

RRI 2016
International Conference «Responsible Research and Innovation»

**ENGINEER SUPPLY OF UNIVERSITY RESEARCH
INFRASTRUCTURE AND ECOSYSTEM OF SMALL
INNOVATIVE ENTERPRISES**

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Abstract

The present article generalizes the actually formed strategies of engineer supply of the university research infrastructure as an element of an ecosystem of small innovative enterprises development. The authors outline the criteria for adequacy of choice of the aforementioned strategies for concrete university complexes, which realize the process of commercialization of intellectual activities with the use of the institution of small innovative enterprises. Descriptive strategies studied in the article may be used by a person responsible for decision-making for comparison between the current situation and that of standard. Unique project. The gist of the strategy is that there is a fact of acquirement of particular and unique specific equipment to conduct researches in several contiguous scientific and technical spheres which lies in the basis of development of an engineer and a research infrastructure. Market position. This strategy of development of an engineer and a research strategy implies a close cooperation with industrial organizations and other entrepreneurial structures of the region. Net structure. This type of the structure is oriented of creating a coordinating entity, which would let the organizations find the ways of the appropriate use of an engineer and a research infrastructure. Tradition development. This strategy is acceptable only for universities, which were historically developed as research centers. The choice of a developmental strategy of an engineer and a research infrastructure for small innovative enterprises and a provision of commercialization of university innovations hence become the elements of formation of a united ecosystem of innovative entrepreneurship.

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Keywords: Innovative ecosystem; small innovative enterprises; infrastructure.



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1. Introduction

«Budgetary scientific institutions and scientific institutions established by the national academies of sciences have the right, without agreement of their property owner with notification of the federal executive authority, maintaining the function of state policy elaboration and regulation in the sphere of science and technical activity, to become establishers (solely or together with another entities) of economic societies whose aim consists in the practical use (implementation) of the results of intellectual activities (programs for computers, data bases, inventions, useful models, industrial prototypes, breeding achievements, topologies of integrated circuits, production secrets (know-how)), exceptional rights for which belong to the present scientific institutions. The fund, equipment, and another property, being in operational control of a budgetary scientific institution or a scientific institution established by the national academies of science, may be listed as a part of fixed capital of an economic society, which is being created, according to the prescription set by the Civil Code of the Russian Federation.» (Federal law of the Russian Federation, dated August 2, 2009) The entry into force of the aforementioned law signified a new milestone in the development of the research infrastructure of Russian universities.

The basic idea of the given law consisted of creation of commercialization mechanisms for intellectual property objects, the rights for which belong to institutes. In other words, small innovative business enterprises under educational organizations should have become the elements of infrastructure, maintaining simplicity and comfort of scientific and inventive activities. Within the framework of interaction, which can be characterized as state – private partnership, it was intended to satisfy the concerns of a large quantity of interested parties like scientists (possibility to engage extra financing), investors (new perspective projects for investments), universities (extra source of income). In spite of the fact that small innovative enterprises (SIE) under universities are, virtually, the objects of infrastructure and form a certain ecosystem of innovative entrepreneurship, new infrastructural supply, in its turn, is required for their successful performance. Besides the common engineer infrastructure (buildings, water service, energy supply, etc.), the provision of engineers' engagement in the research process (metrological and special equipment, supply of specific storage modes of materials and recycling) is of extreme importance for SIEs.

Since the institution of small innovative enterprises has been existing for more than five years, there are a lot of examples of successively functioning enterprises, as well as even more numerous examples, when analogous enterprises remained just as formally extant legal entities. It is impossible to explain numerous failures only by marketing miscalculations, lack of entrepreneurial experience or high risks, connected with innovative activities. In our opinion, significant results in successful projects of creation of small innovative enterprises were justified by the fact of availability of necessary engineering equipment for research and the process of its implementation.

Generalization of the experience of supply of engineers from the university research infrastructure to small innovative enterprises like an element of development of their ecosystems thus becomes a matter of interest.

The authors aim to find out and to generalize the actually formed strategies of engineering management for the activities of small innovative enterprises supervised by Russian universities.

2. Methods and Discussions

In order to conduct a research, the authors proposed a survey of a group of small innovative enterprises of the Central Federal district of the Russian Federation. The necessary information was retrieved from the register of small innovative enterprises of the Ministry of Education and Science (MIP, 2016). Further, several representatives of them (albeit a significant number of companies refused to take part even in the survey) were questioned in a form of the free interview based on the problems of their enterprises' performance and functioning, including the issues of engineer supply of research infrastructure.

Detailed scrutiny of laying down innovative activities as a particular integrity, as a system in which all the elements are interconnected and cannot function efficiently one without another is a distinctive feature of many studies on innovative processes. Terms like «national innovative system», «regional innovative system», «system of innovative management of a company» serve as typical examples. At the same time, different authors have their own, sometimes differentiating, approaches to describing the structure and processes of interaction between innovative systems. Thus, we should mention the studies of James Moore (1993), who, at first, defines the term of the business ecosystem in common and then reveals specific particularities of an innovation entrepreneurial ecosystem.

In the article «What is an Innovation Ecosystem?» (Jackson, 2014), the mentioned phenomenon is understood as a certain dynamic system, whose centripetal force is the capital's increment due to the fact of implementation of new products and technologies. In this case, the author places the cycles of financial and intellectual resources in the center of the model and rightfully remarks the possibility of its existence only when a certain ecosystem, or equilibrium relationships between legal institutions, infrastructural elements, and interests of various parties (from the state to small enterprises) are settled.

Daniel Isenberg (2011), by detailing the elements of the entrepreneurial ecosystem fostering innovation activity of economic subjects, pays attention to the importance and coherence of the infrastructure in the group of other elements which form an ecosystem (infrastructure, markets, policy, finance, culture). Such representation may seem to have been too common, but, nevertheless, we should understand the impossibility of describing a single element without detailed analysis of all the rest of them.

Adrienne, & Burk (2011) marks that an obligatory condition of the existence of an efficient innovation ecosystem is the absence of barriers and obstacles between organizations and individual counterparties during the process of realization of their private interests. Institutional and infrastructural transparency of the environment, in which innovators and innovatively active economic subjects maintain their performance, is a mandatory prerequisite of functioning for an innovation ecosystem. The author names them 'net and culture'. They are not always incarnated as a set of formal rules or technical objects, but their absence makes the system non-viable.

There are several works, in which the idea of formation and development of innovative ecosystems is examined through the lens of native Russian specifics. For example, Moshkin (2012) defines the term of a university entrepreneurial ecosystem as a set of conditions ensuring successful creation and development of innovative firms. The basis of the system is represented by the process of self-

organization; hence, the infrastructure is seen as a condition of its realization, like a certain ‘mediator’ of innovative entrepreneurial activity.

Kopeykina (2008) does not distinguish an infrastructural component in particular, mentioning that in order for an innovation ecosystem to come into existence, the following conditions should be fulfilled:

- human communities, united by institutions. Particular attention should be paid to informal aspects, like common interests and communication possibility;
- new ideas as a result of realization of the participant’s intellectual potential;
- entrepreneurial competences, i.e. the people with specific talents that are differing from scientific and technical creativity;
- financial resources in a form of a financial system, uniting different investors, ready to undertake high levels of risk connected with promotion of new products and technologies.

Nonetheless, the author reasonably mentions that it is a university where one can find a center and an infrastructural component, in the framework of which all these elements can be self-organized in a form of a complex and dynamic system maintaining the transfer and diffusion of innovation.

3. Results and Conclusions

According to the results of the study of a group of small innovative enterprises of the Central Federal district, it is possible to distinguish the following practically prevailing strategies of development of an engineer and a research infrastructure in universities as an element of ecosystems of small innovative enterprises.

3.1. Unique project

The gist of the strategy is that there is a fact of acquirement of particular and unique specific equipment to conduct researches in several contiguous scientific and technical spheres which lies in the basis of development of an engineer and a research infrastructure. The motive of acquirement of such equipment may be the presence of a scientist in a university staff, who has unique competences and skills, gained and won a grant or a participation in a project, the frameworks of which make the acquisition of such equipment possible. These elements of an engineer and a research infrastructure are often acquired ‘for growth’, ‘for the future’, for upcoming researches, for the terms of service usually exceed the terms of realization of a research, for which the acquirement of the equipment is initialized. Particular scientific and research thematic studies are carried out in connection with this equipment, as well as formal and informal communication between colleagues.

The fact of acquirement of a scanning electron microscope by ‘Orel State Agrarian University’ as a participant of a program ‘Innovative institutes of Russia’ is an example of realization of such strategy. Afterwards, this equipment became a part of a scientific and research test center allowing the university to carry out a broad spectrum of studies in agricultural biology (Scientific and research test center of Orel State Agrarian University, 2009).

The danger of realization of this strategy is a remarkable difficulty to forecast the level of future capacity utilization for such equipment. Quite often, the acquirement of the equipment as a one-off action remains a ‘dead capital’, because there are neither specialists of necessary qualification, nor expendable materials and research themes.

3.2. Market position.

This strategy of development of an engineer and a research strategy implies a close cooperation with industrial organizations and other entrepreneurial structures of the region. In the frameworks of this strategy, the acquired equipment is not just (and not so much) aimed to satisfy the scientific communities, but becomes an element of the service infrastructure of commercial enterprises. Realization of this strategy can be possible in case of adequate demand for the corresponding services. Very often metrology and certification are a category of such services. Sometimes it is too expensive for particular entrepreneurial structures to acquire measurement and control equipment and obtain a license to issue certificates of conformity and type approvals. Functioning of these metrological laboratories and the university supervision of them are the basis for services provided to both scientific and entrepreneurial communities.

An example of realization of such strategy is a metrological laboratory of Orel State University named after Turgenev (Golenkov et al. 2002) serving as the basis for metrological office, which cooperates with the closed joint-stock company (CJSC) «Nauchpribor» and other enterprises of the region.

An attempt to realize the mentioned strategy should be connected with the importance of correct assessment of the market of specific services, at which the given infrastructural department of a university is aimed. Appearance of a potent competitor or rival, as well as market overestimation, might lead not just to bankruptcy of an entrepreneurial entity, but also might block the possibility to carry out scientific researches, thus deteriorating an ecosystem of small innovative enterprises and of a university on the whole.

3.3. Net structure

This type of the structure is oriented not towards the process of forming an engineer and a research infrastructure as it is, but to that of creating a coordinating entity, which would let the organizations find the ways of the appropriate use of an engineer and a research infrastructure of third-party companies in the limits of restrained budgets. Realization of such strategy is seen as rational for universities, when small innovative enterprises maintain scientific and implementation activities within a few highly specialized projects. The availability of one's own engineer and research infrastructure does not pay off in this case neither at the expense of one's own researches, not on the account of satisfaction of market demands. Appearance of a coordinating entity, the specialists of which know the market of services and can contribute to the corresponding contacts, drastically diminishes the cost of small innovative enterprises at the early stages of laying down formal and informal contracts.

An example of realization of the strategy is the Center of collective usage 'Genetic resources of plants and their usage' (Genetic resources of plants and their usage, 2009), established in 2009 under Orel State Agrarian University. In spite of the fact that this structure is a center of common usage, and it takes part in a corresponding federal program, it is, in fact, a certain net of laboratories supplied by corresponding engineer equipment, situated on the territory of different scientific organizations, like the Research Institute of Legumes and Groat Crops, the Research Institute of Fruit Selection, State Science Institution Shatilovo Agricultural Experimental Station, etc.

The main danger and risk of the strategy is the low level of qualification and competence of the staff of the coordinating center and lack of competitiveness inside the net, which in case of services monopolization can make the costs of small innovative enterprises incommensurably high.

3.4. Tradition development

This strategy is acceptable only for universities, which were historically developed as research centers. Having both formal and informal contracts in scientific spheres, receiving quite stable state financing, and enjoying popularity from venture investors, these universities may afford forming their own engineer and research infrastructure judging by the logics of their own development. Small innovative enterprises established under these institutes will, respectively, be based on the infrastructure of their leadership university and have much more chances of successful commercialization of the objects of intellectual property. Unfortunately, the examples of realization of this strategy are not so numerous. We can (with some degree of conditionality) attribute this type to Moscow State University and to some more leading domestic universities.

In order to find out and generalize actually set strategies of engineer supply for activity of small innovative enterprises under Russian universities, we will use a descriptive approach to detecting and studying the strategies.

We distinguish two types of models: descriptive (expository) and prescriptive (normative) ones. The prescriptive information model turns out to be normative knowledge. The descriptive information model turns out to be generalizing knowledge. The prescriptive information model is realized as procedural knowledge. The descriptive models often become the basis for formation of prescriptive models (Tsvetkov, 2015).

An example of the use of prescriptive and descriptive models is presented in the paper of Mintzberg et al. (1998), where the authors proposed to divide the schools of management into prescriptive and descriptive ones. The main goals of prescriptive schools are to justify the methods of strategy elaboration which ensure the rise of the concurrent status of an organization. Within these schools, the strategies can be described as a sequence of actions, regulations, rules, applying to which an organization can achieve desired results. Descriptive schools deal with the problems of the concurrent status supply only partially; their principal aim is to authentically describe the process of elaboration and realization of a strategy 'as it is'. Any recommendations can be made only on the basis of analysis of actually set models (Brekhova, 2007).

Thus, the present paper generalizes actually prevailing strategies of engineer supply of the research infrastructure of a university as an element of the ecosystem of small innovative enterprises. The authors conclude the criteria of admissibility of this or that strategy for concrete university complexes, realizing the process of commercialization of results of intellectual activities with the use of the institutions of small innovative enterprises.

Acknowledgements

The authors wish to express their gratitude to the administration and the staff of all small innovative enterprises who volunteered to take part in the survey and the interview.

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