The Coordination Centre Model as a Tool for Increasing Human Capital Efficiency and Commercialization of University Innovations

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Abstract. Currently, one of the main conditions for the modernization of educational activities and the economy as a whole is the innovative activity of higher education institutions. This article analysed the innovative activities of the St. Petersburg Polytechnic University. Peter the Great, during which it was revealed that despite the rather active development of innovative products by the technical departments, the level of commercialization of the developments is extremely low. The main reason for this phenomenon is weak marketing support, which allows both to predict the demand for certain developments from the market before the implementation of innovative projects and to effectively promote the results of already completed work. To solve this problem, we propose to introduce, on the basis of the Engineering and Economic Institute, the Coordination Centre for the Promotion of University Innovations, which is able to ensure continuous interaction of all departments of the university with the goal of effective commercialization of technologies and developments.

1. Introduction

The implementation of innovative activities by higher schools is the main condition and driver of modernization of the educational system and economic development in general [1]. Innovations have a positive effect on the renewal of the material and technical potential of the economy and are one of the significant factors in increasing the efficiency of higher schools. Performing such functions as educational and scientific, universities also need to focus on innovation for further strategic development [2], [3]. In addition, by creating an effective system of research and innovation in Russian universities, it will be possible to form an innovative economy and train qualified personnel, which is the basis of economic growth and social development of society [4], [5], [6]. As noted by L.V. Kozhitov, current innovative activity, like scientific and educational, is one of the most important areas and main tasks of modern higher schools [7].

The section “Formation of the institutional environment for innovative development”, laid down in the Concept for the Long-Term Socio-Economic Development of the Russian Federation for the period until 2020, defines such crucial tasks as the development and further effective use of mechanisms of interaction between the state apparatus, population, business structures and civil society. It also determines institutional changes for the development of small and medium-sized enterprises through business incubators, technology parks and industrial parks and at the same time strengthens the role of research institutes responsible for creating an enabling environment in which long-term investment projects are implemented [8].
To move to an innovative economy in Russia, it is necessary to increase the level of integration development of science, education and business, remove existing institutional and legal barriers in the field of regulation of the intellectual property market, and also take care of the formation of public-private partnership mechanisms [9], [10], [11].

For the effective development of the university, it is necessary to select promising areas of research that would be implemented both in the form of a portfolio of research and development (R&D), and in the form of promising projects. To make it possible, the university must provide a system for forecasting and permanent monitoring of the relevant research areas and innovative developments, which can be further commercialized in the market. Without this forecasting system, the university will be able to take only the position of a catch-up or will act in the subject area that players establish [12]. In addition, the university should focus on research of both the primary and secondary markets, which are carried out by scientists as part of personal projects or marketing departments of innovative infrastructure, if any, and work effectively.

By creating an innovative infrastructure at the university, it becomes possible to solve the complex task of creating a special environment that encourages students, graduate students, and higher school workers to conduct, in addition to scientific and educational activities based on modern scientific trends and market demands, innovative and entrepreneurial activities that promote the commercialization of university high-tech products. The innovative infrastructure, which includes various elements, ideally provides full support for the entire innovation development cycle - from the initiation of an idea to the commercialization of a product, while solving tasks aimed at analysing, evaluating and selecting projects that are at various stages of development, problems of ensuring project teams with necessary resources (for example, premises, equipment, etc.) and services (information and advisory support in the field of intellectual property, marketing, fund raising, and so on.) [13], [14]. As one of the main indicators of an efficiently working innovation infrastructure, the number of innovation and intellectual activity that are accepted for budget accounting is considered [15].

Strengthening the competitive position of the Russian Federation economy is possible due to the introduction of the results of innovation activity into the economic turnover obtained by scientists of higher schools. These aspects of commercialization underlie the processes of integration of science, education and production. However, in our country, integration processes are complicated by several factors: the weak material and technical bases of science in higher education; insufficient number of sources of investment in innovation, in connection with which the task was set to study the experience of Peter the Great St. Petersburg Polytechnic University in this area and suggest directions for improving the current situation.

2. Methodology
This article analyses the innovative activities of the units of the St. Petersburg Polytechnic University. Peter the Great, during which it was revealed that despite the relatively large number of R&D and innovative products developed, only a small part of them reached the market for goods and services. In this regard, we conducted an interview on the possible reasons of low level of commercialization at the university. 10 experts (5 of them represented the entrepreneurs from partner companies and 5 – researchers from different departments) took part in this interview. Questions were the following: “Could you define the possible reasons of low commercialization level at university?” and “Which actions can be undertaken to improve the indicators in this area?”

Based on the answers we proposed to organize a certain governing body that coordinates innovative activities through the interaction of engineering, economic, humanitarian and technical units.

Thus, the aim of this study is to develop a model of the Coordination Centre for University Innovation that promotes effective intra-university cooperation in the field of innovation and, as a result, can increase the number of commercialized developments acquired by domestic and foreign enterprises.

3. Results and Discussion

3.1. Analysis of innovation activity at university
In the scientific field, Peter the Great Polytechnic University positions itself in the role of a large multidisciplinary research centre, which occupies leading Russian and global positions in a number of scientific areas. According to information on the university’s website, the research projects of numerous university departments are being successfully developed on the basis of grants from the RFFR (Russian Fund of Fundamental Researches), RSF (Russian Science Fund), FTP (Federal Target Program) projects and economic agreements [16].

To begin with, we would like to give indicators of the university’s participation, in general, in competitions held as part of the FTB, RFFR, RSF, etc. (Table 1).

**Table 1.** The results of the SPbPU participation in the competitions of the FTP, RFFR, RSF, etc.

| Name of Fund, Program | The number of applications submitted, pcs. | The number of agreements concluded, pcs. | Amount of financing million rubles |
|-----------------------|--------------------------------------------|----------------------------------------|----------------------------------|
| FTP“Research and development in priority areas for the development of the scientific and technological complex of Russia for 2014 - 2020” | 15 46 21 - | 6 14 3 - | 164 838,9 228 - |
| Russian Science Fund (RSF) | 51 82 130 33 | 5 9 18 - | 84,7 172,9 218,6 - |
| Russian Fund of Fundamental Researches (RFFR) | 65 97 128 23 | 42 17 32 10 | 38,7 17,6 82,4 11,25 |

In terms of the amount of allocated funds and the number of applications submitted, a positive trend is visible from 2016 to 2018, which indicates the active development of scientific and research activities in recent years.

The indicators of three institutes with the highest indicators of innovative activity were also separately analysed - IMET (Institute of Metallurgy, Engineering and Transport), IPNM (Institute of Physics, Nanotechnology and Telecommunications) and IAMM (Institute of Applied Mathematics and Mechanics).

For participation in research and scientific projects based on competitions of the Russian Federal Fundamental Researches, Russian Science Fund and the Federal Target Program for the last three years, the Institutes had the following indicators (Table 2):

**Table 2.** Participation of SPbPU Institutes in competitions.

| Institutes | RFFR | RSF | FTP |
|------------|------|-----|-----|
|            | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| IMET       | 9/9,15 | 2/2,2 | 4/10,2 | - | 1/15 | 5/57 | - | 3/240 | - |
Institutional innovation indicators for 2018 are shown in Table 3.

Table 3. Innovative activity of SPbPU Institutes.

| Indicators of Innovation Activity | IMET | IPNM | IAMM |
|----------------------------------|------|------|------|
| The number of publications indexed in the Scopus IDB, based on at least 2 articles per 1 researcher | 158 | 485 | 235 |
| The amount of R&D financing per one researcher (thousand rubles), total without VAT | 2052 | 793 | 1086 |
| Number of valid patents for inventions, utility models, industrial designs, pcs. | 11 | 14 | 9 |

For a more detailed analysis of the effectiveness of the commercialization of university research and development, an analysis was carried out of the innovation activity of the Higher School of Applied Physics and Space Technology (HSAPST), which is part of the Institute of Physics and Technology and has one of the highest indicators in this field among other departments of the university.

Figure 1 shows the total number of research, development and projects carried out over the past three years, both due to business contracts, and financed under the 5-100 program and thanks to the approved applications for various grants.
High school has a statistically significant number of R&D covered by business contracts, which is gradually growing every year. The number of approved grants for financing innovative projects is also growing annually by an average of 10-15%, which suggests that research areas of higher school are efficient in terms of scientific funds. Under the 5-100 program, fewer projects were supported in 2018, however, this decline may be related to the approaching expiration of this program at the Polytechnic University.

In order to have an idea of the effectiveness of the innovative ideas and products commercialization, we specified the number of higher school R&D that have found application among those that were funded under the 5-100 program or supported by various grants. The data are presented in Fig. 2.

It turned out that 54% of the supported projects over the past three years have not found application. In this case it can be said that Economics Institute has a significant potential for participating in the innovation processes of the Technical Institutes, and can increase the effectiveness of promoting research and development, and as a result, increase the level commercialization of research projects.

3.2. Interview results

Among the reasons for the inefficiency of promoting innovative products in Russia, the following points were highlighted by experts:
- often, scientists and developers do not conduct a thorough study of the market and do not imagine how their scientific results can be transformed into a market product;
- the management of enterprises is not familiar with the most important areas of modern research and science. Accordingly, they are not able to determine the reliability of the scientific results proposed for implementation, and their manufacturability;
- politicians and technical experts who establish the rules for promoting innovative products have little idea of the real atmosphere of the life of scientific laboratories, the conditions for conducting research, as well as the possible consequences of the adopted legislative act / regulation on the reproduction of scientific knowledge and its commercialization.

When determining the opportunities for commercializing scientific projects, experts are sure that it is necessary to take into account:
- what state support is provided for developments in the field of knowledge in which the technology in question is created, which enterprises conduct research in the field in question, and how this fact may affect the commercialization of the proposed technology;
- how the existing state policy in the field of innovations commercialization and support of science and technology promotes or hinders the process of commercialization of the proposed technology;
- what is the impact of government policy on the innovations commercialization in the international arena;
- how the most important factors of public policy affect the process of technology commercialization.

3.3. The development of Coordination Centre Model

Thus, taking into account the problems indicated by experts in the field of innovative activity of the university, we propose, in order to increase the efficiency of research and development, to organize a Coordination Centre for the results of innovation activities within the University, developed on the basis of the “Integration Council” model of the university and the enterprise, which was proposed by Fedorova A.V. [17].

The creation of such a Centre seems appropriate to us, due to the lack of a department / structural unit responsible for inter-university cooperation, which is extremely necessary in the field of research and development. Some researchers proposed to introduce coordination centres as a separate unit of university [18],[19]. But this R&D promotion Centre is supposed to be organized on the basis of the Economics Institute to create favourable conditions for the promotion of innovative products and services of technical orientation institutes and to manage the innovative development of the university as a whole. This Centre will be able to monitor special aspects of digital technology-based brand promotion [20] and benefit from the human capital potential of Economics Institute.

The organizational model of the proposed university innovation management body is schematically presented in Figure 3.

Figure 3. The model of Coordination Centre.
The basis of such management is the fact that each institute of the university has its own internal R&D management structures, which are parts of the educational, scientific and managerial innovative infrastructure. However, a certain governing body is also being created - a coordination centre, with the help of which the innovative spaces of institutions are combined, while their integrity and independence are not violated.

In addition, the figure also indicates the flows of knowledge and directions of knowledge exchange among existing structural units. Each structure fulfils its own functionality and characterizes the category of human resources involved in integration processes.

Along with leading, managing and coordinating activities, this structure is designed to perform a wide range of functions, such as general strategic planning of cooperation processes, marketing support for technological developments, studying the mutual influence of individual areas, evaluating the results of on-going cooperation and other functions.

4. Conclusion

Taking into account the fact that a weak system for promoting research and development and, as a result, a low level of commercialization, was identified as a key factor hindering the innovation process of the university under consideration, we proposed a model of the Coordination Centre that can solve the problems identified and establish integration processes within the university. With the effective cooperation of the Economic and Humanitarian institute, it becomes possible to achieve a significant increase in the number of commercialized innovations created by the technical departments of the university. Thus, we can conclude that the developed model of interaction on the basis of the Coordination Centre has the right to exist in scientific, educational and entrepreneurial activities, especially on an innovative basis, created at the university level, ensuring the implementation of the Strategy for Innovative Development of Russia for the period until 2020.

The program 5-100 financially supported the research.

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