

Innovations in education in the context of the formation of intellectual resources for the development of technological entrepreneurship

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Abstract—The problem of training engineers-entrepreneurs capable not only to professionally perceive scientific, engineering and technological innovations, but also to generate ideas, to be able to predict and evaluate the market prospects of their implementation; to have the potential of the organizer of the practical implementation of promising innovations in the relevant spheres. The article observes the features of the model of innovative education in the context of its potential for the formation of intellectual resources in demand of the field of technological entrepreneurship. The principles that form the basis of the methodology of teaching innovative entrepreneurship are systematized. We proposed scientific and methodological recommendations in the sphere of improving the process of interdisciplinary coordination in the educational process, ensuring the interaction of competencies in the field of engineering, Economics, law and management.

Keywords—*innovations in education; intellectual resources; technological entrepreneurship; engineers-entrepreneurs; educational process.*

I. INTRODUCTION

The innovative scenario of economic development of the Russian Federation assumes continuous increase of efficiency of use of intellectual potential of the human. Economic transformations, negative changes in the field of international cooperation due to sanctions restrictions have led to a significant change in the structure of production of competitive products in demand in various sectors of the country.

Special attention is paid to the development and implementation of innovations, primarily in the sphere of technology. The problem of preparing specialists for the development and implementation of technological and product innovations at enterprises, competent in the subject of engineering entrepreneurship, capable of professionally solving the problems of commercialization of ideas embodied in the products, to comprehensively address the issues of production management. To implement this task, we need specialists with relevant competencies in the field of engineering and in the field of entrepreneurship.

An engineer-entrepreneur is a person who is able not only to professionally perceive scientific, engineering and technological innovations, but also to generate ideas and scientific ideas, to be able to predict and evaluate the market

prospects for their implementation; to have the potential of the organizer in the relevant spheres of activity.

It can be stated that it took fundamentally new specialists with theoretical knowledge and practical skills of an engineer, economist, manager. Issues of commercialization of innovations also require high competence in legal issues in the field of intellectual property protection. In connection with the internationalization of business, these specialists, in addition to the above skills and knowledge, must be fluent in foreign languages.

The complexity of technological systems, diffusion of innovative technologies objectively contribute to the division of production processes into separate components and, thus, cause a deepening professional differentiation of management, in particular, engineering management and content close to it technological management. The objective process of differentiation of types of management imposes new requirements on the professional Manager, in particular, the ability to use management tools of various classes, including engineering and technological management. Such managers with a high level of intellectual potential are objectively in demand in the field of innovative entrepreneurship.

The structure of the courses in the preparation of managers for professional activities related to the support of the processes of development and implementation of product and process innovation, innovation transfer, should be laid significant aspects of the interaction of engineering, management, law and Economics. This educational concept provides an opportunity to develop and effectively apply in business activities in the technological sphere of systemic creative thinking, which allows you to see the problem in many aspects, assessing both external influence and internal relations, taking into account the experience of the past, present and future prospects.

It is important that the Manager receiving the appropriate training should be different and developed engineering thinking and ability to apply engineering principles and skills in the workplace from the generation of ideas and the formation of the concept to the completion of the project. The development of engineering approach and engineering thinking in this case provide the necessary movement in the direction of intellectual economy. Engineering thinking provides the ability to identify technical, technological and

organizational contradictions, to Orient the specialist to the optimal and promising solution of the production problem.

Thus, for the development of technological and substantially close to it engineering entrepreneurship in the Russian economy requires specialists with special training and possessing specific knowledge, skills and abilities on the basis of interdisciplinary coordination. This problem is multifaceted and its solution involves the reliance on innovation in the educational process.

The authors of the article consider innovations in education as a necessary factor for the acceleration of innovative transformations in the economic development of Russia. Despite the importance of the problem under consideration, scientific and methodological aspects of the construction and implementation of the educational process in the sphere of training of highly qualified staff for engineering and technological entrepreneurship in the Russian conditions require their further development and professional study of issues of interdisciplinary coordination and integration.

The purpose of the study is to examine the factors of adaptation of higher education to the demands of the innovation economy in the context of the requirements for the training of personnel for engineering and technological entrepreneurship; the formation of scientific and methodical recommendations in the field of improving multidisciplinary coordination in the educational process, ensuring interaction of competences in the field of engineering, Economics, law and management.

II. MATERIALS AND METHODS

The methodological basis of the research consists of General scientific methods: analysis of domestic and foreign information sources on the problems and trends of higher education, competence approach, innovations in education; normative and educational-methodical documentation; systematic approach and generalization; generalization of the authors' own scientific and pedagogical experience.

III. RESULTS AND DISCUSSION

A. Innovative economic – intellectual economics

1) Innovative part of economic development

The modern stage of social and economic development is characterized by the entry into a new industrial era, "... historically higher, when the total labor force of society is dominated by workers of intellectual labor and higher qualification, and science acts as a direct productive force" [1]. In this regard, the problems of formation and development of innovative economy is one of the most discussed topics.

In the context of the developing national technological initiative, traditional spheres of material production, solving the problem of ensuring competitive advantages of products, are forced to transform, changing their technological basis [2]. Performing the function of the driving force in the innovation economy is assigned to innovative enterprises, ensuring the continuity of the processes of innovation. The role of intellectual capital as a key resource that forms the innovative potential of the enterprise, region, and country is increasing [3].

Currently, we are in the situation of overcoming the consequences of a long period of low level of development of the innovation environment in Russia, when educational and scientific organizations did not seek to implement scientific developments. The main interest was in conducting research, obtaining a patent or publishing research results. Organizations mainly acquired foreign technologies and adapted them to specific working conditions.

The development of the innovative economy in Russia, including in the field of technological entrepreneurship, is hampered by a number of institutional problems, such as: the lack of demand for qualified specialists; the lack of integration of science and business; undeveloped innovative infrastructure; the low degree of state support; the legislative framework that requires improvement. The noted problems in practice are manifested by low innovative activity of especially important for the Russian economy organizations of manufacturing industries. In the period 2014-2016 the dynamics of the indicator of innovation activity in this area tended to decrease. At the same time at the end of 2017. the positive dynamics of a number of indicators of the innovative component of economic development was identified. In particular, the group "Production, processing and Assembly" revealed a positive dynamics of the share of fundamentally new technologies in the total number of advanced production technologies (Table 1).

TABLE I. DYNAMICS OF INDICATORS OF ADVANCED PRODUCTION TECHNOLOGIES ACCORDING TO THE DEGREE OF NOVELTY IN THE GROUP "PRODUCTION, PROCESSING AND ASSEMBLY»

№	Indicators of advanced manufacturing technologies by degree of novelty in the group "production, processing and assembly"	2013	2014	2015	2016	2017
1	The proportion of the amount of advanced production technology in the group in the total amount of high technology, %	36.2	35.9	39.1	33.2	34.5
2	The proportion of the amount of technologies using patented inventions in the total amount of advanced production technologies of the group, %	51.6	52.7	45.0	33.5	38.0
3	The proportion of the amount of fundamentally new technologies in the total amount of advanced production technologies of the group, %	8.9	11.1	14.1	11.7	14.0
Based on: Russian statistic Yearbook. 2017: Stat.YB./Rosstat. - P76 M, 2017 – 686 p.						

2) Innovative entrepreneurship as a key factor of technological changings

Nowadays, one of the conditions for the successful functioning of the innovation economy is the development of innovative entrepreneurship. The formation of the innovation system and infrastructure for the development of Russian innovation, building relationships between science and industry is a necessary factor in the development of innovative entrepreneurship, which in the information society is a key factor in technological change, contributes to the dynamism of the economic system, ensures the acceleration of the implementation of research and development, their commercialization.

Due to the fact that small innovative enterprises are the result of the integration of University science and business, it is interesting to compare the nature of the dynamics of the indicator of the share of organizations in the business sector and higher education in the total number of organizations that have carried out research and development. It is established that with the positive dynamics of the indicated indicator in the higher education sector, the tendency of its decline in the business sector is still maintained (Table 2).

TABLE II. DYNAMICS OF INDICATORS OF SPECIFIC WEIGHT OF THE ORGANIZATIONS OF HIGHER EDUCATION AND THE BUSINESS SECTOR IN THE TOTAL NUMBER OF ORGANIZATIONS PERFORMING RESEARCH AND DEVELOPMENT

№	Indicators of the share of organizations in the total amount of organizations that made research and development	2012	2013	2014	2015	2016
1	Share of business sector organizations, %	38.2	35.2	35.1	33.5	32.3
2	Share of higher education institutions, %	18.5	21.1	21.6	26.9	26.4

Based on: Russian statistic Yearbook. 2017: Stat.YB./Rosstat. - P76 M, 2017 – 686 p.

According to the statistical Yearbook for the end of 2017 in Russia the number of enterprises engaged in professional, scientific and technical activities amounted to 13.1 million (5.1 per cent) with the number of employees 291 thousand people (4.7 per cent), providing a turnover in the amount of 912,9 billion rubles (3.3 percent).

At the same time, the number of small enterprises from this sphere of activity involved in research and development amounted to 1.3 thousand (0.5%) with a staff of 38.6 thousand people (0.6%), ensuring a turnover of 104.5 billion rubles (0.4%).

Currently, there is an acute problem of providing small innovative enterprises with modern production and control and measuring equipment. In foreign practice, a solution to this problem was found through the collective use of equipment in service centers, which are not yet widespread in Russia.

Legal regulation of innovation in Russia is to establish the forms and methods of state support of this activity at the expense of the budget of the subjects of the Russian Federation, in the development of regional and Federal innovation programs, the adoption of legal acts regulating various aspects of innovation.

It seems justified to focus on the problem of insufficiently developed for the effective functioning of the innovation system of the legal framework governing innovation in Russia [4]. In contrast to the European experience in tax policy, the Russian tax system is mainly aimed at supporting

the creators of innovation, while Europe has developed government programs to encourage consumers, which contributes to the increase in demand for innovative products, therefore, to the emergence of new products on the market.

B. Innovations in education as a factor of adaptation to the demands of innovative economy

1) Competence approach: "from passive learner to active learner»

The education sector is one of the most innovative sectors, which largely determines the creation of an innovative climate and the competitiveness of the economy as a whole. Competence-based approach implies that students will be able to solve problems in various fields and types of professional activity, and the educational process should be built in accordance with the results of education, which are initially included in the educational program.

The educational process in the competence approach is focused on the formation of students' experience of independent solutions of professionally-oriented tasks. Formation of competences is carried out within several disciplines, and also provided work curriculum practices: training, production, etc. undergraduate sections of the school activities.

The modern system of innovations in education includes: technological innovations (educational technologies); pedagogical innovations (teaching and learning methods); economic innovations (economic mechanisms in education); organizational innovations (organizational structures and institutional forms in education). In research in the field of modern learning technologies should be identified such priority educational technologies as: problem, contextual, project, training on the basis of activation and intensification of activities. The review of foreign literature shows the orientation of universities to active teaching methods, in particular, problem-oriented and project-organized [5, 6, 7].

Special attention should be paid to the issues of reproduction of scientific and scientific-pedagogical personnel of higher qualification. Training of competent graduates can be provided only by highly competent teaching staff. The results of the analysis of the main indicators of postgraduate and doctoral studies indicate a decrease in the number of graduates. The number of graduates with the protection of dissertation reduces (Table 3). One of the good reasons for this situation, of course, is

the increase in the requirements of the HAC to applicants for academic degrees, to the significance of the results of research presented in candidate and doctoral dissertations.

Implementation of educational programs of the new generation requires continuous development of innovative educational technologies aimed at training competitive specialists. Systematic knowledge, skills and abilities of future specialists and entrepreneurs in the field of innovative technology and engineering should be provided through interactive project-oriented educational technologies – as a key factor in the learning process. Competence model for students should be based on the requirements of professional standards. In professional standard determined normative knowledge, skills and employment action, so the standard performs the function of the converging element of the labor market with the education market.

TABLE III. DATA OF ASPIRANTS' ACTIVITY

Year	Degree	Degree with protection of dissertation	
	Amount of people, total	Amount of people, total	Part from the whole amount of people, %
2000	24828	7503	30.2
2010	33763	9611	28.4
2014	28273	5189	18.3
2015	25826	5652	18.0
2016	25992	3730	14.3
2017	18069	2320	12.8

Based on: Russian statistic Yearbook. 2017: Stat. YB./Rosstat – P76 M, 2017 – 686 p. Counting in % was done by the authors.

It should be noted that there is a problematic component in ensuring the relationship of competencies and professional standards, namely: requirements for learning outcomes should be based on professional standards, but this often does not happen due to the fact that in reality educational standards are formed and adopted somewhat earlier than professional ones.

Due to the fact that the study of the relevant disciplines is the development of only part of the competence, it is important to transfer the component competencies mastered from previous disciplines. It seems justified and necessary in the teaching of disciplines to focus on the continuity of the material studied courses, both in the theoretical material of the discipline, and in the development of tasks for laboratory and practical work, to the topics of seminars and term papers/projects. This should be reflected in the work programs and evaluation funds of the relevant disciplines. It is important to include in the curriculum of training managers and a number of technological disciplines, thus providing the necessary "technological baggage" for the formation of competencies that ensure the readiness and ability of graduates to participate in the processes of implementation of product and technological innovations [8].

2) Interaction of educational sphere and business

Nowadays, the targets of universities are not only the provision of educational services. Modern universities are organizations that implement the functions of intellectual and innovative centers, suppliers of intellectual resources for innovative economy.

For the development of innovative economy the demand for competent innovators with technical education, as well as innovative managers with engineering thinking is increasing. The priority task of universities is the training of personnel able to generate ideas, develop and implement promising innovative projects [8].

University training for technological entrepreneurship as a result of training should ensure the ability of graduates to professionally search for commercially significant scientific and technical ideas, to develop on their basis projects for the production of commercially promising products.

Interaction between the University and employers during the practice solves the problem of immersion in a professional environment. It is production practices that form the idea of students about the activities of enterprises (firms), their technological capabilities. The University teacher responsible for the practical training of students analyzes the result of the formation of competencies, taking into account the opinion of the head of the practice of the enterprise. Subsequently, this information allows you to make informed decisions to make changes in the work program, in the form and content of practices.

The organization of partnership between the University and enterprises forms students' idea of the activities of enterprises of the city and the region, their technological capabilities, development prospects, social significance. This cooperation allows developing work programs of disciplines that reflect the requirements of employers to the knowledge of graduates, as well as to the content of the necessary competencies.

Targeted training of professional staff, financed by the future employer, is not only an existing, but also a promising model for further development of cooperation between universities and potential consumers of educational services.

The main areas of cooperation between universities and employers are:

- production practice at the enterprises of the relevant sphere;
- final certification with the participation of employers;
- taking into account the views of regional employers to include additional competencies in educational programs;
- making training sessions by representatives of employers;
- organization of internships in enterprises for teachers of universities;
- implementation of joint research works;
- opening of basic departments on the territory of enterprises.

The interaction of the educational environment and business provides enterprises with such opportunities as:

- participation in the adjustment of both educational programs in General and working programs of disciplines;
- invitation to work of graduates already familiar with the production and technological systems of the enterprise;
- access to the results of graduate studies relevant for use in the production of products in the enterprise.

Cooperation between universities and business increases the competitiveness of graduates in the labor market and provides employment opportunities in the enterprise after graduation. Unfortunately, it should be noted that there are no fundamental changes in the interaction of universities and employers, at least for regional universities.

Thus, when training specialists for the development of technological entrepreneurship must comply with the key principles:

- creative development of students, their focus on innovation;
- training of innovators capable of generating ideas and effectively developing entrepreneurial activities;
- implementation of the system of continuous training with integration into the system of innovative production;
- organization of cooperation between universities and business in the field of technological and engineering entrepreneurship.

It is the University that should become a driver in the integration of science and business. The legislative framework provides for the development of innovative entrepreneurship in universities. One of the indicators of the University development efficiency is the number of small innovative enterprises at universities. A promising form of interaction between the University and the business environment is the creation of a belt of small innovative enterprises around the University, grown in the business incubator of the University.

At the same time, the analysis of the nature of interaction between the educational environment and business in foreign countries revealed a number of approaches that claim to a serious understanding of their experience for the application of its individual components in the practice of Russian higher education [9, 10]. It is also justified to analyze the foreign experience of partnership between the educational environment and business. Of practical interest is the experience of training with the labor year in Germany, when students devote one year of professional activity, and only then finish training. It is necessary to analyze the prospects of borrowing the experience of assessing the professional qualifications of graduates by special organizations on the example of the Scottish qualification office.

IV. CONCLUSION

As a result of the analysis of institutional problems hindering the processes of active development of innovative entrepreneurship in the technological sphere, it seems justified to focus on such important issues as: the provision of demand for qualified personnel; the integration of science and business; the development of innovative infrastructure; improvement of the legal framework.

The formation of favorable conditions for the development of innovative entrepreneurship in the technological sphere, in our opinion, involves integrative activities to address these problems, taking into account the following main factors:

1. It should be noted that there is a problematic component in ensuring the relationship of competencies and professional standards, namely: requirements for learning outcomes should be based on professional standards, but this often does not happen due to the fact that in reality educational standards are formed and adopted somewhat earlier than professional ones.

2. It seems justified and necessary in the teaching of disciplines to focus on the continuity of the material studied courses, both in theoretical and practice-oriented material of the discipline, which should be reflected in the work programs and funds evaluation tools of the relevant disciplines. It is important to include in the curricula of training managers and a number of technological disciplines, thus providing the necessary "technological baggage" for the formation of competencies that ensure the readiness and ability of graduates to participate in the search for commercially significant scientific and technical ideas, the development of innovative programs, the introduction of product and technological innovations.

3. The issues of reproduction of scientific and scientific-pedagogical personnel of the highest qualification require due attention. Preparation of competent graduates requires highly competent teaching staff. The results of the analysis of the main indicators of postgraduate and doctoral studies indicate a decrease in the overall number of graduates and the number of graduates with a thesis.

4. It is the University that should become a driver in the integration of science and business. The legislative framework provides for the development of innovative entrepreneurship in universities. One of the indicators of the University development efficiency is the number of small innovative enterprises at universities. A promising form of interaction between the University and the business environment is the creation of a belt of small innovative enterprises around the University, grown in the business incubator of the University.

5. One of the acute problems in the development of technological entrepreneurship at the present time is the provision of innovative enterprises with modern production and control and measuring equipment. It seems justified to turn to the experience of foreign practice, where a solution to this problem is found through the collective use of equipment in service centers, which are not yet widespread in Russia.

6. In contrast to the European experience in tax policy, the Russian tax system is mainly aimed at supporting the creators of innovation, while Europe has developed government programs to encourage consumers, which contributes to the increase in demand for innovative products, therefore, to the emergence of new products on the market.

V. DIRECTIONS OF THE FOLLOWING RESEARCHES

The following researches of the authors will be aimed at the development of scientific and methodological base in the

field of improving the processes of interdisciplinary coordination in the educational process, providing interaction and synergy of competencies in the field of engineering, Economics, law and management.

REFERENCES

- [1] I.Blagih, the Country needs new industrialization, 10, 10-17 (2014)
- [2] A. Volkov, V. Degtyareva and V.Ustinov, Features of innovative entrepreneurship in the development of national technological initiative, *Innovation*, 11, 54-59 (2017)
- [3] Yu. Lapygin, P. Makarov, Intellectual capital as an indicator of the innovative potential of countries and regions, *Innovations*, 6, 8-13 (2018)
- [4] A. Belousov, Legal aspects of formation of innovative infrastructure of economy, *business Security*, 14, 13-14 (2014)
- [5] E. de Graaff, A. Kolmos, *Management of change: implementation of problem-based and project-based learning in engineering* (sense publishers 2007,)
- [6] M. Dolence, student-centered curriculum model: a structured framework for technology planning (Center for Applied Research, 2009)
- [7] J. Walter, D. Radcliffe, the competence dilemma in engineering education: going beyond a simple mapping of graduate attributes, *AJEE*, 1 41-50 (2013)
- [8] V. Belousova, Formation of the foundations of engineering knowledge in the preparation of bachelors in "Management", Collection of articles of the international scientific and practical conference, 11-17 (2014)
- [9] E. Conlon, new engineer: between employability and social responsibility, *EJEE*, volume 33, issue 2 151-159 (2008)
- [10] M. Markkula, P. Lappalainen, new discoveries at the University-industrial cooperation: Aalto University as a precursor to the reform of the European University, *EJEE*, volume 34, issue 3, 251-262 (2009)