

RRI 2016
International Conference «Responsible Research and Innovation»

**SCIENCE DEVELOPMENT IN RUSSIAN UNIVERSITIES AS
MAIN FACTOR OF HUMAN RESOURCES REPRODUCTION**

Elena E. Mastalygina (a,b)*, Ksenia V. Sukhareva (a,b), Ivetta A. Varyan (a,b), Anna K. Zykova (a,b), Polina M. Tyubaeva (a,b)

* Corresponding author

(a) Plekhanov Russian University of Economics, 36 Stremyanny lane, Moscow, Russia

(b) Emanuel Institute of Biochemical Physics Russian Academy of Sciences, 4 Kosygina street, Moscow, Russia,
elena.mastalygina@gmail.com, +79104442364

Abstract

The main trends of scientific work in Russian higher education institutions in terms of Plekhanov Russian University of Economics were analyzed. The structure of the university science was investigated according to the main directions of scientific activity of Russian higher education institution: grants and contract research works, publication activity, commercialization of research, scientific personnel training and students' research work. The main instruments of research policy were studied to develop the most efficient strategy of involvement of students in research and development activities and human resources reproduction. The necessity of systematic work with the considered contingent at all stages of the formation of the scientific path "bachelor – master – Ph.D. student" was established. According to the sociological results, one of the main factors of students' integration into scientific and research work was personal growth that could be realized by means of organization of challenging work with practical results. Further, it is important to develop the system of material incentives for good results of scientific work.

© 2017 Published by Future Academy www.FutureAcademy.org.uk

Keywords: Russian higher education institutions; scientific activity; research policy; human resources reproduction; performance indicators

1. Introduction

The reforming of higher education in Russia has led to changes in its structural and informative components that have imposed new requirements on the training of specialists in a higher education institution (Dezhina, 2011). The research activity itself and the resulting created innovative products are

becoming one of the most important and valuable assets for raising additional funding not only to provide the scientific activity, but also to maintain the economic stability of the entire university as a whole. In addition, the Russian higher educational institutions have the important aim to establish and preserve the country's intellectual potential through the support and involvement of students in research work (Gurban, & Tarasyev, 2016).

This article has analyzed the development trends of the scientific system in higher education by the example of the leading Russian university – Plekhanov Russian University of Economics (PRUE). Considering the laws of the structure of university research and the study of the process of involvement in the scientific work of students and Ph.D students has allowed making a complete picture and identifying the most effective tools for management of research activities in terms of a Russian university. Moreover, the emphasis is placed on the development of youth science as a key factor of reproduction of human resource capacity in higher education institutions.

2. Methods

The analysis of higher education scientific activity was conducted using standard methods of experimental statistics, such as analysis of variance (ANOVA) for single factor and two factors, correlation and regression analysis. Analysis of variance usually refers to statistical analysis involving simultaneous comparison of multiple sets of observations. ANOVA shows what factors (type of motivation, area of scientific activity and etc.) have an influence on measured values. The correlation analysis is aimed to obtain linear mathematical model of relationship between criteria. The process of investigation included compiling the research on attracted funds for research projects and publication activity, using structured methods, meta-analysis and information synthesis.

Sociological research or opinion survey into a problem of students motivation for participation in scientific events was conducted by poll. The sample for statistical data analysis included 500 students at the age from 18 to 22 of different training areas and specialties. In the questionnaire, respondents were asked to give detailed answers.

Each answer was analyzed by the developed scoring system. It consists of different criteria, each of which has the specific weight from 1 to 5 points. These criteria were used to determine the main types of motivation for scientific and researching activities during the training, such as the intended benefits for students from participation in researching activities for the future profession, the aspiration to self-education and knowledge intensification, the desire for personal success in the process of receiving higher education degree, the focusing on achieving positive results in the scientific governmental investigations, the desire for creative interaction with lecturers and professors.

3. Results and Discussion

The structure of university science has been changed and expanded much for today, which is supplemented with new units and areas of work, not previously involved. Thus, to analyze the structure and dynamics of changes taking place in the scientific field of the university, it is necessary to consider several components of the university research activities (Kartashova et al., 2015). Fig. 1 shows a diagram of the basic directions of scientific activity of a Russian higher education institution. Each of the drawing

blocks is a huge multi-step process of planning, implementation, control and monitoring of the results of each aspect of scientific activity.

First of all, it is important to note that the research activity of higher education consists of basic research, applied research and design and development. This trend is realized based on scientific schools of universities, research laboratories, joint research centers, university departments.



Fig. 1. Example of main directions of scientific activity of Russian higher education institution.

As for now, the scientific progress in PRUE is mostly organized in the following research areas:

- development of entrepreneurship, such as: economics of entrepreneurship, social responsibility of business, management of new technologies and innovation, human resource management, financial engineering, logistics, transport, hotel management, trade economics;
- participation of the state in the economy, in particular: the national economy, the criminal economy, energy and environmental policy, international trade and investment, international finance and macroeconomics;
- the regional economy, in particular: the economy of cities, agricultural economy;
- quality of life, quality and safety of consumer goods and services, including: consumer behavior, demographic economics, environmental economics, commodity research, material science;
- statistical studies, in particular: the theory of probability and statistics, econometric modeling;
- Knowledge Management System. Information technology and applied computer science, such as: knowledge management, decision theory, big data, business informatics;
- Education Management and Economics of Education in particular: Economics of education, knowledge economy.

Research work can be carried with financial support of public research funds (grants of RSF RFFR, RHSE) and the state budget (including tenders and awards), non-governmental private funds (Innovation Assistance Foundation, Zworykin Award, Lavrentevky breakthrough), the budget of various organizations (contract work), etc. The indicator of attracted funds for such projects is an important factor of the efficiency of university science (Sidorenko, & Gorbatova, 2015).

Fig. 2 (a) shows the dynamics of changes in the volume of PRUE attracted funds of three types of research projects: 1 – economic-contract work; 2 – work carried out by the government order of ministries, agencies and public authorities; 3 – works financed from public and private funds. Over the past 5 years, a significant increase in this indicator of the work conducted in accordance with the government order and the grant work was detected (Gendina, 2016). The total amount of money spent on

the research conducted in PRUE in 2015 is more than 200 mln. rubles. At the same time, in 2015, significant volumes of research works were carried out by the government orders of the Ministry of Education of Russia (33.6 mln. rubles), of the Federation entity (26 mln. rubles) and Russian scientific funds (24 mln. rubles). Fig. 3 shows the dynamics of changes in the volume of attracted funds in the past 5 years (2010 to 2015) (Fedotova, & Platonova, 2014).

It is important to note that the development program of PRUE provides a set of measures to mainstream scientific research in accordance with the strategic objectives of the university extension. Among them, there is a measure to stimulate scientific activity of employees and students. PRUE has developed a system of internal grants for scientific research work and scientific and practical research, financed by the University (Kisselev, 2013).

According to Fig. 2 (b), the highest amount of University's researches is devoted to entrepreneurship and business economics (22 %), as well as economics and management in higher education (23 %). In addition, a significant proportion of work is related to consumer goods and services research (18 %).

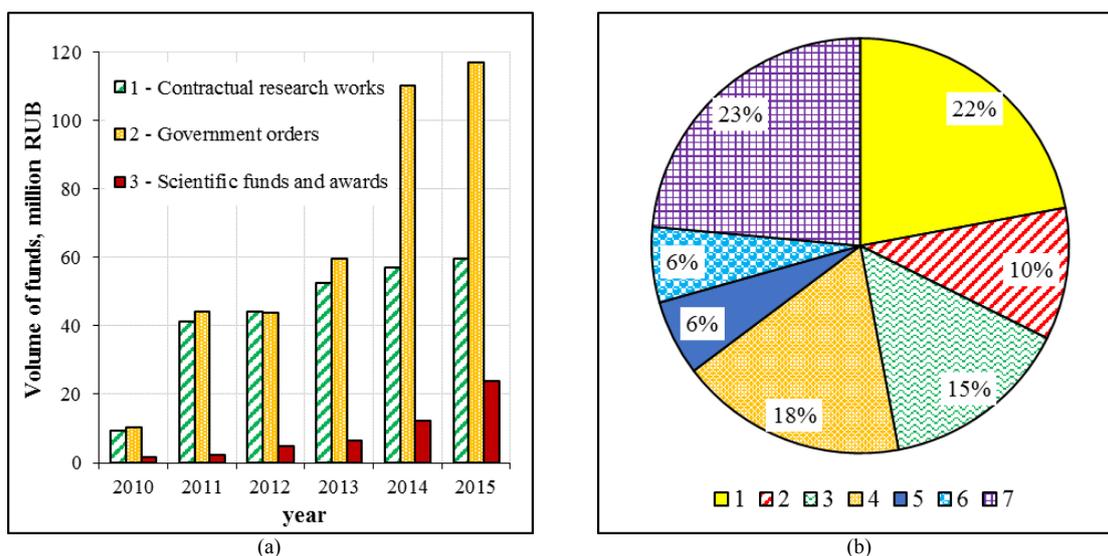


Fig. 2. (a) Changes in the volume of attracted funds by employees in PRUE over the past 5 years (from 2010 to 2015); (b) The structure of the areas of scientific research financed by PRUE in 2015 (*areas of research: 1 – Development of entrepreneurship; 2 – State participation in the economy; 3 – Regional Economy; 4 – Quality of life, quality and safety of consumer goods and services; 5 – Statistical study 6 – Management System Knowledge and Information technologies applied informatics; 7 – Education Management and economics of education).

The significant impact on increasing funding of the research projects in PRUE is based on the growth in the number of scientific schools and research laboratories in the University's structure. It is worth noting the establishment of the University Joint Research Center of scientific equipment, which serves both the university staff and external users. Moreover, since 2013, PRUE had changed the load structure of the teaching department. Up to date, the working time of the teacher consists of two components: classroom load and research work. Thus, we can note a positive trend in the aspect of attracting teaching staff of the University to research.

The second direction of research activities of the university includes the publication of the scientific literature, proving of scientific results and discoveries at conferences, as well as patenting of the university intellectual property and patent work.

The most authoritative bibliographic and abstract databases of scientific publications and citations

systems in the world are Web of Science (Web of Knowledge data) and Scopus (SciVerse Scopus data). As a rule, these international databases are a tool for tracking citation of articles published in scientific journals in the rating of world universities (ARWU, THE WUR, QS WUR).

Moreover, national regulatory documents have already included the quantitative and qualitative indicators of the development of science measured in a number of published articles and the number of citations. According to the Resolution of the Russian Government on April 15, 2014, № 301 "On approval of the state program of the Russian Federation" "Development of science and technology for 2013-2020", the main indicator of successful development of science and technology in Russia is the number of publications in international scientific journals indexed in databases Web of Science and Scopus data.

The analysis of the dynamics of publication activity of scientific and pedagogical workers and students of PRUE according to the Scopus database was made. Fig. 3 (a) shows the dynamics of changes in the number of publications for the NDP and students PRUE for the period from 2010 to 2015.

Analysis of the subject areas of PRUE students and professors publications over the past 10 years (Fig. 3 (b)) allows to consider areas of knowledge "Economy and Finance" (31 %) and "Social Sciences" (30 %) as the most popular. It was defined primarily by the characteristics of the studied university specialization.

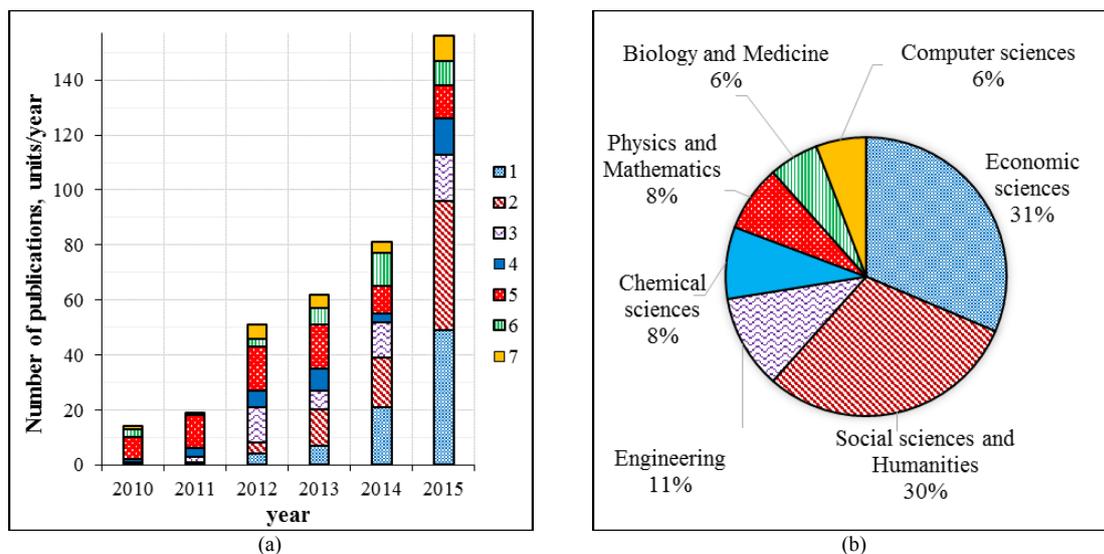


Fig. 3. (a) Changes in the number of PRUE publications indexed in the Scopus database by subject areas; (b) Distribution of PRUE publications indexed in the Scopus database by subject areas in 2015 (*1 – Economic sciences; 2 – Social sciences and Humanities; 3 – Engineering; 4 – Chemical sciences; 5 – Physics and Mathematics; 6 – Biology and Medicine, 7 – Computer sciences).

Apparently, the PRUE bonus system used in employees and students stimulation for publication in the top-rated (peer-reviewed) scientific journals and for results of intellectual activity (patents, certificates) has an impact on the growth of publications (Stukalova et al., 2014).

Just another important direction of scientific activity of the university is also referred to the training of highly qualified research staff, especially postgraduate students, and the development of students' science. This unit not only stimulates the development of university research in general, but also enhances the competitiveness of the university in the educational market and contributes to solving the problem of the reproduction of the teaching staff. It is realized because of the fact that the initial stage of reproduction of

the personnel with the necessary professional capacity refers to the period of training of the future specialist.

This raises the problem of students' integration into the process of development of knowledge, skills and abilities, which are necessary to carry out scientific and research work of students (Melkumyan et al., 2015).

The above-mentioned trends have a significant impact on the future of a student as a professional in the context of the restructuring of the scientific-educational university strategy. In this connection, a case study was conducted in order to identify the main factors that influenced the decision of students to participate in scientific events (data of 2014). The study was conducted by poll. The sample included 500 students from 18 to 22 different training areas and specialties. In the questionnaire, respondents were asked to give detailed answers. The questions were aimed to identify the factors that make the students participate in scientific events (Fig. 4 (a)).

In the study of motivation for participation in scientific events, it was found that the most significant factor for 45.2% of the students became personal growth, namely, the desire to develop individual abilities, talents; to learn new useful skills needed to communicate; to establish interpersonal contacts. The second most important factor was the opportunity for students to be active and to promote themselves for future employment, to realize their own initiative (35.6%). The third factor is the possibility of future fulfillment in the field of science (8.7%). In general, based on the respondents' answers, we may conclude that the key objective of participation of students in scientific events – to get the large amount of knowledge that will effectively realize their potential: professional, personal, creative (Osmani et al., 2015).

The basic units of research activity in universities (the example of PRUE) include the following:

- BLOCK 1. Students' research activities of the classical type, especially in the framework of structural divisions of the university;
- BLOCK 2. Student research activities, which are essential elements of a competition (Olympiad ("FinOlimp" since 2006), intellectual games (contest "battle of minds" from 2016) and quizzes, which are the main scientific and organizational activities of the Student Scientific Society);
- BLOCK 3. Scientific projects and contests (one of the most innovative tools, as part of which students can obtain certain skills of research work in practice (more specific examples), for example, the Stock Market Game "Wall street: Money never sleeps" in 2014, "Week of round tables: 4 sectors" from 2016)

The conduction of sociological research's indicators of the effectiveness of the strategy applied in the selection of research actions carried out is the attendance of events in PRUE in dynamics from 2012 to 2015. Fig. 4 (b) summarizes the results of creative activity of students, the state and the form of interest in scientific activities carried out by the University for the period of 2012-2015.

The comparison of the results, which are shown in the diagram, demonstrate the changes in the distribution of students' interest depending on the type of activities. Therefore, since 2012, there has been a trend of increased proportion of visits of events referred to block 3. It caused by the changes in the structure of research activities carried out in the university and an increase of the share of events referred to block 3. This trend is primarily due to the new and exciting formats of the activities of this block, which meet the main needs of the students (according to the survey) – the desire to develop the individual

abilities, talents and to learn new useful skills needed to communicate, the ability to be active, to promote oneself for the future employment and also to be proactive.

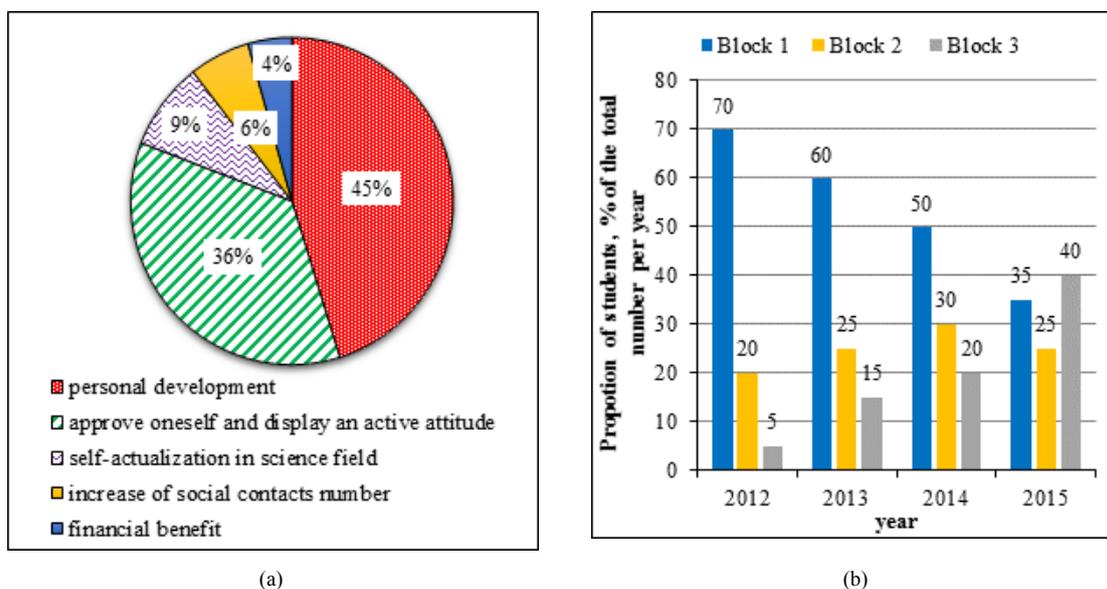


Fig. 4. (a) Factors that motivate students to participate in academic activities; (b) The structure of the students' participation in scientific events of PRUE from 2012 to 2015 by the activity blocks (% of the total number of students participating in scientific events per year).

The training of scientific workers with the highest qualification including Ph.D. and Sc.D. courses is one of the results of the effective scientific strategy when dealing with students. Scientific events will undoubtedly contribute to the further involvement of students in the graduate education. Table 1 presents the trends of number of graduate students and the competition for Ph.D. courses in the PRUE for 2012-2015 years.

Table 1. The number of Ph.D. students (pers.) and competitive enrolment (pers./place) in PRUE during 2012-2015.

Year	Number of Ph.D. students, pers.	Competitive enrolment, pers./vacancy
2012	430	1.9
2013	539	2.1
2014	470	2.5

The number of graduate students at the University at the end of 2013 was 539 people, which is 20.3% higher than the corresponding figure in 2012. The number of graduate students at the end of 2014 was 470 people, which is 14.7 % lower than the corresponding figure in 2013. The decrease in this indicator is likely caused by the reduction of the admission quotas and an increase in the number of persons expelled before the graduation for various reasons. The number of graduate students at the University at the end of 2015 was 595 people.

Change in the strategy and restructuring of research activities carried out in the PRUE is one of the reasons for the planned increase in the number of graduate students and the amount of competition for a place in the graduate school. This can be explained by the increase of students' interest in the scientific life of the university, emergence of new formats of scientific events and the increase of image of the scientific activity in the eyes of students.

4. Conclusion

The development trends of the scientific system in higher education by the example of Plekhanov Russian University of Economics (PRUE) were analyzed. According to the results devoted to assessment of the scientific potential of the students' development strategy of PRUE, the key trends were identified. The scheme of research activity in universities (in terms of Plekhanov Russian University of Economics (PRUE)) was investigated. Several efficient ways to increase students' involvement in scientific activity were found. Firstly, it is important to work with the considered contingent at all stages of the formation of the scientific path "bachelor – master – Ph.D. student". Secondly, higher education institutions should use new approaches in order to attract students to the scientific activity. Finally, the development of modern formats of scientific events should be designed. The comparison of sociological results of research activity of students demonstrated the changes in the distribution of students' interest depending on the type of activities.

References

- Dezhina, I.G. (2011). Development of Research in Russian Higher Education Institutes as a New Government Priority *Sociology of Science and Technology*, 2 (2), 38–47. (in Russian)
- Fedotova, O., & Platonova, E. (2014). Contemporary Politics of Russian Universities in the Development of Human Capital: The New Organizational Platform and Role of the Initiative *Procedia - Social and Behavioral Sciences*, 141, 1177 – 1181.
- Gendina, N. (2016). Chapter 7 – Information Culture and Information Literacy as a Scientific Direction and a Field of Educational Activities in Russia *Pathways into Information Literacy and Communities of Practice*, 167-202.
- Gurban, I.A., & Tarasyev, A.A. (2016). Global trends in education: Russia case study *IFAC-PapersOnLine*, 49(6), 186-193.
- Kartashova, A., Shirko, T., Khomenko, I. & Naumova, L. (2015) Educational Activity of National Research Universities as a Basis for Integration of Science, Education and Industry in Regional Research and Educational Complexes *Procedia - Social and Behavioral Sciences*, 214, 619-627.
- Kisselev, M.V. (2013). Perspective aims of higher education research development *Vestnik KNITU [Bulletin of Kostroma State Technological University]*, №1 (30), 3–8. (in Russian)
- Melkumyan, E., Pavlyutkin, I. & Prutskova, E. (2015). Civic effects of higher education in Russia: religiosity, social capital and the 'pure teaching effect' of educational programmes *Tertiary Education and Management*, 21 (3), 215–228.
- Osmani, M., Weerakkody, V., Hindi, N.M., Al-Esmail, R., Eldabi, T., Kapoor, K. & Irani, Z. (2015) Identifying the trends and impact of graduate attributes on employability: a literature review *Tertiary Education and Management*, 21 (4), 367–379.
- Sidorenko, T. & Gorbatova T. (2015). Efficiency of Russian Education through the Scale of World University Rankings *Procedia - Social and Behavioral Sciences*, 166, 464-467.
- Stukalova, I.B., Selyanskaya, G.N., Ponomarev, M.A., Bobkov, A.L. & Mastalygina, E.E. (2014). Directions of competitiveness increasing of institute of higher education performance (on the example of Plekhanov Russian University of Economics) *Bulletin of Plekhanov Russian University of Economics*, 1, 15–24. (in Russian)