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Tatiana Krasikova
PhD (Economics), Deputy Head of Department for Research, Irkutsk State Technical University, Russia
83 Lermontov Str., Irkutsk, 664074, Russia
Tatiana.krasikova@istu.edu

Dmitry Ognev
PhD (Economics), Dean of Postgraduate Studies Faculty, Irkutsk State Technical University, Russia
83 Lermontov Str., Irkutsk, 664074, Russia
odv1974@rambler.ru

Alexander Kirilenko
PhD (Economics), Head of Management, Business and Law Department, Irkutsk State Agricultural Academy, Russia
257 Baikalskaya Str., Irkutsk, 664038, Russia
kirilenko@igsha.ru

ROLE OF UNIVERSITIES IN THE REGIONAL INNOVATION SYSTEM FORMATION

Abstract. In the matter of universities formation as the major subjects of the state innovative activity, it is necessary to consider separately their role in development of the regional innovation system. It is important to implement the model of «Triple Helix» which extends to the formation and development of the regional innovation system (hereinafter RIS). Both Western and Russian scholars pay their attention to the meaning of RIS and role of university for RIS development. In general, according to the authors, the RIS is either a complex or the institutions or the organizations (or the institutional infrastructure) that are the base of the region's innovative development. There are a lot of approaches to the definition of RIS, but our analysis of the different views on the essence of RIS shows several common features, and thus we would like to highlight the following. The changes taking place in higher education not only in Russia, but around the world, demand new infrastructure of university as a regional base of human, industrial, technical and technological resources. It is needed to identify mechanisms that would lead universities as intellectual centres to participate successfully in the regional economic development. Working-out applied tool that can assess effectiveness of not only a university, but also cooperation between the university government and industrial sector, is a promising direction for further research.
Keywords: university; regional innovation system; criteria for University efficiency; Triple Helix.
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Т. Ю. Красикова
кандидат экономических наук, заместитель начальника управления научной деятельностью,
Иркутский государственный технический университет, Россия
Д. В. Огнев
доктор экономических наук, декан факультета послевузовского обучения,
Иркутский государственный технический университет, Россия
А. С. Кириленко
доктор экономических наук, профессор, заведующий кафедрой менеджмента, предпринимательства и права,
Иркутская государственная сельскохозяйственная академия, Россия

РОЛЬ УНИВЕРСИТЕТОВ В СТАНОВЛЕНИИ РЕГИОНАЛЬНОЙ ИННОВАЦИОННОЙ СИСТЕМЫ

Аннотация. В статье показана роль университета в становлении и развитии региональной инновационной системы (РИС) и регионального инновационного кластера. Рассмотрены основные функции университета как основного фактора влияния на развитие региональной инновационной системы. Предложены критерии оценки эффективности университетского пояса как составляющей РИС, которые позволяют определить его влияние на региональную инновационную систему.
Ключевые слова: университет, региональная инновационная система, критерии эффективности университета, модель «Тройная спираль» (Triple Helix).

Т. Ю. Красікова
кандидат економічних наук, заступник начальника управління науковою діяльністю,
Іркутський державний технічний університет, Росія
Д. В. Огнєв
доктор економічних наук, декан факультету післявузівського навчання,
Іркутський державний технічний університет, Росія
О. С. Кірілєнко
доктор економічних наук, професор, завідувач кафедри менеджменту, підприємництва і права,
Іркутська державна сільськогосподарська академія, Росія

РОЛЬ УНІВЕРСИТЕТІВ У СТАНОВЛЕННІ РЕГІОНАЛЬНОЇ ІННОВАЦІЙНОЇ СИСТЕМИ

Анотація. У статті показано роль університету в становленні та розвитку регіональної інноваційної системи (РІС) і регіонального інноваційного кластера. Розглянуто основні функції університету як основного фактора впливу на розвиток регіональної інноваційної системи. Запропоновано критерії оцінки ефективності університетського пояса як складової РІС, що дозволяють визначити його вплив на регіональну інноваційну систему.
Ключові слова: університет, регіональна інноваційна система, критерії ефективності університету, модель інноваційного розвитку «Потрійна спіраль» (Triple Helix).

Introduction. In the matter of formation of universities as major subjects of innovative activity of the state, it is necessary to consider separately their role in the development of regional innovation system. It plays an important role in terms of the approach the model of «Triple Helix», which concept extends to the formation and development of regional innovation system (hereinafter RIS). Economic activity of university is largely determined by effective integration of education, science, industry and government agents and that, ultimately, is an effective tool to build a regional innovation system.

Brief Literature Review. F. Cook is one of the first theorists of RIS. According to him, RIS is a «set of nodes in the innovation chain, including the company generating knowledge directly, as well as organizations and businesses using (or applying) this knowledge, and a variety of structures that perform specialized mediation: infrastructure support, financing of innovative projects, marketing expertise and political support» [1].

Russian scientists also try to determine the issue of regional innovation system (K. A. Zadumkin, N. I. Vakhrusheva, etc.). In general, according to the authors, the RIS is either complex or institutions or organizations (or institutional infrastructure) that is the base of the region's innovative development. There are a lot of approaches to the definition of RIS, but our analysis of the different points of view on its essence provides several common features, and thus we may highlight the following.

RIS effectiveness is defined as a set of knowledge, skills, abilities, which are produced and generated in the interaction of certain institutional entities or institutions. In this case, by analyzing the structure of RIS participants we can conclude that universities in the region are on the first place among the factors, influencing RIS. They play their role as the organization generating and broadcasting knowledge, skills and abilities, and their infrastructure is able to provide a direct positive impact on the development of RIS. This concept of «university in the region» is especially popular in the works of foreign authors in the last 20 years, and is directly related to the model of «Triple Helix», proposed in 1997 by H. Etzkowitz [2]. L. Leydesdorff also gave his attention to the development of this theory in his works (2000-2012). K. Hill's paper is devoted to the university's role in the innovation system (2006).

The purpose of this article is to determine the role of university in the regional innovation system within the changing paradigm of higher education. In this paper, regional university complex is proposed to understand as the set of the higher education subjects, the most important distinguishing features of which are developed cooperative ties with the industrial sector of the regional economy and which should play a leading role in regional scientific-production associations due to its capacity (industrial enterprises, technologic zone, engineering organizations, technology transfer centres, design offices etc).

Results. Analyzing foreign experience of RIS development, it should be noted that the RIS essence in Europe and the United States varies widely. Firstly, we have completely different history of university complexes formation as a source of knowledge in the region (and as a consequence of the business core development in the regional university complex) in the Old World and the New World. Secondly, the concept and development of RIS was much more important for Europe than for the United States due to heterogeneity of the innovative regions development in Europe – most effective RIS concentrated either in capitals or around the major cities. Examples of effective RIS built in the small and medium-sized regions of Europe are presented in very little set: Oxford, Cambridge, Karlsruhe and Emilia-Romagna in Italy could be attributed to those ones [7].

Also, we have another Asian experience, for example, in case with China. In Russia, the activation of «university» factor in the local development of RIS hampered by weak links with industry, weak law-making base and a lack of patent activity development at university. Experts also stress that among problematic moments, there is disinterest of industrial sector in long-term relationships with universities. At the same time, the industrial sector in China is interested in short-term collaborative projects only as a part of the solution to production problems. In 2011, studies showed that the share of universities attracted for R&D collaboration with the industrial sector was 15,4% only (Wang, 2011). In fact, it seems in the very logical way that we consider RIS development within the «Triple Helix», where special attention is given to the active civil society as an important factor for the institutional spheres «hybridization»– state university and industrial sector connecting. Japanese history also confirms the importance of having a similar degree of society development. In 1980s, due to the activity of civil society, 19 Japanese prefectures were included in the program of «technopolis» development with regional universities as the core. The most interesting thing that attempts to revive economic activity in regions, distant from the industrial belt of Tokyo-Osaka, has been repeatedly made by the state government in 1960s and 1970s of 20th century, but without much success. And only when the active civil society was directly involved in discussion of comprehensive plans for the innovation infrastructure restructuring of the region, the Japanese government plans have been implemented. Of course, we can explain that the main reason is that Japanese society refers to a collectivist society with strong patriarchal patterns; however, the experience of the United States (Reagan policy of the «new federalism», for example) was the same – public involvement in the restructuring of the local economy directly affects RIS development.

As for domestic experience, we have an excellent example with Tomsk region and its regional university complex as a constant in the work of relevant topics. Despite some doubts and fears after the regional governor change in 2011, RIS development continues to show a positive trend due to the formed innovation infrastructure in the region. In 2012 the share of business innovation, research and education complex in gross regional product of Tomsk region (which economics has well-expressed «oil and gasoline» characteristics) was close to 8% (2.5 times higher than the national average) [8]. Tomsk Polytechnic University (TPU) is one of the leading players in RIS. In 2012, the first Russian-American Training Centre of company Hughes was opened within the infrastructure belt and the first Russian centre for the pharmaceutical and biotechnology industries training was opened together with «R-Pharm» in the framework of the agreements reached with ASI. In addition, TPU joined the technological platform «Materials and metallurgy technologies» («Modifying bronze» and «Nano-powders»), which allowed Tomsk scientists to participate in joint development with other universities, scientific and industrial organizations. University leading positions were recorded in several rankings. For example, TPU ranked the 9th position in the 10-top in the National Ranking of Universities in Russia, which is conducted by «Interfax» with the Russian Ministry of Education and Science. Another local University – Tomsk State University (TSU) – rated the 7th position. In the «RA Expert» rating «100 Best Universities in Russia» TPU takes the 8th position, but TSU – the 15th one. Also, Tomsk took the third position by «The Number of Nonresident Students». Their quantity increased by 3% to 54% (3 862 people) of the total first-year students in 2012 [8].

Influence of University on RIS development could be divided into two effects: short-term and long-term. Short-term effects include supporting for local economy by graduates. Long-term effects are primary reconfiguration of the regional economy. For example, boom of university high-tech spin-off in the late 20th century was not a uniquely American phenomenon. In France, the share of university spin-off took about 40% of the total number of established high-tech companies in the country from 1987 to 1997. The similar innovative enterprises that emerged in the late 1990s in the UK were numerous, and according to the study held in 2001, the average high school spin-off in the UK created 44 new jobs, which exceeded the number of new jobs created by an average SME [7].

Our authors' view on the extended functions for the university complex as the factor of the regional innovation system development is presented in Table 1.

As could be marked in above presented Table 1, university excepts its traditional functions (spread academic knowledge, cultural function, function of social «selection») fulfill other functions and for the successful implementation of which it is necessary to develop mechanisms of cooperation with the other

Tab. 1: **University functions as the factor of the regional innovation system development**

Function	Comments
Training/Broadcasting of academic knowledge	- Student education; - Advanced training courses for workers of corporate, branches.
Cultural	Younger generation take plans, values, life ideals prevailing in a given society. Thanks to this, young people are attached to the life of society, socialized and integrated into the social system.
Social «selection» Researching	- Implementation of the «social elevator» - Collaborate researches with government and industrial sector
Consulting	- University gives expert consulting for regional government and local business society; - Organization and energizing of business society by mutual conferences, forums, etc.

Source: Own research

members of the regional innovation system chain. Moreover, some of the traditional university functions, such as «to spread academic knowledge», are also modified by new requirements to the quality of knowledge that is generated and disseminated by universities. It is important to understand that the process of these functions realization is necessary for the further usage in implementation of certain values, and effectiveness evaluation. In Table 2, the authors' view on criteria and indicators for the effective participation of university/university complex in RIS development is presented. These criteria and indicators were collected after analysis of university functions as the factor of regional innovation system development.

Presenting the Table 2, we would like to stress the following. Firstly, indicators proposed in this table are not exhaustive. Secondly, it is impossible to achieve any of the presented indicators without the participation of either the government or the industrial sector (activation of «Triple Helix» principles). Achievement of the criteria for «younger» regional human capital is impossible without the regional programs implementation for young people and young scientists supporting or targeted support for this category from the industrial sector (scholarships etc.). Achievement of criteria for regional human capital is impossible without dual connection between university and the industrial sectors. The industrial sector is a natural customer of proper human capital (in its intellectual and innovative parts).

Conclusions. When knowledge transforms to the most important productive force in economic structure changing, universities, as the generators of knowledge, become active actors in the economy. They achieve ability to fulfill not only their traditional academic functions, but also serve as a driver of the regional economy. Despite the fact that a necessary condition for the development of university as the core of the regional innovation system declares its autonomy, the role of the government – especially in the Russian practice when a rigid vertical hierarchy exists – seems undeniable. Generalizing the experience of Russia's Tomsk region, we can say that the local governor's power should be considered positively. The participation of the industrial sector plays an active role in the transformation of university complex also. Nevertheless, when we stress the necessity to actively include the industrial sector in university transformation, we have to point out that it is necessary to maintain a balance between them. The fact that in some cases when the industrial sector has a strong influence, universities can be transformed into a model close to «Corporation model» with detriment of academic component. In some cases this can be seen as a negative aspect of cooperation between university and the industry. Such form of university might lead to the development of «useful» knowledge only, and essence of that industrial sector will determine alone the way of research. Understandable desire to «effective entrepreneurship» in university complexes must not take academic component away, depriving them of the ability to the adaptive flexibility as the public institutions that are involved in the most direct way to generate the cultural environment of the society.

The changes taking place in higher education not only in Russia, but around the world, form new demands for academic infrastructure as a regional base of human, industrial, technical and technological resources. University needs to identify the mechanisms that would lead them as intellectual centres to successful participation in the regional economic development. Working-out of applied tool that can assess the effectiveness of not only university, but also cooperation between university, government and industrial sector is a promising direction for the further research development of the regional innovation system.

Tab. 2: **Criteria and indicators for the effective participation of university/university complex in RIS development**

Criteria of university's effectiveness in RIS	Indicators of effectiveness
Innovative infrastructure of university	- number of start-ups; - number of spin-offs; - number of created jobs in the region; - number of the joint research centres on the base of university; - collaboration with the financial institutions to stimulate innovative activity; - patent and license activity; - university share in the regional gross income
Regional human capital	- number of jobs created by university complex or university and cooperation with industry; - number of employed graduates; - term of adaptation reduction for a «young» specialist
Productivity	- average productivity and labor productivity in the priority sectors of industry in the region
Amount of «younger» regional human capital	- number of students and postgraduates; - number of nonresident students and postgraduates; - number of international students; - number of young researchers and scientists up to 35 years

Source:Own research

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