchange opinions, exchange new scientific ideas, select best students for work and, the most important, is the positioning of the firm as the company which supports higher education.

Nowadays the similar approach is being carried out in Russia too. It regards the development of Special Economic Zones (SEZ), formalized by the Federal Law about SEZ N° 116 dated 22 of July, 2005. This new form of economic activity for Russia includes, in particular, the so-called SEZ of innovation implementation type which are engaged in promotion, industrial realization and further commercialization of scientific research results. These zones are located in four Russian cities, traditionally strong in scientific field (Tomsk, Dubna, Zelenograd and Saint Petersburg) and the enterprises-residents of these zones have strong relations with the educational bodies present there. The research projects conducted there cover the fields of new materials, ICT, energy-saving technologies, bio- and nanotechnologies and some others. These business agglomerations are characterized by the strong presence of IT enterprises and their share among the total of residents, according to a survey of Ministry of Economic Development of Russian Federation [20] was equal in June 2012 to 46%.

The majority of literature on research parks shows that most university research parks are not effective economic interventions. This is surprising because cluster theory [5] suggests that university research parks ought to have positive effect on economic activity. It is possible that the real implementation of university research park is not following the prescriptions of cluster theory and that addressing this shortcoming may provide more effective economic impact.

4 Clusters Analysis: An Advanced Methodology

In the work [3] a model for evaluating the efficiency of a cluster was proposed. It was determined that there is the number of independent and dependent variables for such type of analysis. We have assumed that the main independent variables are to be:

- university knowledge: R&D expenditures in science and technology;
- university faculty capital: number of faculty members in science and technology fields;
- university human capital: number of degrees awarded in science and technology fields (bachelors, masters, doctors' degrees).

We have also assumed that the main dependent variable was given by the number of technology-based firms in a cluster in each of principal technology fields for the park.

So, three main research hypotheses were included in our investigation:

- H1: there is a correlation between the strength of the university's research capacity in specific technology fields to the technical needs of firms located in

the associated university research park. The variable research capacity referred to university's R&D [3].

- H2: there is a correlation between the number of faculty in specific technology fields at the university and the technical needs of firms located in the associated university research park. The variable human capacity refers to the total number of scientists in research and technology fields. Companies obtain knowledge by establishing relations with university scientists.
- H3: there is a correlation between the number of graduating students at the university and the technical needs of firms located in the associated university research park.

The variable of labor pool refers total number of degrees granted at university in science and technology fields. This variable has been used in the studies of [5] authors.

Statistical analysis is the principal instrument for further research. The statistical procedures ought to be done into two steps. In the **first** one the null hypotheses must be formulated for each of the research hypotheses. The following null hypotheses can be formulated:

- NH1: there is no correlation between the strength of the university's research capacity in specific technology fields to the technical needs of firms located in the associated university research park.
- NH2: there is no correlation between the number of faculty in specific technology fields at the university and the technical needs of firms located in the associated university research park.
- NH3: there is no correlation between the number of graduating students at the university and the technical needs of firms located in the associated university research park.

We ought to choose the alpha level for statistical tests. It seems reasonable to choose 0.05: it indicates that null hypotheses are rejected if the sample outcome was among the results that occurred no more than 5 percent. The statistical test is assumed to be the two-tailed test; the region of rejection is located at both left and right tails. The decision to locate the region of rejection in two tails must be based on the hypotheses and the size of the sample. Two tails test are usually more stringent than one tailed test. It indicates that a result which is significant in two tailed test is also significant in a one tailed test (but not vice versa).

At the **second** step descriptive analysis ought to be conducted. The descriptive analysis for variables will include percentages. It is assumed that correlation analysis will be performed using parametric test and Pearson product-moment correlation coefficient. Data ought to be normalized to determine the strength of each university using three variables of research capacity, human capital and specialized labor pool across major technological fields.

Still, all factors considered in the model are factors of internal to the enterprise nature. Our proposal consists in extending its frames by including different external parameters. In particular, we propose to consider the state-of-the-art of the legislative base in this matter and the grade of mutual trust between the economic agents.

The actuality of spin-offs activity analysis in Russia is conditioned by the adoption of Federal Law N° 127 "About Science and the State Scientific and Technical Policy"

which permits to institutes and universities to create small innovative enterprises. Still, very often it is not convenient for large companies to invest in spin-off firms, but to open a proper innovative unit with the purpose of new products developing. Recently amendments to this Law have been approved and it permitted to the universities to create enterprises for practical realization of their scientific results without a founder (State) consensus. It also previews the possibility to involve other juridical persons if the share of the university exceeds 25% in the joint-stock company and 33% in limited liabilities. The share of the other persons in the social capital must be paid by money means at least by 50%. This law permits to the authors of a scientific invention created in the State institute or university to carry out the commercial activity in the high-tech sphere.

The innovation risk is the reason by which many large companies don't realize broad-scale investments: they need at least some guaranty of success. So, from the practical point of view the application of research to the industrial process became the niche of small innovative firms. This procedure became possible in Russia after the Federal Law N° 127 "About Science and the State Scientific and Technical Policy" adoption. The main advantages of this Law are the following [6]:

- unemployment reduction;
- the possibility for the universities to develop the own innovative technologies;
- enhancing of the state funds directed to innovation development effectiveness;
- practical realization of ideas in socio-economic sphere.

Different sources [10] mention that the main factor of economic development is represented by the mutual trust between the economic players. From this point of view, Russia is quiet a problematic reality² [9]:

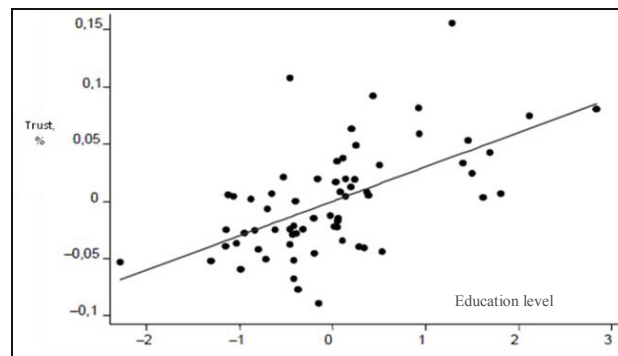


Fig. 1. Correlation between the trust level and education level in Russia

² This problem was raised recently during the XIII International Academic Conference on Economic and Social Development in the Higher School of Economics in the report of Mikhail Zadornov, President of the "VTB-24" bank. According to his data only 800 thousand persons (of nearly 75 million of economically active population in Russia) allocated part of proper means in Russian stock exchanges. This data is extremely worrying because it indicates not only a low investing activity of Russian population, but first of all its reduced trust level towards the national financial institutes.

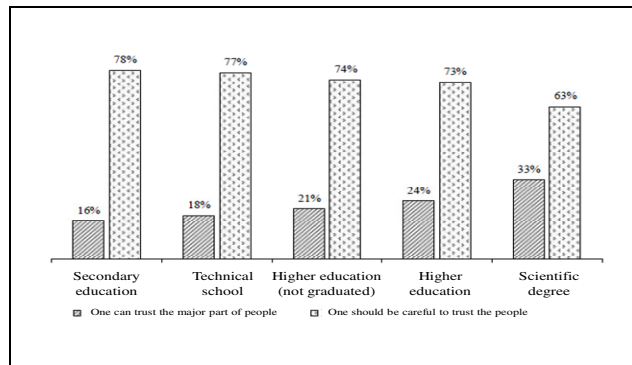


Fig. 2. Trust level by different categories of educated people

So, the model described in [3] can be extended as follows:

- H4: there is a correlation between the grade of mutual trust between the economic agents and the technical needs of firms located in the associated university research park.
- H5: there is a correlation between the grade of legislative base development and the technical needs of firms located in the associated university research park.

The following null hypotheses can be formulated:

- NH4: there is no correlation between the grade of mutual trust between the economic agents and the technical needs of firms located in the associated university research park.
- NH5: there is no correlation between the grade of legislative base development and the technical needs of firms located in the associated university research park.

5 Conclusion

In this work a new methodological proposal for university clusters was formalized. The further development of the research may consist in the data gathering and the further statistical analysis application having the scope to apply it to real known international or Russian technologies parks, clusters or Special Economic Zones in order to determine the correlation of the factors described in it.

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