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## THE IMPORTANCE OF HIGHER EDUCATION IN TRAINING OF ACADEMIC PERSONNEL

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*The authors scrutinized a system of factors that clinch the training course of academic personnel in higher education. The authors monitored the share of researchers by age groups, science domains and activity sectors within the national project "Science". The paper focuses on the experience of training of academic personnel at Volga State University of Technology, which is the subject of advancing and functioning of academic staff.*

*Key words: science, higher educational institution, academic personnel, human resources, research activities, national project*

### INTRODUCTION

Tertiary school is one of the types of educational institutions in Europe encompassing higher education institutions that train highly qualified specialists for practical activities within various scientific domains in Russia. The objective of higher education is to ensure the continuity and integration of scientific knowledge in the system of "education-academia-industry" [1, p. 104]. Academic staff who are the intellectual potential of a country play an important role in this system.

The national project "Science" aims at ensuring the attractiveness of work in the Russian Federation for leading Russian and foreign scientists as well as young promising researchers [2]. The national initiative in corporates the federal project "Human resource capacity building for research and development" [3]. The federal project focuses on "designing a system of training and professional growth of academic and pedagogical personnel, providing conditions for young scientists to carry out research and development, an establish scientific laboratories and competitive teams" [3].

Such foreign scientists as B. Raymond, M. Mulhall, M.H. Tritten, S.G. Wilber researched academic personnel in higher education. The Russian experience in training academic staff in higher education is presented by B.I. Bedniy, L.R. Rustamova, N.I. Khokhlova, E.V. Chuprunov, L.N. Bannikova, N.A. Zavalko, A.V. Lubkova, L.N. Sheven and others studied the functioning of academic personnel.

Highly qualified academic personnel increase the country's competitiveness in the world, as well as integrate education and science.

### THEORY AND EXPERIMENT

Science and education are two systems that supplement each other and have a common personnel potential. Research work is a prerequisite for the training of highly qualified academic personnel. The quality of training is enhanced by strengthening the material and technical facilities of scientific research, represented by scientific equipment designed or acquired as part of the fundamental and applied research used in the educational process, as well as improving the personnel certification system.

The demand for training academic personnel in prioritized scientific domains can be traced in the required level of publications within various science scopes. Currently Russia needs excellent scientists in engineering, natural and computer sciences (Table 1).

The determinants for the courses of research and training of academic personnel are the prioritized areas of economic and social development of the society that increase the level and quality of life of citizens. Hence, scientists of Volga State University of Technology, for example, Yu.S. Andrianov, I.A. Kudryavtsev, V.A. Gryazin, A.I. Kudryavtsev, K.S. Klyuzhev designed a technology for medical rehabilitation of patients with the function of the musculoskeletal system using robotic exoskeleton; V.N. Dubrovin, Ya.A. Furman, A.A. Rozhentsov invented technology of intra operative navigation for minimally invasive operations with support for augmented reality and control over the actions of the surgeon.

The scientific achievements of highly qualified academic personnel are best resulted in inventive and patent-licensing activities, including analytical, expert, legal and

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commercial functions, positive decisions on the ownership, using and allocating property rights to intellectual property. The rating of countries by patent activity is given in table 2.

The largest number of patents for the invention are issued by countries such as China, the USA and Japan. These countries are top-ranked in the export of new technologies and inventions to other countries of the 37 thousand of applications). Russian universities have been issued about 28 thousand patent documents over the past five years [4].

Table 1: Distribution of the number of research articles in subject domains and the number of universities offering the academic programs for those domains

Subject domain	Number of research articles, 2018	Number of universities			
		2016	2017	2018	2019
Humanities	29	31	16	20	29
Computer Science	166	36	33	35	38
Power-Plant Engineering	76	23	25	31	36
Mathematics	188	26	30	30	31
Chemistry	223	28	28	30	36
Economics	36	30	29	34	37
Social Science	56	33	28	26	34
Chemical Engineering	79	-	31	39	44
Engineering	368	-	32	48	49
Medicine	157	-	-	35	39

Source: data of the analytical center "Expert" [8]

The department for scientific programs, publications and intellectual property of Volga State University of Technology focuses on skilled work on managing the results of intellectual activity, arranged at the high level using computer technology and coordinated with the structural units and services of the university. Having the exclusive right, the university acts as the applicant and patent holder in legal protection of intellectual property. The university filed 81 applications for intellectual property, including 20 applications for computer programs and databases, 17 applications for a utility model and 44 applications for inventions in 2018. As a result the university was granted 93 copyright protection documents, including 30 patents for invention, 28 utility model patents, 35 certificates of state registration of computer programs and databases, among which 79 copyright protection documents for intellectual property were issued in collaboration with students [5, p.10].

Training and attracting scientists (35 thousand people in addition) is an objective of the development of science in the Russian Federation. The reason for this is a decrease in the total number of scientists in 2010-2018 by 5.7% (21 thousand people) (table 3).

Whereas, monitoring of the statistical data over the past nine years has shown an increase in the share of researchers up to 39 years in the total number of researchers in Russia by 8.4% and in the Volga Federal District (here in after VFD) by 7.5% and a decrease in the Republic of Mari El (here in after RME) by 4% (Fig. 1). As part of the national initiative "Science", it is planned to increase this indicator from 43.9% in 2018 to 50.1% by 2024.

The presence of the Russian Federation among the five leading countries of the world carrying out research and development in areas determined by the priorities of scientific and technological development within the framework of the national initiative "Science" is ensured by research of scientists in the science domains. The num-

Table 2: Rating of countries by patents in 2018, thousand

No	Country	Total of applications	Applications by residents	Applications by non-residents
1	China	1 381.6	1 245.7	135.9
2	USA	607.0	293.9	313.1
3	Japan	318.5	260.3	58.2
4	South Korea	204.8	159.1	45.7
5	European Union	166.6	78.6	88.0
6	Germany	67.7	47.8	19.9
7	India	46.6	15.0	31.6
8	Russia	36.9	22.8	14.1
9	Canada	35.0	4.0	31.0
10	Australia	28.9	2.5	26.4

Source: No news codata [9]

Table 3: Dynamics of the number of researchers by age groups in the Russian Federation, people

Age groups	2010	2015	2016	2017	2018
under 29	71194	76813	71492	66376	60634
30-39	59910	85972	88782	91429	92106
40-49	54113	50171	50193	51149	52800
50-59	88362	69552	65196	59893	54830
60-69	60997	63943	60915	57414	54076
70 and above	34339	32960	33801	33532	33401
Total	368915	379411	370379	359793	347847

Source: Data from the Federal State Statistics Service [10]

ber of researchers in the natural (by 8.2%), technical (by 6.9%), medical (by 19.1%) and agricultural (by 20.8%) fields of science decreased in 2010-2018. However, a significant increase in scholars in social sciences (by 49.4%) and humanities (by 6.6%) can be seen (Table 4). Research and development in the Russian Federation pursues two main courses: a fundamental course - obtaining new knowledge on the basic laws of the structure, functioning and development of man, society, nature; and an applied course - the application of new knowledge to achieve practical goals and solve specific problems and experimental development - activities based on knowledge acquired as a result of research or practical experience [6].

Table 4: Dynamics of the number of researchers by science domains in the Russian Federation, people

	2010	2015	2016	2017	2018
Natural Sciences	45915	45958	45958	43206	42106
Technical Sciences	25880	26789	26789	25016	24075
Medical Sciences	11520	10707	10707	9754	9312
Agricultural Sciences	6546	6143	6143	5567	5183
Social Sciences	7918	13308	13308	11537	11832
Humanities	7335	8628	8628	8247	7822

Scientific research is carried out in academies of sciences, higher educational institutions, design bureaus, laboratories, etc., The public sector accounted for 37.3% of research, business - 32.3%, higher education organizations - 26%, non-profit organizations - 3% in 2018 (Fig. 2). Creating an integrated system of training and professional growth of academic personnel is the major task in the development of human resources in the field of research and development within the national initiative "Science". The number of people researching and developing decreased by 7.3% in Russia as a whole, by 9.7% in the Volga Federal District, and in the Republic of Mari El this indicator fell down by 1.4 times in 2010-2018 (Fig. 3). Training of academic personnel in higher education is carried out in graduate school and doctoral studies, as well

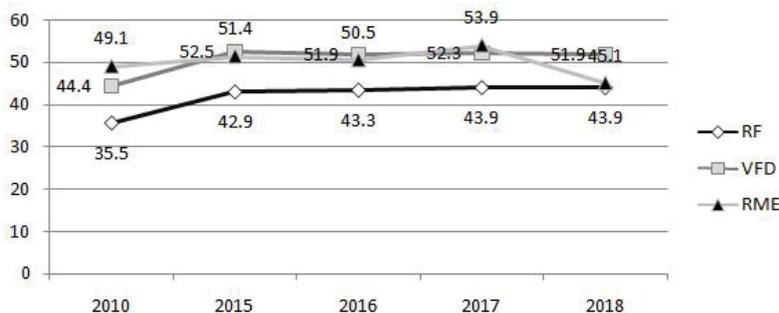


Figure 1: The share of researchers under the age of 39 years in the total number of researchers in the Russian Federation, VFD and RME, %

Source: Data from the Federal State Statistics Service [10]

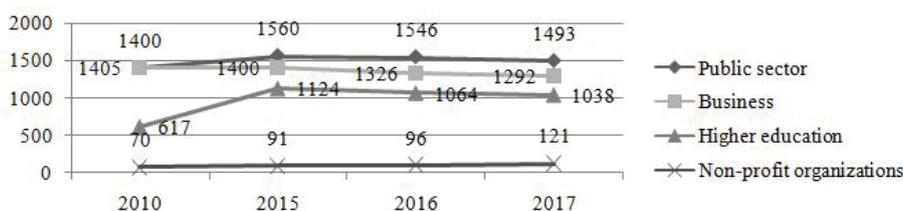


Figure 2: Dynamics of organizations performing research and development by sector of activity in the Russian Federation, units

Source: Data from the Federal State Statistics Service [10]

as in the form of allocating for writing a Candidate's dissertation without mastering the training program for scientific and pedagogical personnel in graduate school. Since 2010, the Russian Federation has seen a decrease in the total number of researchers with an academic degree of 4.5%, of which doctors of science by 5.6% and candidates of science by 4.1%. Whereas, the above indicators increased as a whole by 14.4% and 35%, incl. for doctors of sciences by 14.1% and 60%, for candidates by 14.5% and 31.4% respectively in the Volga Federal District and the Republic of Mari El (Table 5).

**RESULTS AND DISCUSSION**

Volga State University of Technology, which is the Volga Engineering and Technology Center, aims at developing a system of innovative continuing education, forming the mechanisms for the implementation of innovative competencies of graduates and young scientists, establishing a system of training, retraining and advanced training of specialists for high-tech sectors of the economy, small and medium-sized businesses [7, p. 254]. Nine people from among young scientists, graduate students and students became winners of the competition for the selection of innovative projects and teams in the business incubator in 2018. The business incubator held a number of training sessions for young scientists aiming at developing the skills of innovative entrepreneurship and small business establishment based on scientific developments.

The issues of training, placement and advanced training of academic and pedagogical personnel are one of the most important aspects of the activity of Volga State University of Technology. Various forms are used to develop the research and pedagogical potential of the university.

A number of activities held at the university allowed to achieve the necessary indicators of the qualitative composition of the faculty. The university's graduate school offered 13 educational programs for training of academic and pedagogical personnel of higher qualification in 2018. Graduate school has been operating at Volga tech since 1939, which offers programs for training of highly qualified academic personnel in natural, technical, agricultural and socio-economic sciences.

Moreover, the university has a doctoral program and is preparing candidates for the academic degree of a candidate of science except for postgraduate study in 6 scientific specialties. 34 doctors of sciences and 12 candidates of sciences supervised the research work of graduate students, doctoral students and applicants in 2018. The number of graduate students and doctoral students by years is given in table 6.

Table 6: The dynamics of the number of graduate students and doctoral students in Volga Tech [5]

No	Indicator	Years			
		2015	2016	2017	2018
1	Total number of postgraduate students including:	206	193	133	94
2	Full-time postgraduate students	92	81	76	72
3	Part-time postgraduate students	114	112	57	22
4	Not-publicly funded postgraduate students	113	116	75	48
5	Doctoral students	2	0	0	6

Table 5: Dynamics of the number of researchers with a degree, people

Year	Russian Federation		VFD		RME	
	Doctor of science	Candidate of science	Doctor of science	Candidate of science	Doctor of science	Candidate of science
2010	26789	78325	1713	6164	5	35
2015	28046	83487	2047	7220	7	49
2016	27430	80958	2015	7235	7	45
2017	26076	77251	1917	7193	5	50
2018	25288	75042	1956	7063	8	46

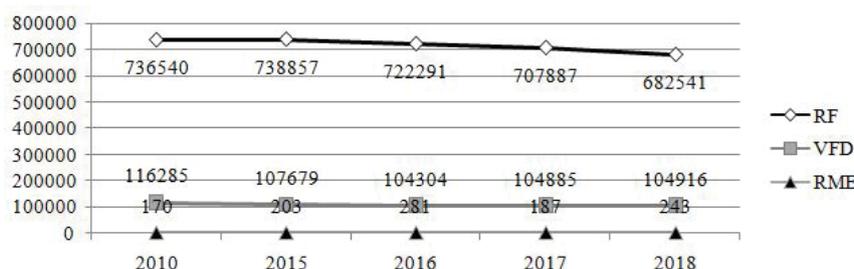


Figure 3: The dynamics of the number of academic personnel in research and development in the Russian Federation, VFD and RME, people

Source: Data from the Federal State Statistics Service [10]

In order to ensure the possibility of timely defense of candidate and doctoral dissertations, the university has 4 dissertation councils, 2 of them are on the basis of Volga tech and 2 are joint dissertation councils operating on the basis of Kazan National Research Technical University named after A.N. Tupolev, Mari State University and Vyatka State University [5, p.14]. Graduates of postgraduate and doctoral studies at Volga tech successfully defend candidate and doctoral dissertations in dissertation councils operating on the basis of Russian universities and research organizations and get the degree of candidate of sciences, or doctor of sciences [5, p.14].

The university publication activity is consistently organized, which is a necessary element in the quality training of academic personnel. 2291 articles were published in scientific journals and proceedings, including 333 articles in journals from the list of Higher Attestation Commission, indexed in the Russian Science Citation Index in 2018. 43 papers were published in the journals indexed in the Web of Science Core Collection database and 104 publications in the Scopus citation index. The Hirsch index (h-index) according to Scopus (5-7) and Russian Science Citation Index (18-24) of such scientists as D.V. Ivanov, V.A. Ivanov, N.V. Ryabova, I.I. Popov, Y.A. Furman, O.A. Mironova, V.G. Navodnov, and others is quite high.

The best graduate students are awarded with the title "University Hope", and nominated for scholarships of the President of the Russian Federation, the Government of the Russian Federation, the Head of the Republic of Mari El, or receive the Prize of the Board of Trustees of Volga tech. 10 young scientists received personal scholarships in 2018. Graduate students take an active part in grant competitions for research within the federal program "U.M.N.I.K." and others.

## CONCLUSION

Tertiary school is an active subject of functioning of academic personnel. Academic personnel increase the country's competitiveness, are the source of formation of new theories, methods, technologies, devices, installations, mechanisms, gadgets, etc. The study showed that the training of academic personnel in higher educational institutions is affected by many factors: the territorial location of universities; trends in the socio-economic development of the country; world globalization processes and research courses of tertiary schools. The success of the training can be traced in the publication activity of academic personnel, participation in inventive and patent-licensing activities, etc. According to the authors, further development and improvement of the training of academic personnel in higher educational institutions is feasible under four conditions: material support for academic personnel; involvement of the youth in research activity; improvement of the quality and quantity of publications in domestic and international peer-reviewed research journals and use of the experience of world rating universities.

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