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Essence and main components of innovation environment in higher education institutions

The article analyzes the studies and experience of creating innovation environment in the sphere of education, it reveals internal and external components of educational environment. It describes the present-day state of higher professional education institutions, proposes a number of conditions for the establishment of innovation educational environment in universities for the purpose of its successful development.

Higher professional education, innovation educational environment, components of formation, designing conditions.

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In recent years, the Russian Federation has adopted several programme documents (the project "Russian education – 2020: an education model for the knowledge-based economy", the Russian Federation state programme for 2012 – 2020 "Development of education", the federal target programme "Scientific and academic-pedagogical personnel of innovation Russia" for 2009 – 2013, the Strategy for the science and innovation development in the Russian Federation for the period up to 2015, etc.), which contain the main directions and measures for implementing state educational policy in order to create the necessary conditions for achieving quality education. These documents reveal the provisions of the education law and the ways of solving problems in education sphere.

The national education doctrine of the Russian Federation sets at the state level the strategy and main directions for the development of education. The urgency of addressing this issue in the sphere of higher education is caused by the necessity of integration into the world educational space on the basis of the Lisbon Convention (1997) and the Bologna Declaration (1999). A new level of higher professional education development manifested itself mainly in the integration of innovation forms of education, the creation of variable teaching models, the upgrading of management strategies. In this perspective, the issue requires profound scientific consideration.

A key indicator of science development is the share of R&D expenditures in GDP. The existing wavelike dynamics of this indicator in Russia, with alternating periods of rise (up to 1.28% in 2003) and fall (down to 1.04% in 2008) is related to the change in the growth rate of expenditures on science in GDP.

Thus, the volume of expenditures on civil science from the federal budget reached 219.1 billion rubles in 2009, having increased 3.7-fold (in comparable prices) in 2000 – 2009. Russia matches France and Italy and outruns the United Kingdom and Canada according to the amount of the state budget expenses for civil science (calculated according to the purchasing power parity of national currencies) in comparison with other G8 countries. The leaders are the United States (80.4 billion dollars), Japan (29.8 billion dollars) and Germany (23 billion dollars).

For 2000 – 2009 the relative indicators have been growing: the share of allocations on civil science from the federal budget in GDP has increased from 0.23 to 0.56%, and in the federal budget expenditures – from 1.66 to 2.27%. In accordance with the Federal Law "On the federal budget for 2010 – 2012", the value of the latter indicator reached 2.34% in 2010. Russia was inferior only to the USA by the value of this indicator among the G8 countries (2.79% in 2008).

The volume of funds, allocated for R&D by the business sector, has increased 1.5-fold for 2000 – 2009, but still it is not enough to ensure the competitiveness of Russia's economy. The share of business in the internal R&D funding decreased from 32.9% in 2000 to 26.6% in 2009. The comparison of the structure of domestic expenditures on R&D by the funding sources shows that, on average, the contribution of business in 2008 amounted to 64.6% in OECD countries, in the EU countries it was 27 – 54.7%, and in some countries it was even higher – from 67% in the United States up to 72 – 78% in China, Korea and Japan. State funding of R&D prevail in Russia and India (66.5% and 66%, respectively), Brazil (52.9%); its share is also significant in Italy (44.3%) and France (39.4%). Meanwhile, the role of human capital in the country's economic development remains rather insufficient, despite its constant growth.

For example, according to the human development index (HDI), which is an integral indicator, determining the level of the country's development, Russia ranks 66 (with the value of 0.755) among 187 countries (between Libya and Grenada) as of 9 January 2012. Thus, it can be assumed that more attention should be paid to such properties in the structure of human capital, which comply with the requirements of modern production, and it should be facilitated by a more efficient education system at all levels.

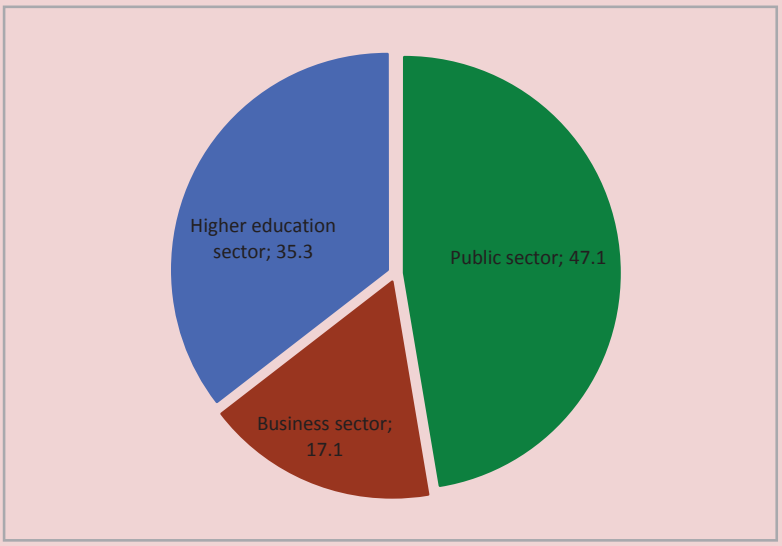
The dynamic changes are taking place in the sphere of Russian education: the emergence of innovation educational institutions, training in new specialities. For example, the number of higher educational institutions doing research (506, or 14.3% of the total number of R&D organizations), for a decade has grown by more than a quarter, which indicates the positive changes in the development of university science. The increase in in the number of experimental plants after a long-term decline should be also pointed out as a positive trend: in 2009 versus 2000, the growth amounted to 73%, and in comparison with 1995, their number has increased 2.5-fold.

However, the outdated sectoral employment pattern leads to a mismatch between the structure of personnel training and the requirements of the economy. Specialists' salaries don't depend on their education level, which forces them to take up jobs that do not require professional education.

The volume of financing allocated from the federal budget to scientific research in the universities in the form of funds for the maintenance of subordinate institutions is determined on the basis of the regular number of researchers in the higher education sphere.

The information and scientific communication between Russia and other countries is underdeveloped, and the links between the investors and innovation infrastructures are weak. So, one can observe the predominance of the public sector in the structure of R&D organizations in Russia in 2010 *(fig. 1)*.

Figure 1. Structure of R&D organizations, by the sectors of activity (2010; in % to the total outcome)



In most countries, R&D is an integral component of the activities in universities, along with education. In OECD countries about 16.8% of the research and development expenditures are directed to the higher education sector, in 27 EU member-states – 23.1%. Selection of the priority directions of scientific-technological development reflects the best international practice of the state support of science.

For instance, in the EU such activities are related to the implementation of the Seventh Framework Programme, which aims at stimulating economic growth and enhancig the competitiveness of European economies through active investments in knowledge, innovation and human capital. Programme intended for 2007 – 2013 has a budget of 53.2 billion euros, more than half of which (60.9%) is allocated for the support of joint projects implemented by the EU member states and associate members, in 10 major science and technology spheres, largely coinciding with Russia's priorities. Over two-thirds of the funds (70.4%), allocated for support of priority directions, cover four spheres: information and communication technologies; medicine; transport and aeronautics; nano-sciences, nanotechnologies, materials and advanced production technologies.

Russia is lagging behind the world leaders in the marketing of science and innovations; the advanced access to the global scientific information is not available to Russian scientists. The opportunities for carrying out the abroad evaluation of ideas and proposals of Russian scientists are limited, as well as their access to the world's leading scientific editions.

"Russian scientific products started to loose their authority in the global space in the 1980s, the situation was aggravated in the 1990s, and this process has been continuing in the last decade. Russia ranked 9 according to the number of publications in the world's leading scientific journals in the first half of the 2000s, however, in the second half of the decade it ranked only 14. As for the number of citations, Russia, ranking 17 in the beginning of the decade, left the top 20 in its end. The weak dynamics of the publishing activities of Russian scientists at the background of high growth rates observed in other countries, allows assuming, that in the coming years this negative trend might strengthen".

In our opinion, the present situation, characterized by production intensification, the increase in the amount of information, lead to the necessity of enhancing the person's cognitive activity in information technology sphere, self-education, design skills, contributing to the demand in the labour market.

At the same time, Russian society and business persistently direct the educational process toward a specific economically beneficial result. However, the appropriate professional training, especially in the sphere of engineering and technology, is not provided due to the inconsistency between the material-technical and educational-production base of the higher professional educational institutions and the requirements of modern production.

Thus, the employer has objective requirements to the quality of specialists' training and the proper conditions for this training are not created. Another point is clear: the situation can be changed radically, if the qualitative development of the professional higher education system is ensured, while providing a steady, purposeful change of educational environment components for achieving a high level of professional training of universities' graduates.

Various aspects of efficient organization of educational process on the innovation basis in general have been studied and analyzed by a number of researchers. In particular, the development of the environmental approach to education, actualization of the concept "educational environment" is studied in the works of V.N. Abrosimov, T.V. Anikayeva, I.A. Bayeva, G.Y. Belyaev, L.A. Bodenko, I.V. Krupina, L.N. Kulikova, V.V. Rubtsov, L.I. Tuktayeva, I.M. Ulanovskaya, V.A. Yasvin, etc.

The authors give different assessments of the essence of innovation educational environment; the opinions vary concerning the assessment of its characteristics, structure, and formation conditions.

There are no special studies on the formation of innovation educational environment in higher professio-nal education institutions. The works on these subject focus mainly on theoretical problems, without revealing the specific ways and con-tent of innovation educational environment formation process.

In our opinion, the conditions for the efficient designing of educational environment and its components in the higher professional education institutions remain under-developed. The external and internal components of creating educational environment are not always clearly defined.

The external components of educational environment include:

✓ innovation educational environment as part of the socio-cultural, professional and educational environment;

✓ a set of educational and professional institutions and their respective management bodies, in cooperation with educational, scientific-industrial, professional (labour) and other associations and organizations, focused on innovation goals of advanced education;

✓ provision of the structural-functional model of forming innovation educational environment with regard to the individual needs of a university;

✓ factors, which have an indirect impact on the environment (economic situation, expectations from the received education, family composition, pre-university training, the availability of education loans, skills, etc.).

The external components of educational environment include the introduction of the Bologna process, because the very system of education in Russia has to be changed so that the country could enter the world educational space.

It is necessary to reconsider the educational process management (concerning the creation of mechanisms for the external evaluation of the quality of education with the purpose of its further recognition by foreign partners)

and its organization (change in the trajectory of students' education, introduction of the European academic grading system, curriculum review), relations between educational institutions and the world.

The development of the Bologna Declaration principles in universities is stipulated by the external environment (directives by the Ministry of Education and Science, and the desire of educational institutions to become full-fledged participants in the European educational space), which requires the implementation of a set of innovations in its internal environment.

The implementation of the Bologna Process is itself an innovation, because it brings a number of advanced changes; besides, it is of practical importance and it results in creation of a global educational space.

It should be noted that the development of the Bologna process in Russia's education sphere will reveal the measures, the implementation of which will be necessary for the acknowledgement of Russian education in other countries.

The "international mobility" in education has long become a common practice in the world. Over 570 thousand foreign students study in the United States, over 300 thousand – in Great Britain, about 150 thousand – in Australia. By 2020, according to the forecast of the British Council, the Association of Universities UK and IDP Australia, about 6 million people will have been studying in higher educational institutions outside their homelands. Thus, in the nearest 10 – 15 years, the number of students studying abroad should increase 3-fold.

Nowadays, a higher education institution provides an opportunity to study several specialties together. Each year there is an increase in the number of departments that practice a multidisciplinary approach ensuring a versatile training of students. Upon the completion of such training, qualified specialists can find a job in the most promising sectors of economy.

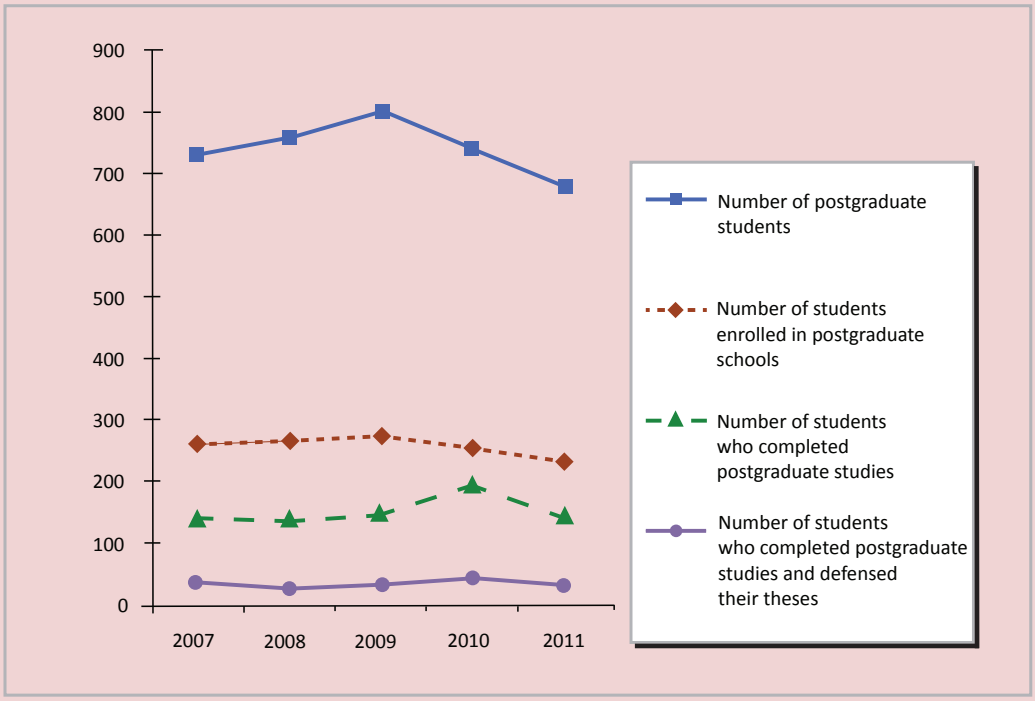
Demographic issues have a significant impact on the establishment of educational environment and its components in higher professional education institutions. For example, the statistics for the Vologda Oblast indicate the decline in the number of students for the period of 2007/2008 to 2011/2012 academic years by 11,649 people.

A similar trend has been maintained in the country in general. The number of 18-year-old people is declining, and, accordingly, the system of education should change, adapting to the new demographic conditions. According to statistics, the number of academic teaching staff possessing an academic degree in the Vologda Oblast, in academic years from 2007/2008 to 2011/2012 has decreased: Doctors of Sciences – by 27%, Ph.D – by 80%. This can't but influence the quality of education. Science has become unattractive for young people. So, for example, indicators of graduate schools performance in the Vologda Oblast show that in 2007 – 2011 the number of post-graduate students that defensed their theses was about 4.5 times less than the number of those enrolled *(fig. 2)*.

However the actual requirements of the economy for highly qualified scientific personnel in the conditions of its modernization remain poorly investigated (today, as well as in the future). *The table* shows the development ranking of post-graduate studies: technical sciences (273 pers.), economics (120), pedagogics (67) philology (45), philosophy (38), agriculture (26 pers.), etc. Thus, it can be concluded that due to the absence of material base for costly scientific research, such sciences as geography (-), veterinary science (-), chemistry (2), biology (9) and other have become unattractive.

Innovation development of an educational process as a sustainable system consists in subjecting all the components of this process to the common goals, or to recreate the missing components.

Figure 2. Dynamics of main indicators of postgraduate schools performance in the Vologda Oblast, pers.



Number of postgraduate students according to the spheres of science in the Vologda Oblast (at the end of the year, persons)

Sciences	2007	2008	2009	2010	2011
Total	727	756	795	735	684
by the branches:					
physics and mathematics	22	24	23	24	19
chemistry	2	4	4	1	2
biology	14	12	10	9	9
engineering	261	268	273	254	273
agticulture	21	22	21	24	26
history	23	26	34	31	27
economics	116	118	142	143	120
philosophy	30	37	43	41	38
philology	71	74	79	71	45
geography	-	-	-	-	-
pedagogics	93	90	86	70	67
veterinary	3	4	6	-	-
study of art	13	13	13	11	8
psychology	26	32	28	30	26
law	29	29	30	25	23
other	3	3	3	1	1

Innovations in universities include the changes in the purposes, conditions, content, means, methods and forms of organizing educational and management processes; these changes are characterized by novelty, they possess the potential for increasing the efficiency of the system in general or any of its components in particular; they can produce a long-term beneficial effect, which justifies the efforts and resources used for introducing innovations, coordinated with other ongoing innovations.

Methods of forming an innovation educational environment include first of all creativity, inner motivation and stimulation.

Innovation development of an internal as well as external environment of educational institutions is the most important condition for the efficient performance of higher education institutions. Thus, there is a close interaction and interdependence between the external and internal components of the innovation environment that form a system. The present education sphere is facing the tasks of development under a new mode, as well as the tasks of enhancing the quality of this process and searching for an efficient self-development path.

Our analysis shows that the internal components of innovation educational environment of universities include:

◆ academic teaching staff, cultural and recreational resources, legal, programme-methodological, marketing support;

◆ organizational structures, such as standardization services, monitoring services, centres for development of graduates' skills, centres for information technologies, etc.;

◆ intellectual (attraction of top specialists from the basic enterprises for teaching special subjects, participating in the state final examination, working with creative teams on the principle "professional employee of an enterprise – university professor – student", etc.);

◆ financial and economic support; social support of students; a network of experimental-production sites with modern industrial and technological equipment providing opportunities for students to model actual production processes; simulation equipment, equipment with remote access to management; training complexes, etc.);

◆ information networks, Internet, network electronic libraries, multimedia tools, the licensed system and applied software (operating systems, office and graphics packages, software development systems, databases management systems, systems of project and CASE modeling, automated engineering systems, security systems).

At present, the head and the staff of an educational establishment should have motivations and incentives to improve an educational process. It is necessary to form a new vision of goals and objectives of students' training, as well as the ways of achieving these goals and forms of education and management work.

An innovation approach to the formation of internal environment of a university enhances the capacity of teaching staff, improves the quality of educational process.

The university education which produces graduates complying with the modern requirements is possible if an innovation internal educational environment is established, which provides an educational process with the following features:

• formation of knowledge, skills and abilities in the field of software engineering;

• involvement of a greater range of students in the development and upgrading of electronic educational resources in their subject area;

• actual innovation and investment-attractive results of the students' activity on production and moral levels;

• formation of instrumental, interpersonal, systemic and specific competences.

Innovation educational environment changes the contents of education, enhances the traditional forms and stimulates the development of the new forms of teachers and students' activity, and, simultaneously, the environment itself has been developing due to the internal processes, involving both teachers and students. The formation of an innovation educational environment should result in a purposeful, regular change of its composition and structure, which corresponds to the requirements of information society.

Designing the changes in educational environment requires the development of a clear pattern of innovation transformations, defining the object, subject, goals, objectives and hypotheses. It is also important to determine the terms and stages of the experiment's implementation, the criteria for evaluating the expected results. This link allows for predicting the possible positive as well as undesirable consequences that could be originally foreseen.

The conducted theoretical analysis of the research and the studies of the experience of creating an innovation environment in education sphere allow us to point out the following:

– requirements of society concerning the quality of specialists training are becoming more strict;

– academic-teaching staff, administration and management staff of education institutions recognizes the need for modernization of educational process based on the creation of innovation educational environment and implementation of innovation projects;

– the state and society acknowledge an important role of specialists in the personnel potential of the country;

– there is a contradiction in the training system, the list of specialties, the content, form and methods of training, and evaluation of the quality of specialists' training;

– state of the material-technical and educational-production base, scientific support of education does not meet the modern state and prospects of social and economic development, which causes the aggravation of internal problems in educational system;

– lack of inflow of young teaching staff hampers the achievement of goals, especially in science-intensive and high-tech spheres;

– material base of professional educational institutions doesn't meet the requirements of modern high-tech production, information infrastructure, advanced information technologies are developed poorly;

– system of professional education is not oriented towards the consumers' demands, it trains specialists according to its own interests, which is incompatible with the new needs of the economy.

These contradictions determine the necessity of the development of conditions for the successful formation of innovation educational environment in universities. Such conditions may include, firstly, the clarification of the essence and structure of innovation educational environment and the process of its formation.

Secondly, they include the formation of innovation educational environment in universities, taking into account the technical profile, organized as a single process of development and implementation of a set of interrelated, consistently carried out target innovation projects in the framework of a single programme that unites the target, organizational-managerial and result-assessing components, which, according to "the theory of the product life cycle", (in this case, the project) provides the whole cycle from identifying the problem to evaluating the results. At that, the completion of one successful project is the beginning of implementation of the next, i.e. the sustainable development of the innovation environment in a university is ensured.

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