***IBIMA Publishing***
*Journal of Eastern Europe Research in Business and Economics*
*http://www.ibimapublishing.com/journals/JEERBE/jeerbe.html*
*Vol. 2016 (2016), Article ID 623415, 19 pages*
*DOI: 10.5171/2016.623415*

*Research Article*

# University-Industry Cooperation in the Context of the Regional Innovation System in Russia: A Case of the Tomsk Region

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Received date: 27 July 2015; Accepted date: 28 January 2016; Published date: 23 June 2016

Academic Editor: Joanna Radomska



**Abstract**

Today universities receive a very close attention as they are viewed as crucial institutional actors and drivers of socio-economic development in national innovation systems. The types of university-industry linkages as well as the extent of such interaction are seen as an assessment tool to measure the efficiency of the university performance within regional innovation systems. Given the entrepreneurial character of the modern universities in transformation, this article investigates university-industry linkages to draw on systemic model for university-industry indicators developed to assess the university performance on the regional level. By analyzing government initiatives of the past decade intended to spur research activities in Russian universities and more specifically university-industry cooperation, authors shape and discuss several types of university-industry cooperation in Russia. Some of these types can be described as traditional and have been successfully exploited by universities as conventional cooperation channels with external actors. Some types of cooperation arise due to recent government initiatives, thus, the impact of these linkages is still arguable. The analysis in this paper builds on official regional and federal (national) level statistics to assess university-industry cooperation for 6 public universities in the region of Tomsk, Russia. The limitations of quantitative assessment are discussed, since the results of the study shape only several dimensions of university-industry interaction visualized through Russian official statistics. For multi-faceted analysis of university-industry interaction on the regional level, in-depth studies such as qualitative institutional analysis or expert interviews/surveys are required.

**Keywords:** university-industry cooperation, university-industry linkage, entrepreneurial university, university performance, regional innovation system, Russia, Tomsk region

**Cite this Article as:** Irina Pavlova and Marina Burenina (2016)," University-Industry Cooperation in the Context of the Regional Innovation System in Russia: A Case of the Tomsk Region", Journal of Eastern Europe Research in Business and Economics, Vol. 2016 (2016), Article ID 623415,
DOI: 10.5171/2016.623415

## Introduction

The increasing importance of institutional impact in the analysis of the regional innovation systems has been the subject of numerous research works in the past two decades. Research on the university-business interaction has become very important for understanding university as an institution which is undergoing transformation. At the same time, efficiency evaluation of university-industry cooperation is seen as an assessment tool to measure any university's performance. Both cases require developing a comprehensive methodology to analyze university activities. Russia has its own traditions of university-industry interaction being deeply rooted in the Soviet past. Universities traditionally had little autonomy with major performance resulting in education output. Research function in Russia historically was attributed to the Academy of Sciences with its network of research institutions and, therefore, universities were considerably less significant on the research scale. This study is devoted to the analysis of university-business interaction within the regional innovation system. First, the paper addresses the issues of university transformation in national innovation system and entrepreneurship as a new university function. Second, it explores the concept of university-industry cooperation and proposes a model elaborating a system of cooperation indicators. Third, it analyzes recent evolution of government stimuli measures to support university-industry cooperation in Russia. Finally, authors assess university-industry cooperation for 6 public universities in Tomsk regional innovation system using quantitative indicators available in national and regional statistics.

## University Institutional Transformation and a New University Mission: Literature Review

Education has been playing a crucial role in the development of human resources which are considered the main asset of the modern society. Being the haven for nurturing our societal growth, universities are often referred to as drivers of both social and economic development. Currently, each country seeks to develop an economy based on knowledge within the framework of a well-functioning innovation system. Such an economy is characterized by the need for scientific achievements and constant innovation. Since 80-90s researchers are actively exploring the concept of national (including regional) innovation system (NIS and RIS). The founders of this theoretical approach forged the seminal ideas of the concept naming research and innovation as the competitive advantage for the development of businesses and countries (Lundvall, 1992; Nelson, 1993; Freeman, 1987; Freeman, 2002). We understand innovation systems as systems of interconnected institutions creating, accumulating and disseminating knowledge and skills shaping new technologies (Metcalfe, 1995), or as all important economic, social, political, organizational, institutional, and other factors that influence generation, diffusion and use of innovations (Edquist, 1997). In particular, the activities of all actors involved into knowledge production today are often associated with universities.

University transformation is due to the so-called academic revolutions which reshaped university missions and granted them with tools to choose their development strategies. The first academic revolution incorporated research into the academic mission enriching university as an institution with functions of both education and science. It brought to our attention the increased role of practice-oriented research with a new mission of the university to create knowledge. The second academic revolution transformed the university from an isolated ivory-tower organization into an open interactive center for advanced science. Etzkowitz and Webster (1998) describe it as the translation of research results into the area of intellectual property, trade and economic development. Had become by that time traditional, teaching and research missions were enriched during the second academic revolution with a new mission of knowledge capitalization. Internal university dynamics and external needs demanded translation of academic science

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into industry with blurring the boundaries between the university and industry. Science became an internal factor of the production process development. Slaughter and Leslie (1997) identify the structural changes taking place in science as "academic capitalism" referring to the market or market-like activities of the university and its personnel aimed earning money and raising funds.

At the regional level, universities are active participants in its socio-economic development in the regional innovation system due to their interaction with industry and public authorities (Yusuf & Nabeshima, 2007; Arbo & Benneworth, 2007; Schrempf et al., 2013). It is worth to mention that universities in different national innovation systems have various organizational structures and functions corresponding to the specific NIS. In particular, universities in the Russian Federation for the most part are historically engaged in education while the research function of the NIS is assigned to research institutions, namely of the Russian Academy of Sciences. This unique characteristic of the Russian Federation's innovation system makes us comprehending the university differently than in other countries where this institution is engaged both in education and research.

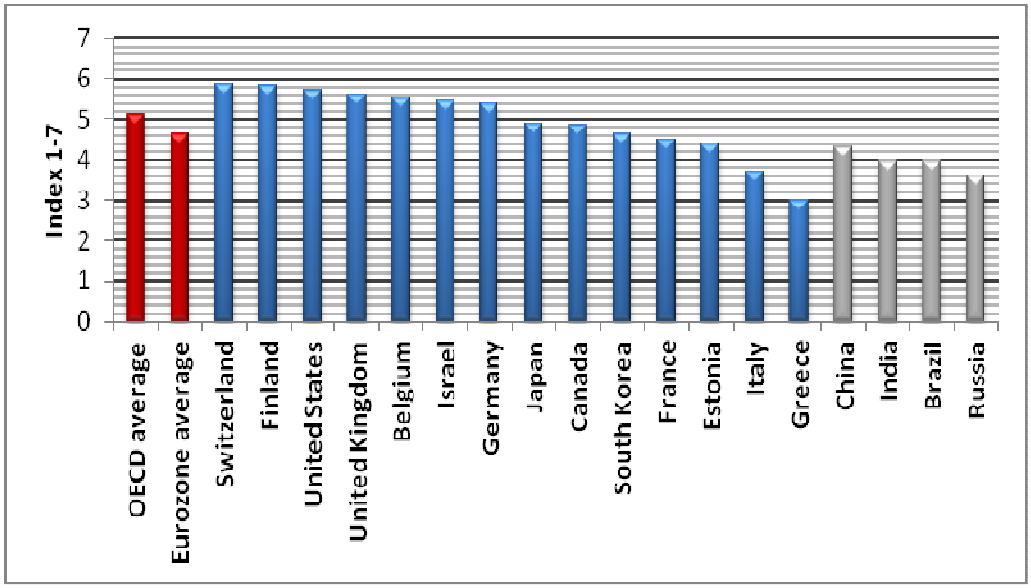
In addition to the academic revolutions, academia describes transforming university missions in terms of the "Mode 1", "Mode 2", "Mode 3" identifying altering status of knowledge generation process within the society. "Modes" used to study the dynamics of the evolving science as well as to describe the differences between the various stages of this evolution. While "Mode 1" envisages generation of knowledge and its practical application dissociated in time and space, "Mode 2" emphasizes the value of applied science considering it as a product of trade (Gibbons et al., 1994). Knowledge became an essential component of forming the commodities costs. Multidisciplinary research is inherent to this knowledge production altogether with blurring boundaries between the scientific community and other institutional spheres of the society such as the business and the government. The process of knowledge generation and distribution is marked by growing communications and interactions between actors. Therefore, double interaction helices "university – business", "government – university", "government – industry" are not suffice to describe present dynamics.

As a critical response to the concept of Gibbons' knowledge production, Etzkowitz and Leydesdorff (1998; 2000) proposed a non-linear triple helix model of cooperation based on spiral relationship of university – industry - government interactions ("Mode 3") with the creation of entrepreneurial universities as crucial assets. Here, the core of innovation is the university, which is a premise for science and education, generating ideas and interacting with business within a legal framework of civil society built under the leadership of the government. The universities become more integrated into the regional innovation system; they are intensively developing as institutions performing not only the traditional educational and scientific functions, but also a relatively new entrepreneurial function. From the perspective of triple helix model, Etzkowitz (2008) characterizes an entrepreneurial university by capitalization of knowledge, close interaction with industry and government, independence in decision-making and reflexivity as an internal characteristic for inner restructuring and revision of university relations with the business and the government. All these lead us to understanding universities as educational, research and entrepreneurial institutions.

**Types of University-Industry Cooperation**

University-industry (university-business) cooperation (interaction/alliances) is seen as one of the research directions for assessing the efficiency of any university. It is also particularly the case for those higher education institutions which identify themselves as entrepreneurial ones. Russia witnesses today active development of

higher education sector with numerous government support programs for universities. Many Russian universities long to call themselves entrepreneurial, though officially there is no such status within the legislative documents. At the same time, university-industry cooperation evaluation allows to assess the university's place and role within regional innovation system, understand the university impact for the local environment. This type of interaction shows the degree of the university openness as a system, its willingness to build relationships with the external environment, as well as the implications of universities and industries performance for each other. According to the Global Benchmark Report of 2014 (2014), Russia has a weaker position in the research cooperation between universities and business, compared notably with the European Union and the OECD countries, and even falling behind the BRICS countries (Fig 1). Index values from 1 to 7 indicate assessment of university-industry research collaboration by senior managers in the country. Stronger research collaboration between universities and industries is seen as an essential guarantee factor for research relevance and knowledge transfer between universities and businesses.




***Source: Global Benchmark Report 2014 (2014)***

**Figure 1: Research collaboration between university and industry in 2012-2013**

Santoro and Chakrabarti (2001) point out four types of university-industry interaction:

1) supporting research through allocation of financial resources, use of equipment, establishment of charitable trust funds to update the university laboratories and providing scholarships for implementation of new promising projects;

2) carrying out joint research on the contract basis with certain research staff or employees engaged in consulting services, as well as the creation of research groups specifically to address the business challenges;

3) transfer of knowledge through formal and informal interaction, cooperation in education, curriculum development and staff exchanges;

4) transfer of technology focuses on solving a specific business problem when the university is engaged in research and industry, being an expert, evaluates and promotes technologies needed for the market (university usually provides basic and technical knowledge expertise

together with patents or through licensing).

Davey et al. (2011) have another vision of cooperation between business and universities falling within the domains:

- joint scientific research - contract research, consulting, research projects, partnership in publishing the results of scientific discoveries;

- commercialization of R&D results through conducting R&D for the industry's needs, licensing and patenting, creation of small businesses on the basis of university scientific research;

- mobility of students and employees - the dissemination of knowledge and technologies through the exchange of students and teaching staff between universities and enterprises;

- development of joint training programs - including the courses, special guest lectures and workshops;

- lifelong learning - the continuous acquisition and development of competences and skills, including extended education, training and mentoring;

- entrepreneurship - the active involvement of universities in the creation of new enterprises and the development of the students and scholars entrepreneurial mindset as a result of interaction with the business structures;

- governance - scientists from the universities involved in the decision-making in companies and taking managing positions; on the other hand, representatives of businesses are being involved in the governance of the university departments, etc.

All types of interactions indicated above represent consistent structured knowledge flows, both formal and informal, in the form of human, information, material and financial resources exchanges. However, in the framework of university-industry interaction we should also pay attention to implicit (tacit) knowledge often gained in the course of practical activities which is more related to the institutional environment performance and joint activities of universities and business.

Numerous research works investigating university-industry cooperation (Etzkowitz, 1998; Santoro & Chakrabarti, 2001; Barnes et al., 2002; Hall, 2004; Perkmann & Walsh, 2009; Perkmann et al., 2011; Davey et al., 2011; Ranga et al., 2013; Healy et al., 2014) allow joining all possible indicators in a systemic model of university-business interaction according to university missions. This model integrates all indicators into metrics building blocks according to the university institutional functions which are education, research, entrepreneurship (Pavlova & Monastyrny, 2015) (Fig 2). It also includes in-between spaces for transitional indicators featuring university overlapping activities. This model is flexible since it systematizes major areas of university-industry cooperation, but allows any modifications suitable for research tasks for any particular university in any country-specific innovation system.

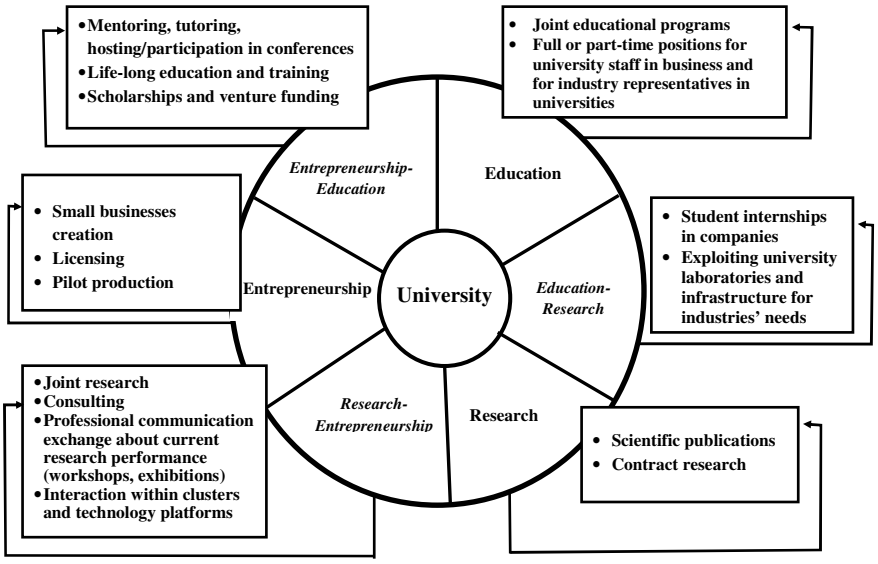



**Figure 2: A model of university-industry cooperation according to university institutional functions**

Also, interaction metrics for universities may be grouped into two measuring categories: input and output indicators. Under the input parameters we understand any factor contributing to the achievement of the desired result of interaction. The output indicators characterize the achieved result or performance and assess social and economic effect of the university-industry interaction. One of the input indicators, for example, is the availability of resources, as research activity requires substantial financing. For companies, it is important that the university has sufficient R&D funds coming from public and private sources in the form of government allocations, research grants and contract agreements since it enables firms to achieve economies of scale. Another important input indicator is highly skilled research workforce. However, such input indicators alone cannot manifest successful and fruitful cooperation.

The interaction between universities and business is the most efficient when the participants are motivated and are willing, for example, to obtain extra financial resources for their research, to make advancements as the scientists and to improve their personal reputation, to boost the efficiency of the production process while implementing R&D results. It is also the case when participants envisage new opportunities as a result of university-industry cooperation such as publishing joint academic papers, engaging in new research projects, undergoing professional training, using university laboratories and equipment, etc. Due to historical background and institutional environment, any innovation system is path-dependant. Therefore, all input and output indicators are country-specific and may show different efficiency of university performance in different national and regional settings.

## Mechanisms of government support for university-business cooperation: case of Russia

Despite the inherent characteristics of rather rigid and conservative internal environment, the universities still are currently undergoing permanent changes since they are obliged to cope with external challenges and meet the requirements of a country-specific innovation system development. A very commonly issue

discussed is the policy design for intensifying university-industry cooperation. For example, Ramos-Vielba et al. (2009) suggest the need for systematic studies on the initiatives promoting cooperation and factors pushing universities and firms towards collaboration. Government initiatives can provide mechanisms and tools for such a cooperation promotion and support.

Since 2008 in order to strengthen the research in the universities and raise universities performance efficiency, the system of higher education in Russia has experienced a considerable institutional rethinking from the standpoint of university restructuring. The role of universities was reconsidered and new national university taxonomy was developed. Thus, new forms of university design appeared with new status and missions, tasks, performance indicators and public financial resources re-allocations. Nine federal universities were established under the Decree No. 716 of the President of the Russian Federation "On the Federal Universities" and 29 national research universities were created under the Decree No. 1448 of the President of the Russian Federation "On the Implementation of a Pilot Project of National Research Universities".

These seemingly new institutions were not launched from a scratch; they were created, being more precise they received the new status, on the basis of already existing, quite successful, leading Russian universities. The primary goal for federal universities was seen as the development of higher education sector within the regional dimension of federal districts, while national research universities act more locally within their regions. Both university categories envisage strategic growth in knowledge production and innovation. Therefore, Russia acquired new types of university with research and innovation missions as a counterpart to traditional historic scientific monopoly advantage of the Academy of Sciences. "The Strategy of Innovation Development of the Russian Federation to 2020" (Strategy of Innovation Development of the RF, 2010) stipulates that research universities should carry out both basic and applied research. The strategy operates with a set of measures and mechanisms aiming at developing university science, as well as supporting university cooperation with industries.

The Innovation Strategy addresses the issues of (1) raising public funds allocations on research, education and innovation activities comparable to those in OECD countries, since they are responsible for competitiveness of domestic economy; (2) increasing spending on a competitive basis for applied research realized jointly with industry. Table 1 shows R&D allocations as a percentage of GDP in Russia compared to OECD countries. Table 2 shows the difference in R&D funding between Russia, the US, the United Kingdom and the European Union. In Europe and the US, the business sector is dominant in R&D funding, while in Russia the prevailing share of R&D expenditures comes from the government. The higher education sector is not significant in the represented regions except for the United States. However, it is noteworthy that Russia observes gradually increasing percentage of GERD performed by the higher education sector (Table 3). Despite the fact that these figures are still inferior to numbers of the OECD countries, since 2000 this indicator for Russia has considerably grown and almost doubled by 2013 from 4.55% to 9.01%.

**Table 1: GERD as a percentage of GDP (%)**

| *Region* | *2011* | *2012* | *2013* |
|---|---|---|---|
| OECD | 2.33 | 2.33 | 2.36 |
| Russia | 1.09 | 1.12 | 1.12 |

***Source: Main Science and Technology Indicators, OECD (OECD, 2015).***

**Table 2: GERD by source of funds (%)**

| *Region* | *Business* | | *Government* | | *Higher Education* | |
|---|---|---|---|---|---|---|
| | 2010 | 2012 | 2010 | 2012 | 2010 | 2012 |
| EU-28 | 53.8 | 55 | 34.8 | 32.8 | 0.9 | 0.9 |
| Russia | 25.5 | 27.2 | 70.3 | 67.8 | 0.5 | 0.8 |
| USA | 57.2 | 59.1 | 32.6 | 30.8 | 3 | 3 |
| United Kingdom | 44 | 45.6 | 32.3 | 28.7 | 1.2 | 1.1 |

***Source: Science, Technology and Innovation. Key Indicators (Eurostat, 2015).***

**Table 3: Percentage of GERD performed by the higher education sector *(%)***

| Countries and regions | 2011 | 2012 | 2013 |
|---|---|---|---|
| OECD countries | 18.40 | 18.44 | 18.18 |
| 28-EU | 23.57 | 23.58 | 23.52 |
| Russia | 9.03 | 9.29 | 9.01 |

***Source: Main Science and Technology Indicators (OECD, 2015).***

University-industry cooperation is considered as the way to modernize higher education and to push forward innovation development of national economy. According to the Russian government, it could be done through the contracts for the implementation of joint educational programs and research, R&D commercialization, technology transfer, etc.

The Federal Law of August 2, 2009 No. 217, "On Amendments in Legislative Acts of the Russian Federation on Establishing Companies by Public Research and Educational Entities in Order to Implement Intellectual Results" (Federal Law of the RF No.217, 2009), also known as 217-FL (Federal Law No. 217), claimed to be similar to the US Bayh-Dole Act. It granted academic institutions with the right to set up small innovative companies on the basis of institution's scientific developments. These newly established legal entities also are subject to tax benefits. Before the adoption of 217-FL, the main legal form university-industry interaction was joint research cooperation with the distribution of profit and revenues within the frameworks of signed agreements. Table 4 shows the dynamics of setting innovative companies by universities under 217-FL (Sheregi & Ridiger, 2013).

**Table 4: Small innovative businesses created under 217-FL**

| Year of creation | 2009 | 2010 | 2011 | 2012 | 2013* | Total |
|---|---|---|---|---|---|---|
| Quantity | 27 | 243 | 355 | 174 | 5 | 804 |
| % | 3.4 | 30.2 | 44.2 | 21.6 | 0.6 | 100.0 |

**** - The data for 2013 are not fully available***

28.6% of small innovative businesses have the university as their only founder (Table.5). The rest are founded by the university together with companies, institutions and individuals. Statutory capital of the companies includes patents (for 71.1% of companies), computer programs and databases (56.6%), equipment and other assets (52.8%), money (44.3%) (Sheregi & Ridiger, 2013). Individuals starting companies together with universities can also be university employees motivated to business generation and university R&D commercialization.

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**Table 5: Founders of small innovative companies under 217-FL**

| Share of companies, % | Founding stakeholders |
|---|---|
| 28.6 | University |
| 43.7 | University and individuals |
| 15.1 | University and companies engaged in joint research program with university |
| 12.6 | University and companies not engaged in joint research program with university |

As one more leverage for change in developing research and innovative university activities and interaction with industries 3 government resolutions can be discussed. Resolution of the Government of the Russian Federation No. 218 from April 9, 2010 "On Government Support for Cooperation of Russian Higher Education Sector Institutions Engaged in High-Technology Complex Projects Development" (Resolution No. 218, 2010) allows manufacturing companies to apply for public grant subsidies for the time period of up to 3 years. Funding is aimed at projects developing high-tech production with grant support of up to 100 million RUR per year with the co-funding obligations of the same amount on behalf of companies. The objectives of this program were identified by the Ministry of Science and Education and Science as (1) development of cooperation between Russian universities and enterprises; (2) development of science and education in universities; (3) encouraging industry to employ the potential of universities for the production development on the basis of research and innovation in the Russian economy as a whole.

Resolution of the Government of the Russian Federation No. 219 from April 9, 2010 "On Government Support for Development of Innovation Infrastructure in Federal Institutions of Higher Education Sector" (Resolution No. 219, 2010) is aimed at the development of university innovation infrastructure, legal protection of university's intellectual property, training university staff, creation and development of small innovative companies.

Finally, Resolution of the Government of the Russian Federation No. 220 from April 9, 2010 "On Attracting Leading Researchers to Russian Higher Education Sector" (Resolution of the Government of the RF No.220, 2010) provides grants of up to 150 million RUR on a competitive basis for research teams with leading scientists as the teams' heads. This instrument is aimed at increasing the quality of university research, making higher education institutions more open to the world of science and attracting large number of scientists from different countries to lead Russian university research teams.

In addition to all the university-industry cooperation incentives' mechanisms mentioned above, technology platforms and territorial innovation clusters are an important basis for the technological and organizational interaction of universities and industrial enterprises. Since 2010, technology platforms have become tools of joint efforts of government, business and academia to identify the problems of innovation development within technology-specific innovation system, develop strategic research programs and find ways to implement them. Russia accounts 32 technology platforms with a wide range of stakeholders: leading scientific and educational organizations, large and medium industrial enterprises, small businesses, associations. Moreover, in 2012, 25 innovation clusters located in areas with a high concentration of scientific, technical and industrial activity received government support.

**University-industry cooperation models in Russia**

The studies of university-industry cooperation experience and government support mechanisms for such interaction lead us to the understanding of several basic country-specific models for university-industry cooperation in Russia:

(1) Basic education and training at the university department when universities and companies work closely together within educational programs developed jointly or developed by university according to businesses' needs. This rather conventional cooperation model is characterized by excellent transparent information and human resources exchanges, as this interaction involves both students and university/industry staff in all possible university-industry partnership activities;

(2) Contract R&D as a traditional university-industry cooperation model commonly used in Russia;

(3) Business generation model including innovative companies under the FL-217. This model implies the creation of any businesses by universities, both students and employees, or university environment. FL-127 became just another tool for this model evolution;

(4) Resolutions No.218-220 as a new university-industry cooperation model aimed for strategic cooperation;

(5) Technology platforms and regional innovation clusters inscribed in regional innovation system where universities contribute to social and economic development.

**Universities in Tomsk Research and Educational Cluster**

Research and Educational Cluster is a city-forming factor for the regional innovation system of the Tomsk region. It is the economic and social basis for the city of Tomsk which has numerous higher and secondary vocational educational institutions. Every eighth resident of the city is a student. Total student body in Tomsk comprises 59,532 students (Main Professional Sector's Indicators of the Tomsk Region in 2014, 2015). The core of educational complex is 6 state (public) universities which were chosen for the current research:

- National Research Tomsk State University (TSU),
- National Research Tomsk Polytechnic University (TPU),
- Tomsk State University of Control Systems and Radioelectronics (TUSUR),
- Siberian State Medical University (SSMU),
- Tomsk State Pedagogical University (TSPU),
- Tomsk State University of Architecture and Building (TSUAB).

In 2014, total financing of educational activities of these 6 institutions amounted to 12,505.2 million RUR, research - 4,812.4 million RUR (Main Professional Sector's Indicators of the Tomsk Region in 2014, 2015).

In the global QS World University Rankings, Tomsk is currently represented by two national research universities – TPU and TSU. They are also participants of the Russian academic excellence project "5-100" aimed at raising the competitive position of leading Russian universities in the global research and education market by entering the pool of the first top hundred universities in the university rankings by 2020.

**University-industry interaction in Russia on the regional level**

University-industry cooperation output indicators were defined and assessed basing on the evaluation of (1) input indicators, (2) areas and forms of university-industry cooperation in Tomsk research and education cluster, (3) available federal and regional statistics for monitoring higher education institutions for 2012-2014. The results of the Tomsk university-industry study are summarized below.

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***"Innovation belt"***

"Innovation belt" of the university, or the closest university innovation environment, is the number of (1) companies established by the university, (2) Tomsk companies which have signed license agreements or have a contractual obligations with universities in the area of science and technology. The leader in the number of companies is TUSUR with 135 companies in its innovation belt, followed by TPU and TSU (Fig 3). Fostering university innovation ecosystems with numerous companies is positioned by Tomsk universities as long-term development strategy.

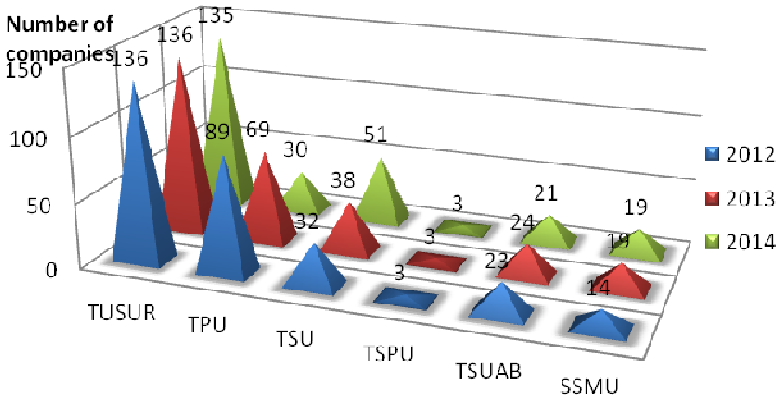


**Figure 3: Number of companies in university innovation belts**

***Vocational training programs***

The interaction of universities and business in educational sphere is measured by indicators of additional vocational training programs developed and taught (1) by universities on the request and according to the demands of employers (both companies and organizations) (Fig 4), (2) jointly by universities and companies (Fig 5). TSPU, SSMU and TSUAB are the leaders in the growth rate in educational programs for vocational training. The total number of programs developed and implemented for the period of 2012-2014 accounts for TPU - 624 programs, TSU - 308 programs, SSMU - 325 programs, TSPU - 225 programs, TSUAB - 104 programs, TUSUR – 61 programs.

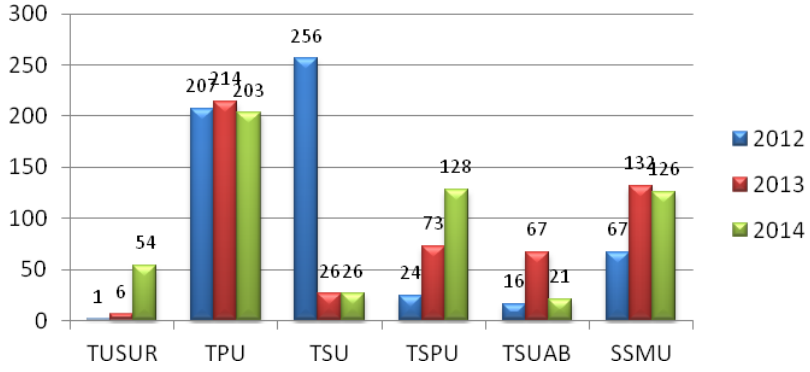


**Figure 4: Number of additional vocational educational programs developed on demand of the companies and organizations**

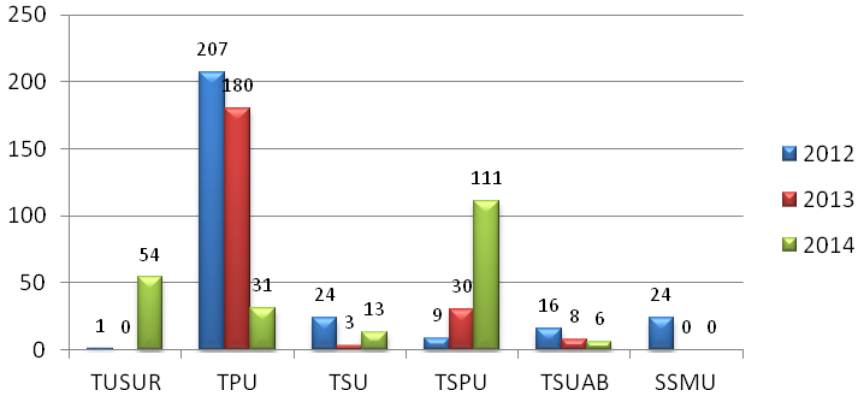


**Figure 5: Number of additional vocational educational programs developed jointly with the companies and organizations**

**Information exchange through conferences and exhibitions**

Information on joint publications manifesting university-industry cooperation is not available for Russian universities on a unified basis allowing credible comparisons. Statistical databases witness only gross number of all academic publications in Russian and foreign journals with their decomposition on those indexed in Scopus and Web of Science. Apart of it, the interaction between the university and businesses in the field of science can be indirectly assessed through information exchange on current research results through: (1) number of scientific and technical conferences organized and hosted by universities; (2) number of conferences in which the university took part; (3) number of exhibitions attended and number of items presented and displayed at exhibitions.

TSUAB and SSMU show positive dynamics in the growing number of scientific conferences with university as their hosts (Fig 6). Other universities observe a decrease in the number of conferences organized from 2012 to 2014. At the same time, absolute leaders is the gross number of scientific conferences for the period 2012-2014 are TPU (200 conferences) and TSU (194 conferences). TPU is also ranked first by the number of conference events where the university took part in 2012-2014; it is followed by TSU with 1241 events (Fig 7). Remarkably, the third place goes to TSPU with 1013 conferences attended. The average annual growth rate of university participation in scientific conferences for 2012-2014 shows the highest dynamics increase for SSMU, TSPU and TSU. TSUAB's growth is quite insignificant. TUSUR has constant figures in this regard. And TPU demonstrates a little negative trend.

In terms of participation in exhibitions in 2012 to 2014, the first place belongs to TPU (179 exhibitions and 1460 exhibit units displayed) (Fig 8). TSU is ranked second with 111 exhibitions and 840 units. Then go TSPU with 109 exhibitions and 1282 exhibits, TUSUR with 78 exhibitions and 108 exhibits, TSUAB with 62 exhibitions and 177 exhibits, SSMU with 11 exhibitions and 16 exhibits. Despite the small number of exhibitions and units displayed, TUSUR and TSUAB have positive average annual growth rate in terms of participation in exhibitions. TSPU, TSU, TPU also have positive growth although it is insignificant. Three universities - TSPU, TSUAB and SSMU – show increase in the number of exhibits at exhibitions compared to 2012.

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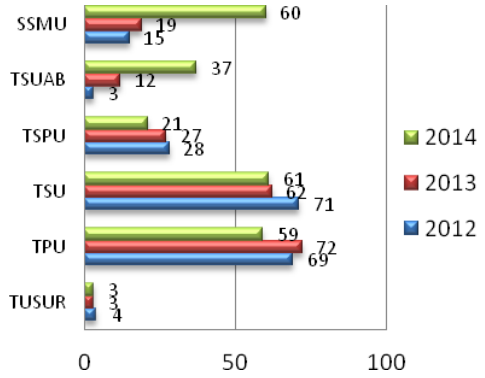



**Figure 6:**
**Number of conferences hosted by universities**

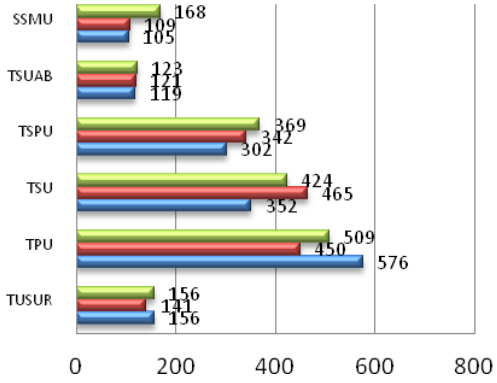



**Figure 7:**
**Number of conferences attended by universities**

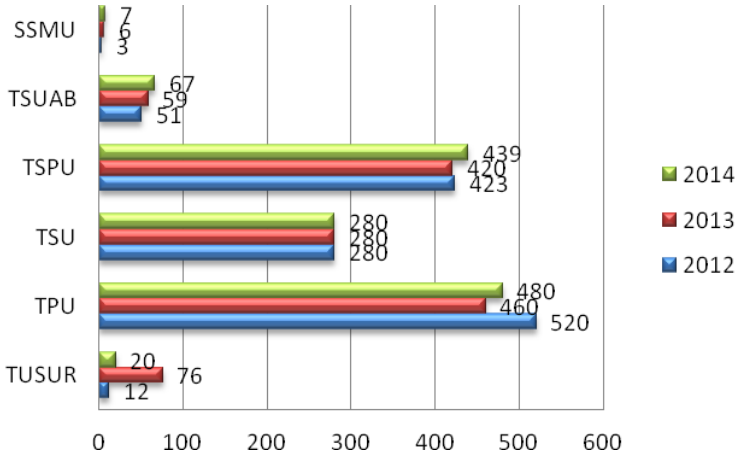
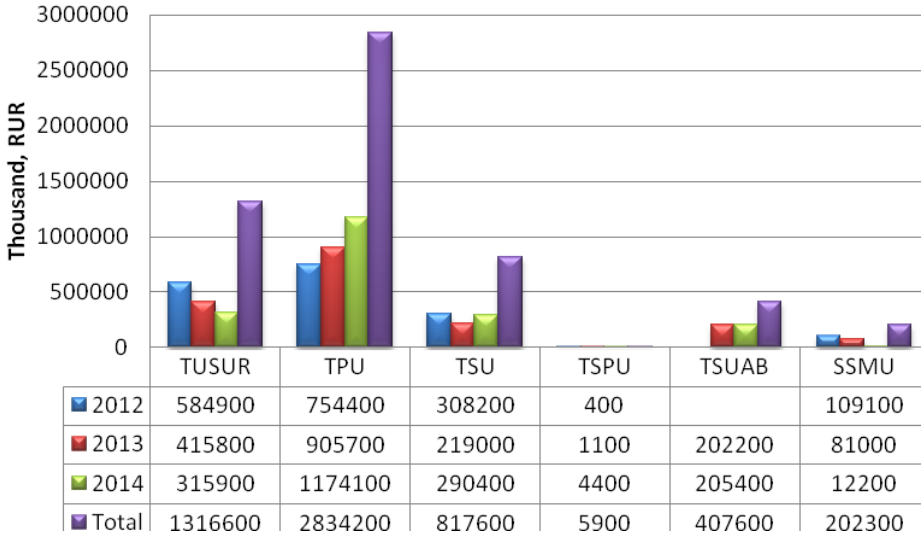



**Figure 8: Number of exhibit units displayed by universities at the exhibitions**

**Joint and Contract Research**

Joint and contract research in university-industry interaction is measured in funds under the commercial contracts and agreements signed between universities and businesses (Fig 9). In 2012-2014, the top contract funding amount is attributed to TPU, followed by TUSUR and then by TSU. Though very low in absolute numbers, TSPU had a relatively significant growth in funding for this period of time. TPU and TSUAB are characterized by a slight increase. TSU, TUSUR and SSMU show decrease in commercial contracts funding for the selected period .




| | TUSUR | TPU | TSU | TSPU | TSUAB | SSMU |
|---|---|---|---|---|---|---|
| 2012 | 584900 | 754400 | 308200 | 400 | | 109100 |
| 2013 | 415800 | 905700 | 219000 | 1100 | 202200 | 81000 |
| 2014 | 315900 | 1174100 | 290400 | 4400 | 205400 | 12200 |
| Total | 1316600 | 2834200 | 817600 | 5900 | 407600 | 202300 |

**Figure 9: University-industry contract obligations in 2012-2014**

***New government support incentives***

In terms of government support incentives for university-industry interaction according to the Resolution No. 218, only three Tomsk universities (TUSUR, TPU, TSU) in 2013-2013 raised funds under contracts with businesses for high-technology manufacturing with subsidies from the government. As a result, TUSUR attracted 269 million RUR, TSU - 230.7 million RUR, TPU - 113.7 million RUR. TSUAB joined the program in 2013 and raised 85.0 million RUR.

Additionally, for a long time TSU was the only one among Tomsk universities engaged in the research programs according to the Resolution No.220. The university received 3 grants in 2011-2013. In 2013, TPU also became a finalist of the program starting the research laboratory in 2014.

***Small innovative businesses***

In the creation of small innovative companies under 217-FL, the leading position is assigned to TPU with a total of 50 enterprises by the end of 2014, followed by TSU - 35 companies, TUSUR - 27 businesses, TSUAB – 5 companies, SSMU – 4 companies, TSPU – 3 enterprises. Fig 10 shows the numbers of the annual small innovative companies creation under 217-FL by Tomsk universities.

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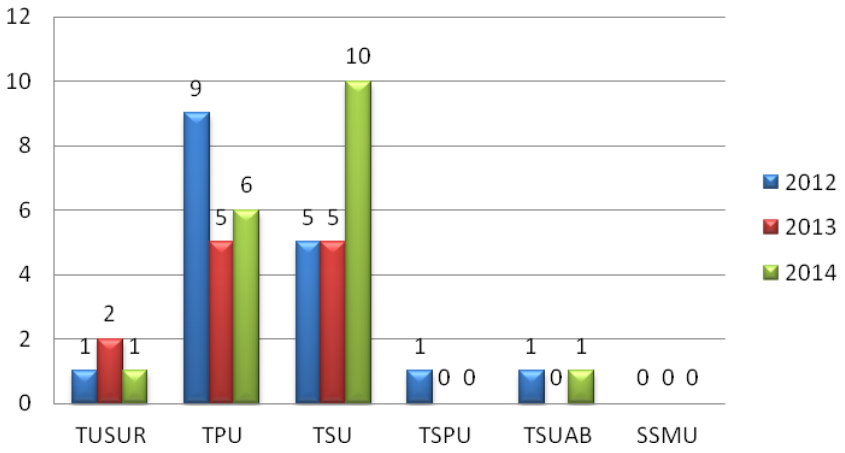


**Figure 10: Small innovative companies under 217-FL**

***Licensing agreements***

In 2012-2014, the number of licensing agreements with both the enterprises from university innovation belt and with other third-party companies accounts 32 agreements for TPU, 23 for TSU, 10 for TUSUR, 8 for SSMU, 5 for TSPU and 2 for TSUAB (Fig 11).

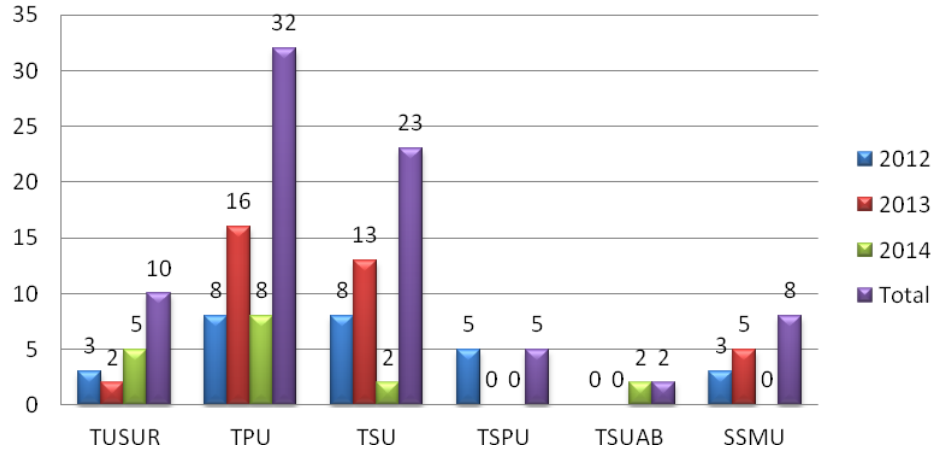


**Figure 11: University-industry licensing agreements in 2012-2014**

***Technology platforms and regional clusters***

Tomsk universities are actively engaged in university-business cooperation within technology platforms. TPU ranks the best among all universities with 24 technology platforms; TSU is involved in 19 platforms; TUSUR is a party to 8 technology platforms; TSPU and SSMU participate in one technology platform each. Also, TUSUR and SSMU make the core of government supported regional innovation cluster "Pharmaceuticals, medical technologies and information technologies".

**Discussion and conclusion**

The study of interaction of Tomsk universities and businesses show that the identified university-business cooperation models pretty much fall within the mold of research works on types of collaboration such as in Santoro and Chakrabarti (2001), Davey et al. (2011) or Seppo and Lilles (2012). First, universities tend to cooperate in traditional frameworks of educational approach. This way of interaction promotes fruitful human resources and information exchange without additional financial resources allocated on behalf of the universities. Usually industries are actively involved in education of full-time students, since they envisage it as a perspective for graduates' recruitment and professionals' headhunting. At the same time, companies actively participate in the educational process through vocational training development. The presented research findings also demonstrate the biased position of the universities in Russia. Traditionally, they have used to be the locus primarily for education. Being obstinate and persistent in their educational mission, today they painfully struggle to increase the value and the scope of research function for the vast majority of university teaching personnel.

For Russia, university-industry contractual obligations were a traditional way for companies to cooperate with universities. As university-business interaction within educational model, this model is also popular and widely used. Also, it is obvious that universities take on the mission to be open entities and build their own ecosystems of companies, preferably innovative ones. The university transactional role in university-industry research cooperation is taken over by the necessity for the university to play more active role as a regional activity integrator.

University-industry cooperation support on behalf of the government made possible new mechanisms for interaction, but there are some limitations to them. As the study shows, statistically 217-FL and Resolutions No. 218-220 provide new possibilities for large universities with strong research background. These universities are already more financially sustainable with much more significant financial resources allocated. They also have considerable student body and professor staff like TSU and TPU which are the leaders in all quantitative metrics selected. Smaller universities with narrow specialization, like TSPU, TUSUR, SSMU and TSUAB can show dynamics on a specific indicator, i.e. vocational programs development, number of conferences hosted and attended, number of companies in the university innovation belt.

Small innovative enterprises created under 217-FL are also the case of statistics limitedness, since there is only one indicator present on the process of businesses generation. Besides, the commercial output of these businesses is still yet dubious.

It is clear that all six universities have their own area of expertise and specialization. In education and training they operate within specific majors which do not usually overlap. The exceptions are pairs like TPU and TUSUR, TUSUR and TSU, TPU and TSU on a limited number of majors taught.

The research findings demonstrate advantages of the used quantitative approach, since it allows general comparisons of universities which are different by their structure and nature. The paper contributes to the literature on university transformation with the identified forms of university-business cooperation in modern Russia supported by statistical analysis on the regional level. Limitations of quantitative metrics and scarce statistics at the same time narrow the analysis, so the quantitative assessment used alone to research developing systems like universities in developing economies can be argued. Partly, it is due to insufficient indicators in the national and regional statistics on universities because of a narrow understanding of the current nature of modern universities performance. For instance, Piva and Rossi-Lamastra (2013) indicate that limitations of the current studies on university-business performance evaluation are possibly due to the scarce use of indicators aimed at measuring "ex ante conditions"

and, moreover, it is important to start measuring performance even before the cooperation is established. Alongside with the quantitative metrics for the in-depth university-industry cooperation study, it is necessary to apply qualitative approach which can reveal the specifics of new emerging entrepreneurial university phenomena in Russia and traits of modern universities under transformation in general. The researchers stress the need of combination of statistical based macro-analysis with micro-analysis to contrast conclusions based on in-depth study of representative cases (Ramos-Vielba et al., 2009). As the next research step, combination of quantitative and qualitative approaches will be applied in the Tomsk university-business cooperation analysis. It will allow us drawing on holistic approach to estimate the importance of the universities for industries; the importance of businesses for the university; the university impact for regional innovation systems and clusters.

**Acknowledgement**

This research was performed in collaboration with Tomsk Polytechnic University with financial support of the Russian Foundation for the Humanities, research project No. 15-12-70002 "Institutions for regional economic development: formation processes".

**References**

(1) Arbo, P. and Benneworth, P. (2007), 'Understanding the Regional Contribution of Higher Education Institutions: A Literature Review', OECD Education Working Papers, No. 9. [Online], OECD Publishing. [Retrieved March 22, 2015], http://dx.doi.org/10.1787/161208155312 .

(2) Barnes, T., Pashby, I. and Gibbons A. (2002), 'Effective University –Industry Interaction: A Multi-case Evaluation of Collaborative R&D Projects', *European Management Journal,* 20 (3), 272–285.

(3) Davey, T., Baaken, T., Galan Muros, V. and Meerman, A. (2011), The State of EuropeanUniversity-Business Cooperation. Part of the DG Education and Culture Study on the Cooperation between Higher Education Institutions and Public and Private Organisations in Europe.

(4) Edquist, C. (1997), 'System of innovation approaches – their emergence and characteristics' in C.Edquist (ed.), Systems of Innovation: Technologies, Institutions and Organizations. London and Washington: Pinter/Cassell Academic, 1-35.

(5) Etzkowitz, H. (1998), 'The norms of entrepreneurial science: cognitive effects of the new university–industry linkages', *Research Policy,* 27, 823–833.

(6) Etzkowitz, H. and Leydesdorff, L. (1998), 'The endless transition: A "Triple Helix" of university-industry-government relations', *Minerva*, 36, 203-208.

(7) Etzkowitz, H. and Leydesdorff, L. (2000), 'The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations', *Research Policy,* 29, 109-123.

(8) Etzkowitz, H. (2008), The Triple Helix: University-Industry-Government Innovation In Action London: Routledge.

(9) Etzkowitz, H. and Webster, A. (1998), 'Entrepreneurial science: The second academic revolution' in H. Etzkowitz, A. Webster and P. Healey (Eds.), Capitalizing knowledge. New intersections of industry and academia. Albany: State University of New York Press, 21–46.

(10) Eurostat Science, Technology and Innovation. Key Indicators (2015). [Online], Eurostat. [Retrieved May 20, 2015], http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database.

(11) Federal Law of the Russian Federation No. 217 from August 2, 2009 "On Amendments in Legislative Acts of the Russian Federation on Establishing Companies by Public Research and

Educational Entities in Order to Implement Intellectual Results" (2009) (in Russian).

(12) Freeman, C. (1987), Technology policy and economic performance: lessons from Japan. London: Pinter.

(13) Freeman, C. (2002), 'Continental, National and Sub-national Innovation Systems – Complementarity and Economic Growth', *Research Policy*, 31 (2), 191-211.

(14) Gibbons, M., Limoges, C. Nowotny, H., Schwartzman, S., Scott, P. and Trow, M. (1994), The new production of knowledge: The dynamics of science and research in contemporary societies. SAGE Publications.

(15) Global Benchmark Report 2014 (2014). Copenhagen: Confederation of Danish Industry.

(16) Hall, B.H. University-Industry Research Partnerships in the United States. Kansai Conference Paper, February 2004.

(17) Healy, A., Perkman M., Goddard J. and Kempton L. (2014). Measuring the Impact of University-Business Cooperation. Final report 2014. Luxembourg: Publications Office of the European Union.

(18) Lundvall, B-A. (1992), National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London: Pinter.

(19) Main Indicators of the Professional Education Sector of the Tomsk Region in 2012 (2013). Tomsk: TSPU (in Russian).

(20) Main Indicators of the Professional Education Sector of the Tomsk Region in 2013 (2014). Tomsk: TSPU (in Russian).

(21) Main Indicators of the Professional Education Sector of the Tomsk Region in 2014 (2015). Tomsk: TSPU (in Russian).

(22) Metcalfe, S. (1995), 'The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives' in P.Stoneman (ed.), Handbook of the Economics of Innovation and Technical Change. London: Blackwell, 1995, 409-512.

(23) Nelson, R.R. (1993), National Innovation Systems: A Comparative Study, Oxford: Oxford University Press.

(24) OECD Main Science and Technology Indicators (2015). [Online], OECD, [Retrieved July 07, 2015], http://stats.oecd.org/viewhtml.aspx?datasetcode=MSTI_PUB&lang=en.

(25) Pavlova, I.A. and Monastyrny, E.A. (2015), 'Complex modeling of socio-economic systems: using institutional functions of research and education complex for analysis of entrepreneurial universities', *Innovatsii (Innovations)*, 3, 39-44 (in Russian).

(26) Perkmann, M. and Walsh, K. (2009), 'The two faces of collaboration: impacts of university-industry relations on public research', *Industrial and Corporate Change*, 18(6), 1033–1065.

(27) Perkmann, M., Neely, A. and Walsh, K. (2011), 'How should firms evaluate success in university-industry alliances? A performance measurement system', *R & D Management*, 41(2), 202–216.

(28) Piva, E. and Rossi-Lamastra, C. (2013), 'Systems of indicators to evaluate the performance of university-industry alliances: a review of the literature and directions for future research', *Measuring Business Excellence*, *17*(3), 40-54.

(29) Ramos-Vielba, I., Fernández-Esquinas, M. and Espinosa-de-los-Monteros, E. (2009), 'Measuring university–industry collaboration in a regional innovation system', *Scientometrics*, *84* (3), 649-667.

(30) Ranga, M., Hoareau C., Durazzi N., Etzkowitz H., Marcucci P. and Usher A. (2013), Study on University-Business Cooperation in the US, Final report, May 2013, London School of Economics and Political Science.

(31) Resolution of the Government of the Russian Federation No. 218 from April 9, 2010 "On Government Support for Cooperation of Russian Higher Education Sector Institutions Engaged in High-Technology Complex Projects

Development" (2010), Ministry of Science and Education of the Russian Federation (in Russian).

(32) Resolution of the Government of the Russian Federation No. 219 from April 9, 2010 "On Government Support for Development of Innovation Infrastructure in Federal Institutions of Higher Education Sector" (2010), Ministry of Science and Education of the Russian Federation (in Russian).

(33) Resolution of the Government of the Russian Federation No. 220 from April 9, 2010 "On attracting leading researchers to Russian Higher Education Sector" (2010), Ministry of Science and Education of the Russian Federation (in Russian).

(34) Santoro, M. and Chakrabarti A. (2001), Firm Size and Technology Centrality in Industry-University Interactions, MIT IPC Working Paper IPC-01-001.

(35) Schrempf, B., Kaplan, D. and Schroeder, D. (2013), 'National, Regional, and Sectoral Systems of Innovation – an overview', Report for FP7 Project "Progress", progressproject.eu.

(36) Seppo, M. and Lilles, A. (2012), 'Indicators measuring university-industry cooperation', *Discussion on Estonian Development Policy*, 20 (1), 204-225.

(37) Sheregi, F.E. and Ridiger A.V. (2013), Perspectives of Interaction of Industry and Science. Volume 8: University small innovative companies. Moscow: Center for Social Forecasting and Marketing (in Russian).

(38) Slaughter, S. and Leslie, L. (1997), Academic capitalism: Politics, policies, and the entrepreneurial university. Baltimore and London: Johns Hopkins University Press.

(39) Strategy of Innovation Development of the Russian Federation to 2020 (2010). Moscow: Ministry of Economic Development of Russia (in Russian).

(40) Yusuf, S. and Nabeshima, K. (2007), How universities promote economic growth. Washington, D.C: World Bank.

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