Worldwide trends in the development of education and academic research, 15 - 18 June 2015

Research Organizations and Business: Interaction Barriers in the Context of Innovative Development

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Abstract

The paper analyzes barriers and evaluates ways by which the research carried out in scientific organizations and higher education institutions can be transformed into process solutions made in the innovation business. The role of postgraduate students in scientific research, transfer thereof into national economy sectors is described. Problems and specific character of interaction of the academic and branch scientific and research institutes, higher education institutions and business in the specific situation of the Russian Federation are analyzed. The advanced elements of experience of industrialized countries in the area of cooperation of postgraduate studies centers and business structures are studied from the viewpoint of opportunities of their being currently applied in the Russian Federation.

1. Introduction

Modern trends of development of science and education, on the one hand, and social consequences of technological transformations, on the other hand, have changed the traditional ways of knowledge generation and enhanced the role of interaction between institutes, universities, and national economies sectors. Implementing the innovation scientific research organization forms and analyzing the barriers to science and practice integration are an important relevant topic for research both in the world practice and in conditions of the Russian Federation.

Within the evolutionary approach, the most important obstacle for innovations are considered to be education defects that are interpreted as limits in cognitive potential and its use at the level of individual subjects (Bach & Mats, 2005; Barnes, Pashby & Gibbons, 2005). This is why innovation policy has to be aimed at resolving...
such problems as lack of coordination between science, education and business, underdevelopment of joint knowledge creation and propagation institutes, time mismatch of change at institutions with the technological change etc. In modern times, state support of interaction and partnerships acts as the crucial factor for higher efficiency of the innovation system.

Innovations are of great importance for the development of Russian economy. The country cannot be put to the innovation way of development within short terms – there are numerous obstacles for that. It should be noted that the majority of regions of the Russian Federation have no professionals in implementing and developing the innovations, so the personnel problem is crucial. There is no efficient interaction system between the scientific organizations, higher education institutions, industrial enterprises, cities, population and authorities. The priority directions of implementing the innovations in educational and scientific activity of higher education institutions is the creation of an innovation environment where a fast and efficient adaptation of educational programs, scientific and research work to changing conditions of Russian and international educational space will be possible, as well as promotion of ensuring favorable conditions for integration of education, science and practice.

In many industrialized and developing countries, having to increase competitiveness in conditions of the global technologies market furthered discussions on organizing the training of scientific workers and on competencies required for them to act in the new scientific and technological landscape.

In modern conditions, mechanisms by which the research carried out in scientific and research institutions, higher education institutions could be transformed into process solutions for innovation business of national economies sectors yet remain understudied.

In this aspect, the modern world trends consist in increasingly supplementing the budget funding of science with private resources of profit companies engaged for joint research. Postgraduate studies as a research education level are viewed as a cooperation space for businesses and universities more and more often.

For instance, various financial support programs for postgraduate students working on company research programs within cooperation with universities are widespread in Germany, Danemark, Sweden, Great Britain and other countries of the world (Griban’kova & Seryh, 2013). The main aim of such programs is growth of quantity and quality of the research, focus on training new research personnel that are not only prepared for pursuing their career path in academic circles but also appropriately competent for other sectors of the economy.

2. Objectives, methodology and research design

The main goal of the study is to analyze barriers and evaluate ways by which the research carried out in scientific organizations and higher education institutions can be transformed into process solutions made in the innovation business.

For attaining the set goal of the research, consistent and phased studying of scientific works by foreign and Russian authors, regulatory and legislative literature, reference and statistic material was performed using both generic scientific and special methods and techniques (system and functional, dialectical approach, principles of logical analysis and synthesis, methods of classification, grouping, generalizing, empirical study, comparative and factor analysis, survey and interviewing).

The systemic approach to performance of planned activities, joint analytical potential of research methods and techniques suggested for use allows on balance ensuring the achievability of the research goal. The relative representativeness of the statistical information massive used and the logic of study allow enhancing the realism of research results aimed at revealing the ways by which the research carried out in scientific organizations and higher education institutions can be transformed into process solutions made in the innovation business.

When analyzing the problems of interaction of enterprises and research organizations in the Russian Federation, we have to take into account the specific character of the Russian scientific research and developments sector that is extremely non-homogeneous in its nature and being in condition of prolonged transformation happening in various directions, not always positive ones. This factor is essential in the context of methodological particularities of this study. The effects of business and postgraduate studies centers interaction, the influence of state innovation policy at the micro level are evaluated by most researchers either on the part of business (Fontana, Geuna, Matt, 2006) or on the part of scientific and research organizations (Kaymaz & Eryigit, 2011). The feature of this study is a comprehensive approach to analyzing integration – both on the part of scientific organizations and higher education institutions and on the part of business, which allows getting relatively objective evaluation. The empirical basis for the study is data on 2013 questionnaire survey of directors of over 100 Russian enterprises
(Appendix A) and of over 50 research organizations (institutes and universities) (Appendix B). In 2014, questionnaire survey of directors of a number of regional companies financing the scientific research and postgraduate studies was conducted too.

3. Discussion of the research outcomes

The results of the research give evidence of essentially differing goals of profit enterprises and research organizations in integration issues. The studies show that it is first of all by knowledge exchange promoting the emergence of new research directions and enriching the scientific potential of the staff, as well as by the opportunity to raise extra funds that the interaction with business is attractive for science. Moreover, cooperation with business brings other advantages for the universities (creation of new jobs, including providing the training for postgraduate students, using the practical experience in teaching etc.).

For businessmen, the cooperation means an extended access to cutting edge scientific discoveries, aid in overcoming technical difficulties, an opportunity to improve their market position when creating innovation products or technologies (Lee, 2000). In certain industries (pharmaceutics, biotechnologies), an important part is played by commercialization process facilitation (Zucker & Darby, 2000). Commercialization of research can be a motive for interaction for research organizations too; however, this motive can be encountered rather rarely.

We have to mention that the value of business and universities (institutes) interaction is not limited by the role of the latter solely as a source of knowledge for business. Moreover, in Russian conditions of transition to the university model of science, other motives for interaction come to the foreground for business. For instance, in its cooperation with universities, this can be access to research and trial base, research personnel (Dezhina & Simachev, 2013).

According to the results of analysis of Russian enterprises and research organizations sampling, it can be pointed out that roughly every second organization (both business and scientific ones) having expenses on R&D has had practice of interaction for conducting the R&D. Over half of research organizations and business companies are oriented to such interaction in the nearest 3-5 years.

However, despite the numerous interaction motives in both parties, problems emerge in practice that are conditioned by various priorities and principles of activity of the cooperation participants. The researchers refer the difference in goals and motivations, schedule mismatch of works performed, so-called "incompatibility of cultures" to the most widespread obstacles to scientific and industrial integration (Zasimova et al., 2008). Business treats practical problems and commercial profit of a project as the most important, while for science, seeking to broaden their outlook and use teaching effects is more characteristic. Businessmen are interested in performing outsourced research as soon as possible and in availability of commercial results.

The issues of just distribution of intellectual property rights and non-transparency of legal regulation of joint projects become barriers for interaction. These issues are especially acute in developing economies with imperfect institutional environment. Complicated relationships of business and science when distributing the results of scientific and technical activity are in much conditioned by the low demand of scientific organizations for intellectual property rights protection, as well as by low interest of industry in using the direct contractual tools. Successful interaction can be kept under by inefficient management, poor awareness, as well as technical difficulties when transferring and adapting the new information and knowledge.

As the study conducted has shown, such problems as inadequate orientation of scientific organizations to customer's needs, quality of the Russian developments being not in line with needs of enterprises impact the interaction process (especially for those who had no previous practical experience of interaction in the realia given).

As the relevant interaction experience is gained, the effect of most barriers goes down. Meanwhile, it should be pointed out that the representatives of business interacting with science do not view most problems as essential but they believe inefficient management in scientific organizations to be the key difficulty in the interaction process. The scientific and research organizations, however, consider most problems as significant, and they think the poor susceptibility of companies to innovations to be the main difficulty.

It would be wrong to confine ourselves to generalized evaluation of individual problems in the activity of research organization preventing them from interacting with business. The Russian research and developments sector is known to be non-homogeneous to a great extent. Our country inherited the separation of scientific complex into three main branches – academic science, industry science, and higher education institution one – from the Soviet economy. The established structure of the Russian scientific complex is unbalanced to a great extent:
Industry scientific and research basic research is mostly performed in academic institutions with young researchers being concentrated mainly in higher education institutions. Industry scientific and research institutes look more preferable from the viewpoint of interaction with business structures: the representatives of companies communicating with this category of research organizations speak about absence of obstacles to interaction and point out the quality of developments being inferior to company's needs less frequently (Table 1).

In interaction with academic institutes, the representatives of business make a special point of the problem of inefficient management. In this case, the major part is played by the mentality gap between scientists and businessmen, the distinctions in goals of research conducting. For universities, their poor orientation to customers' needs is pointed out much more frequently. We should mention a considerable growth of negative evaluation of situation change in the higher education institutions sector: in the panel sampling, the share of directors of organizations who mentioned degradation of situation with higher education institution science amounted to 40% in 2014 as compared to 16% in 2011. In much, this is a consequence of expecting fast positive change in the higher education institutions sector, clearly unachievable. With regard to this, practical interaction of businesses with universities had mostly demonstration effect.

One of the most significant state measures for supporting the cooperation of science and practice was introducing a tool which is new for the Russian Federation yet close to the widespread in industrialized countries matching grants mechanism in 2010. In particular, this involves financing of joint projects of Russian companies and higher education institutions in creation new productions according to Resolution of the RF Government dated April 9, 2010, No. 218 (as budgetary subsidies). An essential particularity of this tool consists in the principle: the production company that implements the project is a direct recipient of state financing addressed to the higher education institution and it pays with the funds received up to half of cost of the R&D performed by the partner higher education institution within the project. Over 2010-2013, the state supported over 100 cooperation projects of companies, institutes and universities. On balance, the results achieved deserve a positive appraisal (Simachev et al., 2014).

Table 1. Characteristics of interaction barriers and perception thereof by various research organizations in 2014 (frequency of directors of organizations' answers, %)*

| Characteristics of barriers | Academic institutes | Industry scientific and research institutes | Higher education institutions |
|-----------------------------|---------------------|-------------------------------------------|------------------------------|
| 1. No obstacles             | 10                  | 29                                        | 21                           |
| 2. Negative history of interaction with Russian research organizations | 10                  | 3                                         | 5                            |
| 3. Mismatch of quality of the Russian developments and needs of enterprises | 35                  | 15                                        | 31                           |
| 4. Excessive prices for the Russian scientific developments | 19                  | 25                                        | 25                           |
| 5. Cheaper and higher quality foreign analogs | 9                   | 6                                         | 8                            |
| 6. The Russian scientific organizations do not render the required package of services | 9                   | 11                                        | 18                           |
| 7. Poor orientation of scientific organizations to customer's needs | 35                  | 21                                        | 39                           |
| 8. Inefficient management on the part of scientific organizations | 23                  | 15                                        | 20                           |
| 9. Lack of information about prospects of the Russian developments | 24                  | 19                                        | 25                           |

* Source: results of surveying the directors of organizations

Results of the research conducted allow stating that there is relation between the scale of a business and its having contractual partners in carrying out research. As the scale of business structures increases, not only does the quantity of companies financing the research rise, but so does the share of companies making close relations with the research organizations.

A positive dependence is also traced between the "age" of activity of the enterprises and the scale of
financing the science. A higher level of cooperative activity is demonstrated by the older "age group", i.e. among enterprises formed over 20 years ago – their cooperation with science is conditioned by traditions having been established back in the Soviet times. The absence of clear signs of cooperative activity of the younger business clashes with the image common in the foreign literature – that of a source of forming the demand for research and developments.

It should be mentioned that the high scientific level of research acts as a common factor of enhanced interaction both in the Russian realia and in foreign practice. To a large extent, the factor also determines relatively better positions of the academic institutes many of which have not only maintained but also developed their scientific competencies.

For the last two decades, crucial change has taken place in the system of goals and objectives of postgraduate students training, sources of financing the education at postgraduate studies centers (replacement of budget financing by business resources). Traditionally, the graduates of postgraduate studies centers are aimed at pursuing their scientific career at the higher education institution. However, in modern realia, it is private business that started to offer quite significant opportunities for carrying out research activity. In many European countries, academic degree holders are increasingly trying to find non-university jobs. For instance, as the analysis of academic degree holders in Norway has shown, among those completing their postgraduate studies in 2003-2009, 9% of the academic degree holders financed their studies at the expense of profit enterprises, and 22% of postgraduate students cooperated with production economy sector industries throughout their postgraduate studies (Enders, 2005). Thus, postgraduate students of industrialized countries increasingly interact with companies, obtain financing from them and work in business having completed their studies.

On the whole, the results of empirical research carried out by us give evidence of a close connection existing between the way of financing the education at postgraduate studies centers and the choice of employment type after graduating from the higher education institution. As a rule, the higher the quality of dissertation research is, the higher the common quality of scientific process is at the higher education institution. However, the academic research is increasingly held in the context of applied topics range requiring intensive cooperation and within the cooperation networks consisting of universities, businessmen and representatives of state administrative bodies. Such forms of work are accompanied by institutional change both in organization of research activity and in the system of financing the scientific works in higher education institutions, with the accent being shifted towards interdisciplinary cooperation between various participants. Conducting the research in this context requires a range of competencies going beyond the traditional academic research abilities and skills. Thus, the new knowledge production realia have also promoted the discussion about innovation forms of postgraduate students training that are more relevant to the new demand for competencies.

For a long time, in the Russian Federation, holding an academic degree gave the right to get a permanent teaching job in universities, and the main meaning of dissertation research consisted in preparation for scientific and teaching professional activity. However, the experience of European countries confirms that the academic degree holders increasingly work beyond the academic spaces in modern conditions. To a large extent, this is explained by the fact that the quantity of job offers in the sphere of science is much smaller than that of graduates of postgraduate studies centers. On the whole, the institutional change in universities, change in ways of financing and carrying out the research, and transformation of scientific labor market have brought about the discussion on relevance of today's researchers training system and the demand for renovation of scientific personnel training system.

In the modern world, postgraduate students are given a significant role in transfer of knowledge between higher education institutions and business structures, both during education and after graduation from the higher education institutions. In industrialized countries, the scientific centers are located in places of greatest concentration of scientific potential – near the leading universities, state research institutes, private research laboratories, locations of companies having a developed innovation infrastructure and also being its part. The opportunity to engage postgraduate students in work is an important incentive for companies in interaction with universities.

Companies interested in particular postgraduate students offer them permanent employment once they complete their studies, which is currently used as the main channel for transferring knowledge from the academic environment to the private sector. Thus, for business, postgraduate students and other researchers are a channel for acquiring specialized and implicit knowledge and accessing know-how accumulated in other institutes and countries (Thune, 2009).

Offering permanent employment to graduates of postgraduate study programs of higher education institutions influences the innovations in companies via three interrelated mechanisms. First, it enhances the total
and the range of scientific knowledge available for the company. Next, postgraduate students as researchers owing to their high general education level and understanding of basic science principles have good intellectual resources enabling them to try out knowledge accumulated beyond the company. Third, graduates of postgraduate studies centers promote mutual understanding and cooperative relations acting as mediators between higher education institutions and enterprises thus evening out the differences of traditions and approaches established in the academic circles and in business.

The review and analysis of published works, as well as results of interviewing allow us to state that in today's conditions three main roles are provided for postgraduate students in the relationships system "higher education institutions – enterprises": they are central figures to knowledge production, knowledge transfer, as well as to forming and maintaining the communication network between universities and corporations.

4. Conclusion

Promoting the interaction of companies and research organizations acts as an important factor of the economy going on to the innovative development model. Such interaction creates conditions for dynamic growth of the innovation business, prerequisites for development the innovative products due to higher susceptibility of companies to knowledge and business – to mutual learning effects.

It should be mentioned that it is to promoting the scientific and production relations and development of business and science cooperation that the main attention is paid in Russian scientific, technological and innovation policy. This seems quite logical given the scale of the national research and developments sector versus its rather limited contribution to social and economic development. In these conditions, the Russian innovation policy is built with the necessity of upgrading the research and developments sector borne in mind. In connection to this, certain measures which in the advanced foreign countries were tools for promoting business to interact with science are used in the Russian Federation first of all for "slightly pushing" science to interaction with practice.

One of the main barriers for interaction of companies and research organizations are the profound distinctions in mentality of businessmen and scientists. For mitigating the problem, state support of partnerships is essential; however, with regard to this, there should not be such strict orientation to final results as physical indicators – qualitative effects are more important, the change of owners' priorities and management models. Just like in business, needs in science lack mutual understanding. In Russia, this is much conditioned by bureaucratization of management systems.

Interviews conducted with various participants of innovation processes show there are positive shifts but they are local in character, and the very environment is not conducive to their proliferation. In our opinion, at present the fundamental barriers are related to the development of institutional environment for generating knowledge and innovations in academic institutes and universities.

In conditions of companies globalizing their activity, they create global demand for the results of research and developments. The negative practice of interaction with Russian scientific organizations acts as one of the factors of companies extending the cooperation with foreign research organizations.

In foreign countries, academic degree holders increasingly work beyond the academic spaces. There are similar trends in the Russian Federation in the modern conditions. More and more often applicants for academic degrees do not count on a career path in the academic environment and link their professional plans to business or civil service. The author thinks this trend does not mean devaluation of scientific knowledge, but it rather gives evidence of enhancing prestige of the research activity. Studying at a postgraduate studies center allows the professional researcher to obtain critical thinking, scientific communication, research organization skills that he can also use in the spheres of activity where he continues his professional development. As a result, the postgraduate students create their infrastructure of innovations as a total of human and social capital within the subjects of economy in which they proceed with their activity.

Acknowledgements

The work has been performed within the implementation of the project part of the state assignment of the RF Ministry of Education and Science on the research topic "Taxation mechanism as a factor of adjustment of interregional social and economic differentiation in modern times" (assignment No. 26.1569.2014K).
Appendix A

A. 1. Questionnaire for business structures

1. Please specify the industry (a) and activity (b).
   a) __________________________________________
   b) __________________________________________

2. Business organization ownership type:
   - public;
   - private;
   - mixed.

3. How many employees are there in your business structures?
   - up to 50 people;
   - 50 to 100 people;
   - over 100 people.

4. Do you carry out research and developments?
   - yes;
   - no.

5. On what scale are you planning to carry out research and developments in the future?
   - on the same scale;
   - we are going to expand;
   - we are not planning to.

6. Please specify the range of profit activity commencement age:
   - up to 5 years;
   - 5 to 10 years;
   - 10 to 20 years;
   - over 20 years.

7. Is your business structure involved in interaction with other organizations in the innovations process?
   - yes;
   - no.

8. What research organizations do you prefer when interacting in the R&D process?
   - higher education institutions;
   - academic institutes;
   - industry scientific and research institutes;
   - other.

9. At the account of what funds are R&D of your business structure financed?
   a) of own funds;
   b) of contractual partners' funds.

10. On average, what have been the expenses on R&D in your business structure over the last 3 years?
    - less than 1% of the proceeds;
    - over 1% of the proceeds.

11. In your opinion, what are the barriers to interaction of business structures and research organizations?
    - there are no barriers;
    - negative history of interaction with Russian research organizations;
    - mismatch of quality of the Russian developments and needs of enterprises;
    - excessive prices for the Russian scientific developments;
    - cheaper and higher quality foreign analogs;
    - the Russian scientific organizations do not render the required package of services;
    - poor orientation of scientific organizations to customer's needs;
    - inefficient management on the part of scientific organizations;
- lack of information about prospects of the Russian developments;
- management system of the Russian scientific organizations is not adapted for interacting with companies;
- warped conceptions of business structures about the quality of developments due to mass media bias;
- other reasons (please specify).

12. What positive change to the activity of your company has taken place owing to modification of tax laws since 2012 – in particular, the opportunity to reserve and account the means for future R&D in current expenses?
- more investments into the new equipment;
- more expenses for innovations;
- more expenses for R&D;
- higher competitiveness of the products;
- higher cost efficiency;
- other change (please list);
- no change.

13. How can you evaluate the potential of your business structure in scientific and innovation sphere?
- high;
- medium;
- rather low.

14. Feel free to comment on the questionnaire or make suggestions:

Region: ____________________________

Appendix B

B. 1. Questionnaire for research organizations

1. Ownership type of your research organization:
- public;
- private;
- mixed.

2. How many employees are there in your organization?
- up to 50 people;
- 50 to 100 people;
- over 100 people.

3. On what scale are you planning to carry out research and developments in the future?
- on the same scale;
- we are going to expand;
- we are not planning to.

4. Please specify the range of research activity commencement age:
- up to 5 years;
- 5 to 10 years;
- 10 to 20 years;
- over 20 years.

5. Is your research organization involved in interaction with business in the innovations process?
- yes;
- no.

6. What hinders the efficient development of innovation activity on the basis of research organizations?
- determination and protection of the intellectual activity;
- commercialization of technologies;
- innovation activity financing;
- difficulty in selecting the promising projects and technologies;
- low commercial efficiency of scientific developments;
- non-professional management of innovation projects and processes;
- poor feasibility study of projects implemented;
- investor's exit from the business;
- no experience in innovations marketing and practice of work in the open market;
- absence of conditions that are favorable for the research activity;
- other problems (please specify).

7. What is the organization form of scientific and research work in innovations area in your organization?
- at the department;
- individual research units (laboratory, centers etc.);
- institutes;
- other (please specify).

8. Please specify the scope of budget financing of scientific and research work:
- we have no financing;
- up to 10 mln rubles;
- up to 25 mln rubles;
- up to 50 mln rubles;
- from 50 mln rubles and more;
- I am at a loss to answer.

9. Please specify the scope of non-budget financing of scientific and research work:
- we have no financing;
- up to 10 mln rubles;
- up to 25 mln rubles;
- up to 50 mln rubles;
- from 50 mln rubles and more;
- I am at a loss to answer.

10. Does financing of scientific and research work influence the level of your pay?
- yes;
- no.

11. Have you got small innovative enterprises (SIE)?
- yes;
- no.

12. In what directions of activity is the innovation activity carried out?
- technical;
- social and humanitarian;
- interdisciplinary;
- other (please specify);
- I am at a loss to answer.

13. Please select what types of intellectual activity results have to be included (or are included) into the SIE authorized capital?
- programs and databases;
- know-how;
- invention patent;
- utility model patent;
- other.

14. In your opinion, what hinders the development of small innovative enterprises?
- lack of legal framework;
- low level of state support;
- absence of the united coordination authority;
- poor information, material and technical resources;
- lack of interest of the business economy sector;
- SIE not exchanging experience;
- absence of stable demand for the products and services;
- difficulties in commercialization of the intellectual activity results;
- other ______________________________________________________________.

15. In your opinion, what are the barriers to interaction of business structures and research organizations?
- there are no barriers;
- negative history of interaction with Russian research organizations;
- mismatch of quality of the Russian developments and needs of enterprises;
- excessive prices for the Russian scientific developments;
- cheaper and higher quality foreign analogs;
- the Russian scientific organizations do not render the required package of services;
- poor orientation of scientific organizations to customer's needs;
- inefficient management on the part of scientific organizations;
- lack of information about prospects of the Russian developments;
- management system of the Russian scientific organizations is not adapted for interacting with companies;
- warped conceptions of business structures about the quality of developments due to mass media bias;
- other reasons (please specify).

16. What positive change to the activity of your organization has taken place owing to modification of tax laws since 2012 – in particular, the opportunity to reserve and account the means for future R&D in current expenses?
- more investments into the new equipment;
- more expenses for innovations;
- more expenses for R&D;
- higher competitiveness of the products;
- other change (please list);
- no change.

17. How can you evaluate the potential of your research organization in scientific and innovation sphere?
- high;
- medium;
- rather low.

18. Feel free to comment on the questionnaire or make suggestions:

Region: ________________________________

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