

New University Educational Space: Integration of Education and Science

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Abstract:

Purpose – *The purpose of the work is to study the new components of the educational space, which is formed on the basis of the integration of educational and scientific activities of research universities. The main aim of the article is evaluation of the effectiveness of the integration of science and education in the new educational space in research universities from the standpoint of forming a complex of unique scientific, research and entrepreneurial competences, both university staff and students.*

Design/Methodology/Approach – *The main research methods are content analysis of the concept of educational space and system analysis of its main components.*

Findings – *The relationship between improving the efficiency of research activities and the formation of a high level of competence of staff and students of the university has been revealed. The synthesis of new opportunities created in modern research universities ensures the formation of a unique set of students' competencies.*

Originality/Value – *Taking into account the insufficient elaboration of the problem area of cultivating the educational space of the research university, there has been taken the attempts not only to identify new components of the educational space of the university, but also to justify the need to include them in the field of formation of students' unique competences, including scientific, research and entrepreneurial ones.*

Keywords: *educational space; scientific competence; research competence; research university; integration of education and science.*

I. Introduction

The mission of universities is to train highly qualified, competitive personnel for the economy of the country and the region. However, universities began to perform new functions, the foremost among which are fundamental and applied researches, commercialization of such researches, the creation of new companies in university incubators, entrepreneurship. The implementation of such a set of goals is possible

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only in the new type of universities, the so-called "the Third Generation University" that act as original incubators of new firms based on the achievements of science and technological developments, and also play an active role in finding ways of practical application of the created knowledge (Wissema, 2009).

The creation of a network of research universities in Russia was the main step towards the creation of a new type of universities that perform equally effective educational, scientific and entrepreneurial functions. Infrastructure, organizational, financial conditions for the integration of these functions into a single complex were created, but there was no effective symbiosis.

The formation of a new mission (the third one) in the context of higher education reform is a complex process that will lead to fundamental changes in university education, its content and structure, forms and methods of training, organization of educational and research processes.

The competence-based approach in education, organization of training in enterprises (basic departments), active involvement of practitioners in the educational process, creation of student innovation centers and incubators, business schools that form entrepreneurial qualities of students, allowed taking only the first steps of integrating science into the educational process. The growth of professional competence and increased quality of the university training are closely connected with the interest to the learning process (Bochkareva *et al.*, 2017).

The experts of Institute for Business Value consider that increasing the value of higher education and helping to prepare students for after university life means adopting a more practical and applied approach to education. The main part of it belongs to building and expanding partnerships between educational and the private sector to create a more valuable education system (Lysytsia *et al.*, 2019).

II. Literature review

Theoretical and methodological approaches to the creation of the educational space are presented in the works of the following persons: Frumin I. D. (1994), Korneva M. I (1996), Stepanov V. M. (1999), Veryaeva A. A. and Shalaev I. K. (1998), Pesotsky Yu. S. (2002), Vilensky M. Ya. (2002), Marichev I. V. (2008), Tolypina Yu. A. (2012), Meshcheryakova E. V., Loktyshina E. A., Meshcheryakova J. V. (2019) and etc. In the studies of many scientists, the main object is an educational space of the secondary school. The educational space of universities is addressed in the works of Shames L. Ya. (2006), Zhdanko T. A. (2011), Bondarevskaya E. V. (2013a,b), Hurajova L. A., Firsova S. B., Glukhova M. N. (2018), Semarkhanova E. K., Bakhtiyarova L. N., Krupoderova E. P., Krupoderova K. R., Ponachugin A. V. (2016a,b, 2017, 2018). However, the conducted literature review indicates an insufficient elaboration of the issues of structuring a new educational space of research universities based on the integration of scientific and educational activities and the same effectiveness of their implementation in the context of the implementation of the "third mission" of the university.

1.1. Educational space

Since the 90s of the 20th century, the concept of "educational space" has become increasingly common in studies devoted to the problems of education and pedagogy. For the first time its categorical

essence was revealed in the papers of Frumin I. D. and Elkonin B. D. (1993, 1994) as a space of interaction between a teacher and a learner, an adult and a child. Frequently, the educational space is identified with the concept of the educational environment (Borisova, 1999). The study of educational space from the system approach and its identification with the education system was conducted by Lifеров A. P. (2009), Dneprov E. D. Tkachenko E. V., Shadrikov V. D. (2005).

The term "educational space" was first used in legal documents in 1992, with the adoption of the Federal Law of the Russian Federation "On Education", being a kind of copy of the Anglo-American concept of "educational space" (Ahlefeld, 2009). However, this term was not precisely defined in the law of the Russian Federation, but only mentioned.

1.2. Aspects of educational space

Researchers reveal various aspects of the "educational space" category, largely due to the specifics of the subject area of the study. The analysis showed that most studies are related to the characteristics of the educational space of secondary schools, only some consider the features of the formation and development of the educational space of higher education. Scientific works of Bondarevskaya A. I. (2004), Bocharnikova N. A. (2012), Redko L. L., Shumakova A. V., Veselova V. G. (2010), Olkhova T. A. (2007), Shmachilina S. V. (2009) identify several types of educational space of higher education institutions. They include cultural, information, professional, social and educational space. A significant amount of research is devoted to the study of the educational space, the space of pedagogical research, as well as the space of professional and personal development.

The interconnection and interdependence of individual levels, components, functions and characteristics of the space is essential to create a common educational space. Systemically important components of the educational space are the joint educational activity of subjects of education, the application of the principles of student-centered education, different models of teaching, creating conditions for the formation of personality, ready to cooperate (Bondarevskaya, 2013a,b; Semarkhanova *et al.*, 2016, 2017, 2018; Shames, 2006).

Researchers like Bondarevskaya E. V. (2013a,b), Demakova I. D., Klochko L. I. (2018), Feldstein D. I. (2011, 2013) include the educational process to the systemically important components of the educational space. They consider the educational space as a system based on the use of various types and forms, methods and technologies of training, as well as the management of its structural components.

In the system of educational activity, researchers determine the educational space, and in professional activity — professional space. (Zhdanko, 2011).

III. Methodology

The research is based on the following methodological basis: methods of generalization, unity of analysis and synthesis, system and structural analysis of conceptual apparatus, extrapolation of previously obtained research results and pedagogical experience. Using the methodology of content analysis allowed systematizing the scientific approaches to the understanding of the category "educational space". The use of

systematic and structural approaches made it possible to identify the main components of the educational space not only in secondary and higher education, but also in the formed network of national research universities.

The study of the main trends in the indicators variation of development of educational and scientific activities of the network of national research universities in Russia made it possible to evaluate their interconnection and mutual influence on the formation of the unique competences of both staff and students in the "field" of the new educational space.

IV. Results and discussion

4.1 Expansion of educational space

The educational space should be expanded, involving new elements in its orbit, allowing not only to transfer knowledge, but also to form the competences of scientific research and the generation of new knowledge (Zhurakovsky *et al.*, 2001), their application in practice, thus forming entrepreneurial competence.

4.2 Advantages of the research universities

Research university is as one of the options for building an educational organization that meets the modern requirements of a competence-based approach.

The main advantages of such universities include new learning technologies and highly qualified specialists in various scientific fields. Only in this case, the integration of science and education that meets the requirements of high activity and intensity of education is possible (Maslennikova *et al.*, 2017).

Thus, the conditions for the creation of new educational space have been created in the system of research universities. It is represented by a purposeful system of interrelated educational, research and professional structures that form the competitiveness of the graduate. The elements of such a system are characterized by multi-functionality and versatility (educational, professional, practical, research, management, financial and economic components).

4.3 New qualities of the research universities educational space

One of the important areas of modernization of higher education in modern Russia is the creation of a network of national research universities. Such universities should equally effectively implement the functions of education and scientific research (Okunev *et al.*, 2015). A distinctive feature of this university is the ability to generate new scientific knowledge on the basis of a wide range of fundamental and applied researches (Gvozdetskaya *et al.*, 2016a,b). The main purpose of such universities is to provide wide access to the academic environment focused on scientific discoveries and offering a pedagogical base for the process of knowledge creation (Crow and Dabars, 2015; Crow and Tucker, 2001).

A research university is a scientific and educational complex with a developed innovative infrastructure performing a full cycle of innovative activities that enables to make a profit and is able to

implement the training of specialists with the skills of innovative entrepreneurship (Abdyrov *et al.*, 2017; Orazalina *et al.*, 2016).

The educational space of research universities formed on the principles of integration of science and education is based on concentration of experience and knowledge of scientists, teachers and researchers; modern infrastructure of scientific researches of higher education institution providing process of commercialization of research activity results in practice; financial resources for creation of hi-tech laboratory complexes (Figure 1).



Figure 1 New components of educational space of research university

The research university will ensure the acquisition of knowledge and the formation of competences based on flexibly organized educational and research activities, which will maximize the results of the interaction of basic disciplines and interdisciplinary research areas.

4.4 Students' competences

The implementation of educational activities in the new educational space of national research universities will form a unique set of students' competences. This complex of competences will provide for conducting fundamental and applied world-class researches (scientific competences), generating new knowledge (research competences), transferring them to technologies and competitive high-tech products (entrepreneurial competences) (Figure 2).



Figure 2 Graduate's competences complex of research university

Creating conditions for the formation of a complex of unique competences among students is implemented through a consistent interaction of the structure and content of educational and practical activities contributing to the creation of a conscious scientific picture of the world and the formation of a new quality of thinking (Maslennikova *et al.*, 2000). In addressing this problem, research universities are able to maximize the synergy of scientific knowledge and educational activities in the educational space (Maslennikova *et al.*, 2017).

4.5 Practise of new educational space formation and development in Russian research universities

The main results of the effective synthesis of new components of the educational space in research universities will be the formation of unique scientific, research, entrepreneurial competences of bachelors, masters, students which allow for conducting fundamental and applied world-class researches, generating new knowledge, their transferring to technology and competitive high-tech products, expanding the range of educational services, developing and implementing new educational programs. ensuring effective integration into the world educational and scientific space (Okunev *et al.*, 2015).

In general, the network of National Research Universities of the Russian Federation and N. P. Ogarev Mordovia State University in particular are selected as the objects of research confirming the hypothesis of the formation of a complex of unique students' competences in research universities.

The creation and development of a network of national research universities (NRU) has been implemented in Russia since 2008 within the framework of the National priority project "Education" (Nesterov *et al.*, 2013). The functions and the composition of the innovation process are constantly changing and stipulated by the objectives of an effective commercialization of innovations. The control must be carried out at the beginning and the end of each stage of innovation. (Akhmetshin *et al.*, 2017).

National research universities have established more than two hundred common use centers (CUC) of scientific equipment and experimental facilities including multidisciplinary interdisciplinary centers. A significant result of institutional reforms in such universities is the creation or significant development of their innovation infrastructure: the creation of innovation and technology centers, technology transfer centers, business incubators, design and technology bureaus, pilot plants, technology parks, small innovative enterprises and other structures (Firsova, 2012; Osipov *et al.*, 2015; Sheregi and Ridiger, 2016).

4.6 Dynamics of academic staff number of publications

The intensification of research and development is reflected in the growth of publication activity of staff, postgraduates and undergraduates of research universities (Figure 3).

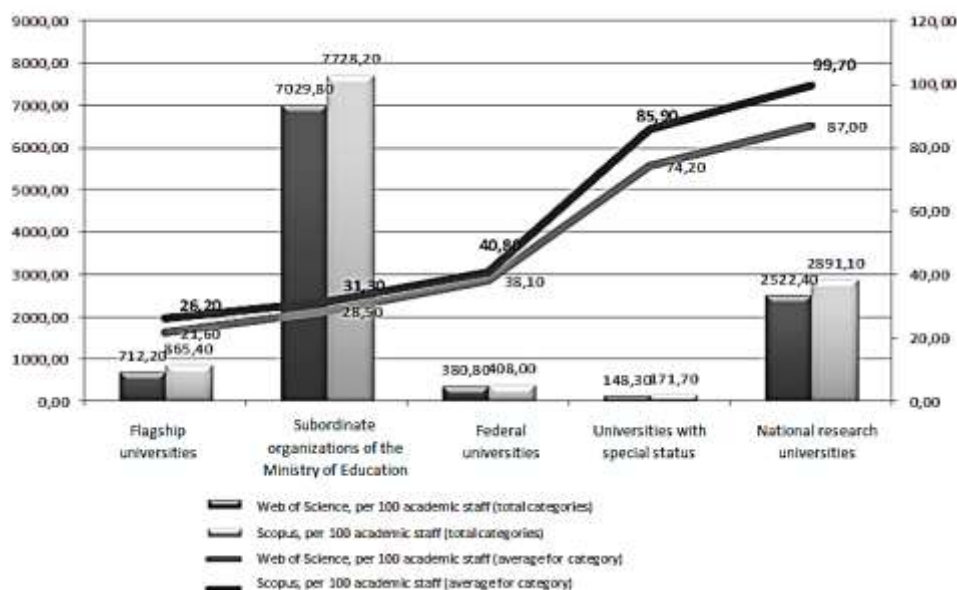


Figure 3 Number of publications of different groups of universities in journals indexed in information and analytical systems of science citation, units

The positive dynamics of the publication activity of NRU staff indicates the development of research competences, both teachers and students (about 20% of the articles prepared by students (graduate students, undergraduates, bachelors) in collaboration with their supervisors).

4.7 Effect of the academic staff advanced training

A significant effect of investments in the development of research base and advanced training of NRU academic staff is their active participation in the programs of innovative development of companies with state participation and in the activities of technological platforms.

In order to commercialize the results of intellectual activity, 625 small innovative enterprises for 3,570 jobs were created in the NRU innovation belt, which in 2014 fulfilled orders in the amount of more than 2 billion 204 million rubles, and for the period 2010-2014 more than 12 billion rubles (Gvozdetskaya *et al.*, 2016a,b).

When examining the effectiveness of research activities and its impact on the formation of a high level of competence of both university staff and students, positive trends were identified in all universities of the NRU network. FSBEI HEN. P. Ogarev Mordovia State University is not an exception.

The infrastructure of scientific and innovative activities of the university is provided by the following: 5 common use centers, 21 research and educational centers, 128 scientific and educational laboratories, 4 engineering centers, Innovation and Technology Complex, Technology Transfer Center, Business Incubator, Technology and Innovation Support Center, Metrology Center, 12 commercialization offices, 25 small innovative enterprises, 7 youth innovation centers, 11 student design bureaus, Center for New Information Technologies, Center for Supercomputing technologies, Internet Center. 71 of the

university's real estate facilities belong to the class of teaching and laboratory, the educational process is conducted in 29 teaching and laboratory buildings and more than 160 laboratories.

New requirements to the organization and quality of scientific research, their scale and complexity, which became possible as a result of re-equipment of the material base, make it necessary to significantly modernize the structure of educational programs of the university, the content of training courses, the organization of practical and laboratory classes.

4.8 Development of educational standards

During the implementation of the Development program, 4 self-established educational standards were developed and 7 unique educational programs were based on them. In the process of their development, the requirements of strategic partners of the university – high-tech enterprises in the real sector of the economy were taken into account. Currently, 987 students are qualified according to the educational programs.

The portfolio of additional professional programs is supplemented by 476 programs. A significant part of them (165 programs) is focused on solving the problem of integration with enterprises of the real sector of the economy, personnel support for high-tech industries, including and the block of programs developed for the innovative territorial cluster of the Republic of Mordovia Energy-efficient lighting and intelligent lighting control systems. The share of programs for engineering specialists has been significantly increased: about 40 programs are annually implemented under which about 1,000 people are trained (specialists from various branches of the real sector of the economy).

The implementation of such a set of basic and additional educational programs indicates a sufficiently high efficiency of infrastructure changes in the National Research Mordovia State University. The creation and development of research laboratories, research and educational centers, business incubators and small innovative enterprises allowed to quite effectively integrate the research function into the educational process, strengthen interaction with enterprises and business organizations and ultimately create unique conditions for the formation of scientific, research and entrepreneurial competences of university graduates, as well as of its staff – teachers, researchers, laboratory assistants, etc.

In modern world, the network form of interaction of interested participants in the process of forming a modern graduate with a set of required competencies has been developed. The university develops and implements educational programs in the network form involving leading research centers and enterprises of the real economy (Figure 4).

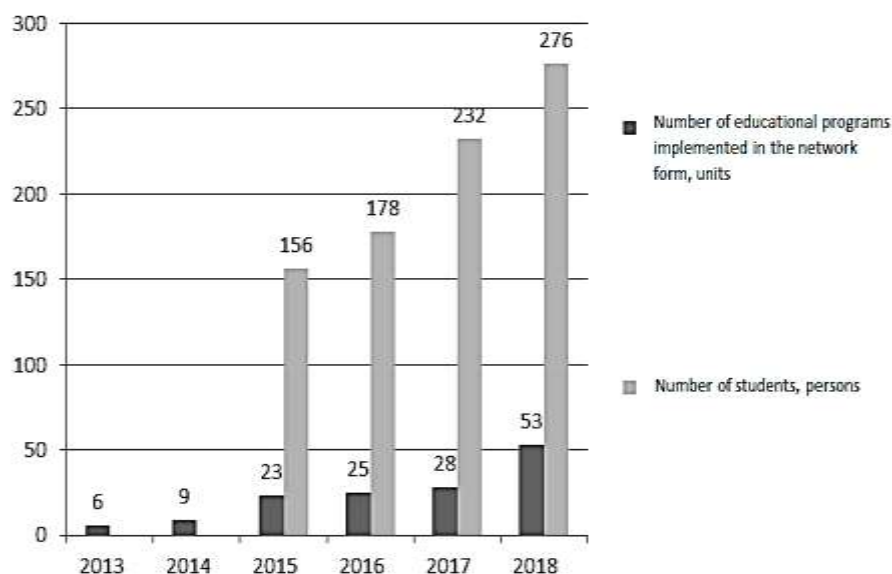


Figure 4 Dynamics of the number of educational programs implemented in the network form and the number of students enrolled in them in FSBEI HE N. P Ogarev .National Research Mordovia State University for 2013-2018

This form of education is organized mainly on promising (unique) educational programs that have an interdisciplinary nature in order to train personnel for large industry, research and other projects. One of the main advantages of the network form of training is the formation of unique competences that are in demand primarily in the rapidly developing high-tech sectors of the economy. (Sishchuk, Gerasimova, & Goncharova, 2018)

The implementation of the practice-oriented approach in the educational process involving employers is carried out on the basis of 20 basic departments. Currently, about 7 thousand students are trained in the basic departments. The main effect of the implementation of this approach is to include the best practices of leading companies in the educational process, and ultimately, to ensure that education better meets the needs of the economy and society.

4.9 Additional opportunities on the base of electronic educational resources usage

Project technologies are used in practice-oriented courses and implement research and interactive and communicative competences. In 2017, N. P. Ogarev Mordovia State University used such technologies in the training of 2543 students in 42 educational programs. It makes possible to create conditions for the independent, and most importantly, motivated acquisition of missing knowledge from various sources, the use of acquired knowledge to solve cognitive and practical tasks; acquiring communicative, research skills (problem identification, information collection, observation, experiment, analysis, hypothesis generation, generalization).

Within the activities of the NRU Development Program, a flexible integrated system of advanced training and retraining of academic, engineering, administrative and managerial personnel was created in

the university that helps to accurately form of missing competences. Diversified forms of advanced training that allows the range of educational opportunities to be expanded.

One of the key results of the NRU development is a significant increase in the involvement of students in the implementation of research projects. Over 9 years of project implementation, their number increased by 1.57 times and made up 28.5% of the total number.

The modern material and technical base of scientific research has provided a significant increase in the involvement of students in research projects of various levels. Such forms of development of scientific competence as student scientific societies, design bureaus, youth innovation centers, which involve the vast majority of 2nd and 3rd grade students in higher education in the Russian Federation, have become widespread. (Okunev *et al.*, 2015).

The large-scale modernization of the research infrastructure has created the basis for obtaining significant scientific results. As a result, R&D volumes significantly increased (in 2014, 367.5 million rubles, an increase by 4.1 times compared with 2009). In 2010–2018 the research was funded through various programs and projects with the following volumes (Figure 5).

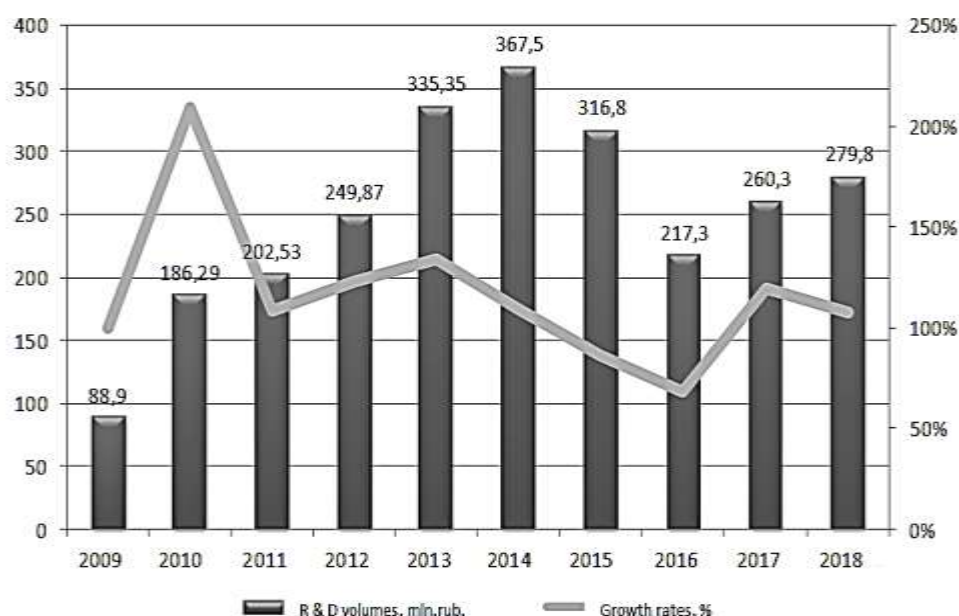


Figure 5 Growth rates of R&D volumes in N. P. Ogarev National Research Mordovia State University for 2009-2018

4.10 The number and cost of the N. P. Ogarev National Research Mordovia State University funding projects

There is a positive dynamics of participation in competitions for grant support of RFBR and RFH. The funding for university projects has increased more than 5 times (Figure 6).

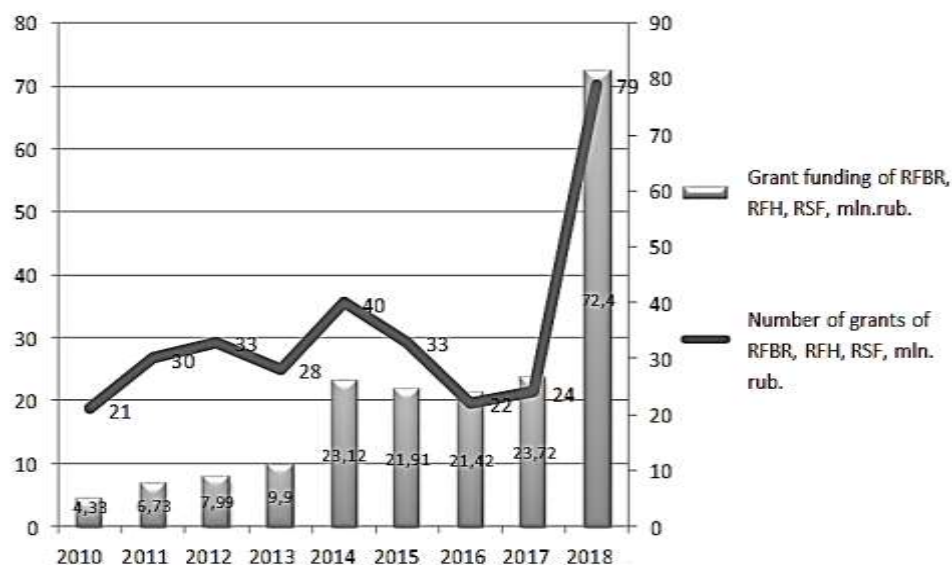


Figure 6 Dynamics of funding projects of N. P. Ogarev National Research Mordovia State University for 2010–2018

The research universities, as a new form of organization of scientific and educational activities of universities, are designed to enhance innovation. With their assistance, transmission of advanced scientific achievements into the practice of work of enterprises and organizations of high-tech sectors of the economy is provided. One of the results of NRU research activities is the intellectual property items (IPI). In Mordovia State University, the IPI generation is provided by the developed infrastructure of research and innovation activities: 7 youth innovation centers, 12 commercialization offices, prototyping and technology transfer centers, a business incubator, and a regional center for patenting. The technologically complete chain of creation and introduction into commercial circulation of the IPI in the university makes it possible to improve the quality of research teams (Gvozdetskaya *et al.*, 2016a,b). In addition, the participation of university staff and students in the processes of commercialization of research and innovation results is the basis for the formation of their entrepreneurial competences.

In the current structure of the university IPI, 124 intangible assets are on accounting, there are 25 licensing agreements on granting the right to use the IPI (Figure 7).

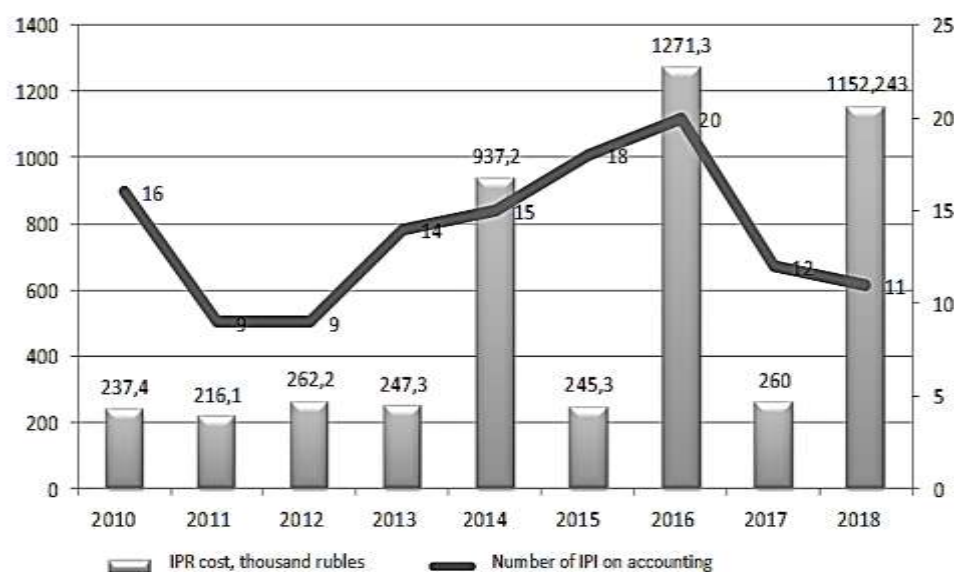


Figure 7 The number and cost of the OIC recognized in N. P. Ogarev National Research Mordovia State University for 2010–2018

The positive dynamics is not so much the number of applications and received security documents, as the cost of the OIC recognized in the university indicates the development of research and, more importantly, entrepreneurial competences of researchers and teachers of the university.

V. Conclusions

An analysis of the situation in the discussion area shows that the synthesis of new opportunities and the conditions of education created in modern research universities ensures the formation of a unique complex of students' competences and significantly increases their competitiveness in the real economy.

One of the key results of the NRU development is a significant increase in the involvement of students in the implementation of research projects. Over the 9 years of this project, their number increased by 1.57 times and amounted to 28.5% of the total number. The modern material and technical base of scientific research has provided a significant increase in the involvement of students in research projects of various levels. Various institutional forms of development of scientific competence of students, such as student scientific societies, design bureaus, youth innovation centers, which involve the majority of the 2nd and 3rd grade students of higher education in research universities, provide an ever-increasing need for closer integration of educational and research processes.

In turn, the innovative environment of research universities of small innovative enterprises, specialized support structures for Start-Up projects are a platform for the development of entrepreneurial competences.

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