

An Analysis of the Forms of Commercialization of Intellectual Property Objects of Higher Education Institutions: Russian and International Experience

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Abstract. The article focuses on an analysis of legislatively derived forms of commercialization of intellectual property, which can be realized by higher educational institutions in the process of implementation the concept of the triple helix and during the transition to the quadruple helix, as well as the main trends of the development of commercialization of intellectual property are covered. Despite the market demand in the effective use of intellectual assets, the higher education institutions share in the structure of organizations which perform research and development activity is insufficient. Transfer of innovative ideas to the real sector of the economy is one of the most important aims of universities development. As for the research tools, logical, empirical, theoretical methods of knowledge were chosen. The article emphasizes the most popular form of commercialization in universities; one of them is research and development contracts, however, entering into contracts significant problems were identified and described by the authors. Besides, the establishment of small innovative enterprises is a promising form of commercialization in higher education institutes. International experience shows the high efficiency of this form of commercialization of innovation, however, the effectiveness of this tool in local practice at the moment can be defined as insufficient. The results of the study considered to be of interest for the development of higher education institutions strategy in implementation of the program of development and research activities and commercialization of their results.

1. Introduction

Intellectual property issues are being given particular attention all over the world. Recently, in local practice, measures to improve legislation and taxation towards consolidation to originate objects of intellectual property and provide their future commercialization have been taken. Proceeding the study, firstly it is necessary to determine the terminology describing this process. After different points of view on the concept of commercialization of intellectual activity were examined, the definition proposed by Karpova N. N. in collection of articles of Fonstein N. M. and Zinov, V. G., is accepted by the authors as the base and the most simple and exhaustive for this article. The term "commercialization of intellectual property", proposed by above-mentioned authors, covers "the process of involving the results of intellectual activity in economic turnover or using them in their own economic activities" [6, p. 59].

In the modern world, the relevance of intellectual activity results is due to significant progress of high efficient technologies usage which allows producing goods at world-class standards. Intellectual resources are the most important basis for the development of advanced economies in the world. But, despite the global trends, the commercialization of intellectual property share in Russia is negligible and represents no more than 2 percent out of the number of valid patents in 2000-2016 [13, p. 199].

This circumstance may be related to the lack of a legislative framework of intellectual property. It makes it difficult to find, systematize and choose the form of commercialization for stakeholders. For the purpose of fully completed information about the legal forms of commercialization, the authors have studied and analyzed the legislation, legal websites, as well as special literature. As the issue of commercialization of research work and its products, which represent the results of intellectual activity, are potentially subject for its commercialization, is a primary aspect at the international level, that's why many works of foreign and local authors dedicate to information coverage.

The issues of intellectual property promotion and protection, including the sphere of higher education, to be given to the work of Katkova E. A., Karpova N. N., Khomenko E. V., Prohoda I. A., Suleymanov N. T., Suleymanova A. N., Fedorets O. V., Skvortsova I. V., and others.

An important role of innovation and research belongs to educational organizations, which expand the field of their activity and become legitimate participants of the innovative products market at present time.

But at the same time, Russia is not currently a leader of intellectual property commercialization, and the success of higher education institutions is not significant and it is mostly based on the results of several dozen of universities.

The objective of this article is to assess issues of main trends of the processes of development of intellectual property results commercialization, as well as to identify the most effective forms of commercialization of higher education institutions innovative developments.

The object of the research is intellectual activity and its results. The subject is the commercialization of intellectual activity. As tools of scientific research logical (analysis, synthesis), empirical (observation, description, comparison), theoretical (axiomatic method, generalization, method of system analysis) methods of cognition were chosen.

2. The main trends of development of commercialization of the of intellectual activity results at the universities

One of the aspects of the concept of the triple helix model of higher education is to consider the University not just as an educational institution, but also as a center for generating innovative ideas and their further commercialization. There are logical frameworks for establishment of such model of the University, bearing in the mind the requirements dealt with in the Federal state standards for the share of lectures with scientific qualifications, who train students in various scientific fields, in percentage terms. Thus, Universities are the centers of accumulation of scientific capital and capacity. In fact, universities should act as one of the main institutions in the structure of the economic system of the country, generating the results of intellectual activity.

The data of table 1 in generally confirm that the share of higher education institutions in the structure of organizations that carry out academic research and development rises dynamically but still is insufficient.

Table1.Table research and development organizations.

Years	1991		2000		2010		2015		2016	
	nu mb er	sha re	nu mb er	sha re	nu mb er	sha re	nu mb er	sha re	nu mb er	sha re
Total	456	100	409	100	349	100	417	100	403	100
Researching institutes and organization s including higher education organization s	4		9		2		5		2	
	183	40	268	66	184	53	170	41	167	41
	1		6		0		8		3	
	450	10	390	10	517	15	104	25	979	24
							0			

*compiled by the authors based on data from the statistical collection “Indicators of science: 2018” Higher school of Economics.

The same trends about innovations are typically for other countries, but with a proviso that apply to the group of middle-and low-income countries, where Russia is confidently in the top 5. This group has recently shown a steady growth in the range of innovations quality. Moreover, the growth has occurred in the quality of scientific publications, especially three largest universities of Moscow state University, St. Petersburg state University and Novosibirsk state University (Hirsch-index, citation) have particularly high rates. But there is a significant gap in the number of exported inventions. Thus, according the statistics data of Global Innovation Index for 2018, «

“1097 patent applications were received from Russia through the PCT system (an international patent that runs across different countries). There are 56 624 applications from the USA, 48 882 from China, and 18 982 from Germany for comparison”.

It is necessary to emphasize that the positive indicators of the ratings are achieved by a small group of universities; while the most of the higher education institutions have inadequate innovation activity performance, although work in this direction is carried out in all universities.

According the Higher school of Economics research, no more than 25% of academic personnel of universities are engaged in scientific research [5, p. 166].

Monitoring of innovation activities effectiveness of Russian universities, conducted by RBC in 2016, identified the following data according the transfer of innovative developments:

- extra-budgetary scientific development has amounted, on average, 420 thousand RUB. per one academic employee (as for leaders it is more than one million);
- extra-budget scientific research and development has amounted, on average, about 10% of the total budget of universities (some of them – more than 35%);
- there is one small innovative enterprise (SIE) to 1000 students and scientific-pedagogical employees (as for leaders there are 2-3 SIE to 1000students or academic employees);
- in the half of the studied universities, small innovative enterprises do not make any profit for the University, the rest part of studied universities make about 400 thousand rubles profit a year, mainly due to contracts where the SIE is a customer, and the University is a contractor, and it does not fairly represent profitability or effectiveness of the SIE. Only some universities indicated profit as royalty from SIEs (0,26 mln – BSU) or MIPS payments under the license agreements (1.2 million rubles – HSE-NRU);
- universities income from the innovative development management is extremely low, on average, 28 thousand rubles per year per 100 academic employees;

- engineering services provided by universities make, on average, 7.6 million rubles per 100 academic employees (6 universities out of 40 indicated 0);
- international patents are another weak side of technological transfer development of universities. 28 universities out of 40 do not have any international patent, several universities have few. Tomsk Polytechnic University is the only which has 11 international patents.

In Russia, the increasing of innovation activity and commercialization of intellectual property has started not so long ago and it is significantly hampered by some reasons. There are three categories of Universities so far, the first of which (top 20) are obliged to be into the international rankings, which determines the research activities commercialization high rates. These educational institutions receive 25 % of the total targeted budget funding for academic activities. The second level of universities is so called top 100 – the total amount of its funding is $\frac{3}{4}$ of subsidies for education [2]. Other universities share $\frac{1}{4}$ of funding, in other words some of them do not get any funding. It is worth nothing that some of the "non-top" universities contribute the maintaining and "strengthening" the position of outsiders because of weak management culture, and lack of understanding of modern trends and strategic thinking. In such kind of universities the vast majority of scientific and pedagogical staff retains a conservative perception for educational organization and considers it a non-profit institution, but "not a business". It can be predicted, that such kind of universities may lose their autonomy, can be unified to the top universities or eliminate because of the strengthening of the requirements for the commercial side of educational activities while the transition to the fourth helix in case of a lack of demand for training directions provided by the universities on the labour market.

3. Forms of commercialization of universities intellectual property

Taking into account the specific features of higher education organizations activity, the main tools for the commercialization of intellectual property and their introduction are: engineering, franchising, the establishment of small innovative enterprises, industrial cooperation (ordinary partnership and joint ventures), leasing of intellectual property, securitization, alienation of rights, execution of the order under the contract, licenses selling.

From the legislative perspective, taking into account the legal framework of Universities activities, it is impossible to use franchising, leasing and securitization in its pure form.

There are the most effective forms of commercialization of intellectual property in higher education institutions:

- 1) execution of the order under the contract (state or municipal contract for state and municipal needs and contracts for the performance of research, development and technological works, including alienation of the rights contracts;
- 2) licensing and transfer of rights;
- 3) establishment of small innovative enterprises;
- 4) industrial cooperation as a ordinary partnership (establishment of clusters);
- 5) engineering (engineering centers establishment).

It can often be used a combination of tools due to commercialize intellectual property.

The example of using of industrial cooperation and engineering is the engineering centers establishment based on top universities of the country. According V. Osmakov, deputy chief's of the Ministry of industry and trade, 60 engineering centers were opened based on 37 universities and 11 more are going to be opened as in the end of 2017 in Russia. 125 industrial enterprises with the orders equal to 2.5 billion rubles in total have been customers for these centers.

The most popular form of commercialization in universities are research and development contracts, that, to a large extent, meets operational characteristics of higher education institutions and makes it possible to implement the scientific potential of the academic staff according the subject their research. However, during the contracting process, the following problems were identified: high level of overhead charges (60 %), which is a demotivating factor for both sides as for the customer as well as for the contractor; deterioration and/or lack, backwardness of the technological base; low level of commitment of academic staff, who are the main labor resource for intellectual activity. The

production component issue can be solved through the idea of clusters establishment, but the personnel issue is more difficult to address.

It is necessary to point out another, perhaps indirect, factor that is a motivational obstacle to realize research and development for academic staff of universities. If we compare time for full completed performance of the preparation for training and methodological materials, according Federal state educational standards requirements, as well as minimum amount of academic setting, with the salary of employees, the result of such comparison will rather demotivate additional research, even considering its possible commercialization in future. There is paradoxical fact that the automation of many processes in higher education sphere entails an increase of bureaucratic component of the activity, which reduces its effectiveness as well.

Another promising form of commercialization of the results of intellectual activity at universities is small innovative enterprises (MIP) establishment. This direction is promising from any points of view and encourages involving creative and talented students into research activity at the earliest stages of training, as well as addressing the students' professional practice, where they can use the theoretical knowledge received during the training. It is necessary to pay special attention for management and marketing during the establishing of such enterprises: they are key factors for commercialization along with innovative activity. The authors of intellectual property often do not have the personal qualities and professional competencies to manage and promote it in the market.

The results of development innovative structures showed that only 3 percent of small innovative enterprises make profit more than 20 million rubles a year through their activity but 43 percent of SIE are not capable.

The authors-researchers [4] emphasize the following issues: difficulties in identifying and evaluation of intellectual property; unfavorable investment climate, especially concerns the venture investments; low financial literacy among scientific and pedagogical workers and underdeveloped innovative structure, in particular in lack of marketing and promotion knowledge and skills.

The last two problems concerning Economics and marketing deserve special attention. The period 2016-2018 tended to revoke state accreditation of so-called "non-specialized" course at higher vocational institutions. So, the state accreditation of 38.00.00 direction Economics and management of two out of eight construction universities (Tomsk and Novosibirsk) in Siberian region were revoked during last for six months. Students and graduates of these directions, the graduate level in particular, had to be members of the small innovative enterprises of universities, which would be the solution of the mentioned above problems and indicate the level of competencies for the graduates of 38th group of specialties, providing the interoperability and efficiency increasing of educational processes at the University. Academic setting for the fourth year construction course bachelors were reduced through eliminating of practical training of the "Fundamentals of investment activity" subject at Novosibirsk Construction University. As a result, actual deeds both the State and universities contradict the declared policy in relation to innovation.

The indicators of effectiveness of small enterprises establishing due to for innovative activity are very low. The number and pattern of growth of MIPS are very low and determine the level of 30% of the world indicators. International experience, for its part, shows high efficiency of such form of commercialization of innovation as small innovative enterprises.

4. International experience of intellectual property commercialization

In the US, the idea of establishing of so-called "entrepreneurial universities" appeared in the 80s of the twentieth century. The function in this matter is performed by the So-called Research Universities of the first and second categories assume main function in this direction (about 235) [1].

The leaders among universities are Stanford research Park (Silicon Valley), a "research triangle" consists of three North Carolina universities and "Boston route 128" Techno park, which includes northeastern and Harvard universities, and Massachusetts Institute of technology. Such parks have helped to establish new industries which produce new goods and services and, as a result, have created new jobs. Just these three sites represent about 750 companies.

The process of commercialization of scientific activities of universities in Western Europe started much later – in the early 2000s. Clearly, that its beginning was a consequence of the Bologna process.

University of Edinburgh, University of Northampton and the University of Plymouth are the leaders in the commercialization of intellectual activity in the UK [1].

There is division of the land into two types in Germany: one of them is a high innovative potential and another is medium innovative potential, but with a high possibility of transfer of innovative technologies. “The Association of private sponsors of German science” analyzed the situation in 393 public and private German universities. The results were presented in the rating called "Startup radar" ("Gründungsradar"). Munich high school was the leader of rating among large universities. University of Lüneburg (Leuphana Universität Lüneburg) was on the top position among medium-sized universities. And Leipzig graduate School of Management (HHL Leipzig Graduate School of Management) has a leading position among higher education institutions with the number of students 5000 and less. Just 26 universities listed to leaders in the development of entrepreneurial culture.

Sweden earlier than other European countries began the process of transfer of educational universities into entrepreneurial – it was in the eighties of the last century. To achieve this goal, all universities provide programs of practical entrepreneurial education and commercialization of scientific developments, while many local universities closed economic and management directions through depriving of state accreditation instead of reorientation and providing a necessary vector for these directions. The Swedish University of Lund was the first one that introduced a course of practical entrepreneurship and today is one of the most science-intensive universities; the University of Carolina – one of the largest medical universities in Europe and the largest medical training and research center in Sweden; Chalmers Technical University and the University of Gothenburg, Royal Institute of Technology – the largest in the field of innovation and their implementation. Entrepreneurial universities have become the center of the establishing of largest techno parks [1].

There is experience of avoiding the involvement of universities in entrepreneurship through the requirements of scientific activities implementation and its commercialization (France) while the country is in the top 10 innovative economies of the world.

One of the leaders in the sphere of development and replication of innovative start-ups is Finland, where the process of involving universities to commercialize research and development activity started in 2010. With regard to this country, we can state about the identity of approaches and motivation for scientific and pedagogical workers of the two countries. Many of them do not consider personal economic component as a main motivating factor for researching, but the main one is self-realization, personal scientific interest. In addition, there is a possible lack of time for such work, related to many other tasks, as well as the time spent to prepare the financing documents. However, the leading universities in technology transfer can be detected: Aalto University, Technological University of Tampere, and University of Jyväskylä. Each of these universities include a unit (research center), which brings together researchers, professors and graduate students. The operational aims of the centres can be different but all of them have the general objective to promote the research and its commercialization through various tools and forms of cooperation with investors and industry.

We should mention the organization of intellectual property management in Asia. The leading position among the innovative universities of the Asian region belongs to Korean Institute of advanced technologies (KAIST), according the ratings based on the analysis of the number and quality of scientific publications and patents [19]. As the University was established with financial support from the United States, so the frame of research work is similar to the model of "entrepreneurial universities" described above. The rating results show a successful symbiosis of Eastern culture and the Western model of business organization.

The "cluster" approach to the implementation of development of research activities programs through the universities participation is very popular in foreign practice. The using of clusters can partially address the material and technical issues for research at universities. Such approach would be rational in local practice, but poor resource base of research and development companies is a barrier to

the active implementation, which is due to the shortage and insufficiency of resources devoted to this type of activity in companies of medium and small businesses.

5. Conclusion

The analysis showed that in the world practice universities are not just educational institutions, but also act as centers of generation of innovative ideas oriented towards commercial goals through intellectual activity. In Russia, most universities show humble indicators of innovation activity, although work in this direction is carried out in all educational organizations. The main barriers for that are:

1) despite the significant dynamics in the legal framework improvement, we want to point out the lack of unified legislative package governing the issues of registration, management and commercialization of intellectual property,

2) insufficient human capacity of many universities to perform the tasks (low level of defense of pre-doctoral and doctoral theses; high average age of academic staff; low level of motivation to engage this kind of activity; heavy work schedules, including the preparation of supporting documents (work programs, assessment tools, etc.) and low wage level in the educational sphere compared with other activities);

3) mental problems: many employees of higher education institutions still perceive education as a creative process, not a business, while the commercialization of the educational activity have started in the early 90s of the last century, but there is still no understanding that higher education institution is a subject of entrepreneurial activity (similar to the concept of "entrepreneurial University" in the United States), some inertia of "scientific and pedagogical workers» as a social group can be also added here);

4) poor manufacturing base of many universities with limited funds for its creation and/or development set by the state and business;

5) there is a gap between research results and consumers of intellectual activity. The elimination of this gap is one of the postulates of the concept of the "quadruple helix" in higher education.

The researcher supposes to be kept abreast of the latest developments, challenges, and problems which the industry and the market face. There is a need for scientific events, exhibitions and fairs, covering the results of innovative developments and projects, where everyone, including potential investors can be invited. The involvement of students in research activities, providing the transfer of experience from the academic staff to young people is a necessary condition. The study of the demand for innovative developments and the market for high-tech products manufactured by competitors can also be an engine for the development of the commercialization process in universities. It is necessary to reduce bureaucratic barriers which affect the activity of scientists, and thus more researchers for the innovative development generating can be involved. In this regard, a necessary condition for the development of the market of innovative products, apart from educational organization activity, is a state regulation, strong state policy, that integrate specific activities of stimulating of the innovation process, as well as the formation of sustainable relations and culture of commercialization of intellectual activity.

References

- [1] Andryushkevich O A, Denisova I M 2014 The experience of establishing of entrepreneurial universities in the context of model of "triple helix" Capital of the country Federal internet-version http://kapital-rus.ru/articles/article/opyt_formirovaniya_predprinimatelskih_universitetov_v_kontekste_modeli_troj/
- [2] Apukhtina Yu 2019 Gray mass Research about how high education became fee-based and bad *Project* <https://www.proekt.media/research/gosudarstvennoe-vysshee-obrazovanie/>
- [3] Gribovskiy A V, Ushakova S E 2014 Mechanism of State support of small business abroad *Science. Innovation. Education* 16 205-221
- [4] Guremina N V 2011 The analysis of establishing of commercial enterprise by scientific and

- educational institutions according to Federal law from 02. 08. 2009 №217-FL *In the world of scientific discoveries* vol **15(3.1)** 604-609
- [5] Katkova E A 2017 Innovative potential of higher institutions of Russia *Economics* 72-1
- [6] Karpova N N 1996 Legislative protection and commercialization of intellectual property of Russia Commercialization of intellectual property: problems and solutions *M.: Zelo* 58-71
- [7] Satalkina N I, Dvoretzki S I, Krasnyanski M N, Galygin V E, Tarov V P, Pasko T V, Terekhova G I 2012 Commercialization of intellectual activity results of scientific and educational organizations: state and prospective of development: monograph *Tambov: publisher FSBEO HPE «TSTU»* 168 ISBN 978-5-8265-1156-5
- [8] Levitskaia L V, Emelyanovich A A, Koval S V 2018 Innovative processes in higher education under the paradigm of new economic context *Kant* **4(29)** 310-316
- [9] Leshinskaya A N 2017 Analysis of small innovation companies functioning based on budgetary scientific and educational organizations in RF. Scientific Statements of Belgorod state university *Series: Economics. Information technology* **23(272)** <https://cyberleninka.ru/article/n/analiz-funktsionirovaniya-malyh-innovatsionnyh-predpriyatiy-sozdannyh-na-baze-byudzhetnyh-nauchnyh-i-obrazovatelnyh-uchezhdeniy-rf>
- [10] Muhamedshin I S 2018 commercialization of objects in intellectual property sphere: monograph Russian State Academy of intellectual property edu. publisher *M.: Prospect* 104
- [11] Nikitenko S M, Goosen E V 2015 Subjects of small innovative entrepreneurship at universities and research institutes: types and a manner of activity *Basic research* vol 12(1) 171-176
- [12] Nikolaeva L P 2013 Commercialization of intellectual property of company as a factor of economic development *Public administration Electronic journal* vol **39** 132-141
- [13] Pechenova E V 2017 Improvement of regulation of commercialization of intellectual property Legislative protection, economics and management of intellectual property *M.: RIM University* vol 4
- [14] Global Innovation Index: Russian position in the world of innovations website vc.ru <https://vc.ru/flood/44152-global-innovation-index-mesto-rossii-v-mire-innovatsiy>
- [15] Emelyanovich A A, Kulyagina E A, Tsurkan E V 2017 Synergies in innovative management *Competitiveness in global world: economics, science, technologies* **3-1(32)** 42-45
- [16] Berthon P, Pitt L, Kietzmann J & McCarthy I P 2015 CGIP: Management of intellectual property, created by customers *California Management Review* **57(4)** 43-62
- [17] Bhargava P M 2016 Scientific Research and Economic Development *Social Change* **46(2)** 260-266
- [18] Donald S 2007 Siegel ReinhildeVeugelers, Mike Wright, Technology transfer offices and commercialization of university intellectual property: performance and policy implications, *Oxford Review of Economic Policy* vol 23 **4** 640-660
- [19] Ewalt D 2016 The Most Innovative Universities The Reuters <http://www.reuters.com/article/us-asiapac-reuters-ranking-innovative-un-idUSKCN1152B7>
- [20] Greenwood D J, Brydon-Miller M & Shafer C 2006 Intellectual Property and Action Research **4(1)** 81-95
- [21] Julpisit A, & Esichaikul V 2018 A collaborative system to improve knowledge sharing in scientific research projects *Information Development*
- [22] Nizhegorodtsev R M, Sekerin V D, Gorokhova A E, Goridko N P 2017 Features of innovation management strategies in the post-industrial economy *Academy of Strategic Management Journal* vol 16 **2**
- [23] Madalińska-Michalak J 2018 Fostering quality education research: The role of the European Educational Research Association as a scientific association *European Educational Research Journal*
- [24] Sá C 2018 Commercialization of Science, Higher Education *Encyclopedia of International Higher Education Systems and Institutions Springer, Dordrecht*
- [25] Sapir A, & Oliver A L 2017 From academic laboratory to the market: Disclosed and

- undisclosed narratives of commercialization *Social Studies of Science* **47(1)** 33–52
- [26] Yang D 2008 Commercializing Intellectual Property Internationally In: Understanding and Profiting from Intellectual Property *Palgrave Macmillan* (London)
- [27] Wood P 2017 Overcoming the problem of embedding change in educational organizations: A perspective from Normalization Process Theory *Management in Education* **31(1)** 33–38