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GLOBAL PRACTICES OF STUDENTS' RESEARCH

Abstract. *The aim* of the study is to consider the problem of students' research both worldwide and in Russia.

Methods. The methods involve review and analysis of the foreign and Russian scientific literature on studied subjects; surveys on the management and realisation of student's scientific activity in different countries; comparative analysis of the data received during surveys.

Results and scientific novelty. At the first stage literature concerning the question of doing research in different countries is analyzed. Then the problems existing in the sphere of students' research worldwide are identified. Among them are students' motivation, supervisors' motivation, developing friendly scientific environment at various levels, communication in science. Then, two surveys were held to support the theoretical issues. The first concerned general aspects of students' research internationally such as when they start doing it, how they are motivated, what are the relations with supervisors etc. The second included questions about general age of getting scientific degrees (bachelor, master, and PhD), and was divided into two parts: for international and Russian staff. Procedures and results of the surveys undertaken for revealing of scientists' opinion on quality and features of the specified kind of students' activity in different countries across the world are described. It is shown, that some problems are common for Russia and global scientific society.

Practical significance. On the basis of world experience, some solutions on development of scientific activity of the Russian students have been proposed by the author.

Keywords: knowledge economy, globalization, higher education, research, sustainable development strategy.

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МЕЖДУНАРОДНЫЙ ОПЫТ НАУЧНОЙ ДЕЯТЕЛЬНОСТИ СТУДЕНТОВ

Аннотация. *Цели* статьи – осветить различные аспекты и вскрыть проблемы научной деятельности студентов в России и за рубежом.

Методы. Обзор и анализ зарубежной и отечественной научной литературы по изучаемой тематике; опросы, касающиеся организации и осуществления студенческой научной деятельности в разных странах; сравнительный анализ данных, полученных в ходе опросов.

Результаты и научная новизна исследования. Рассмотрены глобальные процессы, наблюдающиеся в современном профессиональном образовании. В теоретическом плане изучены вопросы, связанные с научно-исследовательской работой учащихся высших учебных заведений: мотивация студентов и их научных руководителей, создание соответствующей научной среды, налаживание научных коммуникаций. Описаны процедуры и результаты опросов, предпринятых для выявления мнения ученых о качестве и особенностях указанного вида деятельности студентов в разных странах мира. У респондентов среди прочего, в частности, выяснялось, когда учащиеся начинают исследования, какие мотивы движут ими, как складываются отношения с научным руководителем, чем отличаются научные изыскания претендентов на степень бакалавра, магистра, доктора. Сопоставление итогов теоретического и практического анализа показало, что некоторые проблемы являются общими и для России, и для мирового сообщества.

Практическая значимость. Автором на основе имеющегося мирового опыта выдвинуты конкретные предложения по развитию научной деятельности российских студентов.

Ключевые слова: экономика знаний, глобализация, высшее образование, научные исследования, стратегия устойчивого развития.

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Introduction. Students' research is one of the main aspects of higher education today. It is estimated that only four per cent of graduates in Russia become future researches. Nevertheless, doing research is a great way to improve various skills, from research to communicative ones. We cannot but agree with Wieman who states that modern economics and global problems facing the world today require more technically and scientifically-literate people who have «complex problem solving skills» [15]. He suggests teaching students science as they are scientists and, what is the most relevant for the present research, to disseminate their results in scholarly manner.

Global processes in higher education. Global context of modern education is usually characterized in terms of globalization, knowledge society (knowledge economy) and technological revolutions.

The term *knowledge economy* was proposed by F. Fritz Machlup in 1962 [14] and then popularized by Peter Drucker as the title of Chapter 12 in his book «The Age of Discontinuity» [8]. Firstly, it was used to define economic sector, while now it refers to the highest level of innovative economy. Main factors of its development are knowledge and human resources. It is obvious, that knowledge economy includes not only technologies but also the mechanism of «knowledge production»: universities, pure and applied science, communication, patent system, research and innovation. So, the shift to knowledge economy presupposes educational (including scientific education) system change.

Globalization. Being originally economic, today the term «globalization» means the process of not only the world's economic and political, but also cultural integration and unification. This is an objective, system process that covers all aspects of society [2, P. 9–12]. Among conditions of globalization experts in the field of economics name the development of modern communication systems, providing the infrastructure for rapid transition of knowledge, and relatively low cost of air travel which makes possible the existence of the whole united world community [4]. At the same time the central driving force of globalization is higher education. The system of higher education and science, in its turn, undergoes some changes, too.

Globalization in education provides equal rights to all countries for the use of educational services. In accordance with the World Trade Organization (WTO) recommendations, education relates to the service sector. Therefore, the educational market competition grows increasingly fierce. In studies devoted to the impact of globalization on higher education system and its transformation [1; 3, P. 37–38; 4, 9], the following main tendencies of this process are formulated:

1. Easy access to higher education.

2. Diversification of forms, levels and content.

3. Internationalization (globalization of education).

4. Increasing usage of ICT.

These tendencies are also reflected in the research processes: scientists are working in extended research groups, form networking and, as a result, create E-Science. The process of scientific communication also changes greatly: paper-only system of knowledge storage and transfer gives way to electronic facilities. Though, the need of peer review and face-to-face formal and informal communication grows and becomes more relevant [6, 7; 11, P. 1281–1282].

Problems of students' research abroad. Although about 10–15 years ago foreign education and foreign science were seen in terms of their differences from the Russian system, today, during Russia's engagement into the world educational environment and the development of a new paradigm of higher education, particularly relevant is the use of advanced educational achievements of science and practice abroad. In foreign studies devoted to the development of the world higher education system, the issues of its objectivity, quality and relevance, sources of financing and internationalization are observed in details [10, P. 12].Characterizing research abroad, the authors use such key concepts as research system, research environment, innovation, STEM (Science, Technology, Engineering and Mathematics). Higher education is directly connected with research and innovation processes. The interconnection of the above fields is usually described in the concept of HERI [10, P. 7; 166].

Research in Europe and the United States is performed both at universities and enterprises. At the same time, universities occupy a small share of this sector [10, P. 65]. Also parts of some research are performed jointly by enterprises and universities. Nevertheless, the role of universities in the implementation of the high-level research increases, aided by funding from the state and the private sector. It can be argued that the entire university science abroad is associated with the development of national and world economy by performing research in or cooperation with industry and business. Hence the main trends in the development of science abroad are:

1) consistent and adequate funding for research;

2) research universities development;

3) openness and accessibility of the supportive research environment.

Three main functions are performed by doctoral researchers and trainees within the collaboration between universities and industry. Firstly, producing knowledge within the scientific creativity and innovation development systems and technologies; secondly, spreading of knowledge to the wider so-

cial environment; and, thirdly, creating and developing the partnership network between universities and business.

Among the challenges and risks facing students' research abroad could be mentioned:

1) financial: increase in the cost of research; difficulties in obtaining grants, even though there is increase in funding; threat of science underfunding by private sector;

2) professional: the problem of combining scientific work and teaching activities.

3) intercultural: nowadays science produces knowledge that is the basis of social development. Therefore, unequal access to education is a very dangerous global problem which leads to a so-called «Research gap» – a gap that expresses the difference between those who produce knowledge and those who need it but cannot access it [10, P. 11; 43, 49].

Therefore, the main directions of the modern higher education system development are ensuring equal access to everybody and investing in high-level research. They will provide the conversion of scientific knowledge into innovation and will serve as a driving force in the development of society. In addition, those who are engaged in research, constantly improve and update their knowledge and improve their competitiveness, regardless of specialty areas.

Students' research in Russia. The base of the modern student research system in Russia is the number of organizational forms developed during the XX century. They are well-known and still widely used thanks to their efficiency. Among them we can name the following: students' scientific groups and societies, research seminars, scientific laboratories and students' research conferences. But today, facing globalization processes, the whole system of higher education is experiencing some changes, such as easy access to knowledge, internationalization, and increasing usage of ICT.

These tendencies are also reflected in the research processes: scientists are working in extended research groups, form networking and, as a result, create E-Science. The process of scientific communication also changes greatly: paper-only system of knowledge storage and transfer gives way to electronic facilities. Though, the need of peer review and face-to-face formal and informal communication grows and becomes more relevant.

That is why a technical university graduate is expected to have both professional and basic competencies, i.e. communicative (social), psychological, IT and some others. We strongly believe that students' research has influence on key personal skills and abilities, helps to find a solution in any difficult situation, forms creativity and self-confidence. Of course, in combination with professional activities, it also influences person's professional skills.

Main difficulties in the sphere of student research that Russian technical universities face nowadays are:

1) low level of students' motivation in research:

• having no interest in research, mostly because of their young age (for Bachelors), because of combining education with work (for Masters), or even because of time gap (for Masters who graduated from the university long ago before being enrolled to Master courses);

• having no financial support for research.

2) low level of teachers' motivation because of lack of time and small financial support for supervising students engaged in research.

3) low level of communicative skills including foreign language competence.

4) low level of social competence.

Survey results. Students' research abroad. To find out current trends in students' research, two surveys were held internationally. The first concerned general aspects of students' research internationally such as when they start doing it, how they are motivated, what are the relations with supervisors etc. The second included questions about average age of getting scientific degrees (bachelor, master, and PhD), and was divided into two parts: for international and Russian staff.

According to the surveys and interviews with foreign colleagues from several European universities (Austria, Belgium, Brazil, Finland, India, Japan, Germany, Poland, Spain), students are engaged in research either through a practical course or during preparation of the thesis. Temporary position of assistant professor or participation in sponsored project as well as scholarship (approximately €1,500 per month for a 30-hour week) is offered to them. Scientific research usually begins at the level of Master training while at the undergraduate level practical tasks and exercises dominate. Nevertheless, undergraduates can also do research.

Motivation depends largely on the professor's ability to make students interested in his subject or on his participation in research projects. For engineering specialties, a big role is played by the possibility of using well equipped laboratories. Besides, a mark for the students' research paper affects the annual of final score; also, if the study is performed under a contract with a specific company, the student has a chance to get a position in this company after graduation. At some universities, contests for the best master's thesis with the main prize of about € 500 are held. One of the problems in this area is funding, which can only be obtained by performing projects, while in the pure sciences it is much more difficult than in applied ones.

In the U. S. research is considered to be the foundation of the educational process. The minimum requirement is the need for research methods in the educational process. There are two forms of doing research in the United States.

1. Students are involved in sponsored research projects on a competitive basis. For example, the University of California at Berkeley, the student may receive up to 4 credits for participation in such projects. Specifically to attract students in such projects some special programs are developed [5, p. 2–3].

2. If the initiator of research is the student himself, he has the right to perform an independent research project and use the results in the thesis. For this type of work a student may get a grant or credits. Some students work on their own research projects without any extra pay.

There are a number of studies dealing with matters of student motivation, including the motivation of research [13]. It is mentioned, that doing their research students develop universal and professional competence, motivation, cultural values, critical and creative thinking skills. Some papers [13] present the results of psychological research devoted to identifying links between students' research and their future professional activities. The study showed that:

1. Students are generally satisfied with the results of their study.

2. Students, who are interested in scientific activities as the beginning of their future profession, are attracted by a variety of internship programs. After performing the research, students were convinced of the correctness of their career choice.

3. These results are the same for different social and ethnic groups of students.

In some works [5, 6, 11] it is emphasized that, despite the great support of science by the state in the developed countries, in the field of research students also face a number of unresolved problems:

1) difficulty in finding out the number of students engaged in scientific activities;

2) the problem of student motivation;

3) the negative influence of engaging students, especially freshers, into research on completing their curriculum;

4) the problem of creating supportive scientific environment;

5) the issue of research culture;

6) the problem of scientific supervisory.

The second survey included questions on the age of people getting their scientific degrees. Twenty-six researchers and teachers from Russia and seventeen from other countries (Austria, Germany, Poland, Canada, Finland,

Azerbaijan, Kazakhstan, India, USA) were interviewed, among them 64 / 52% represent humanities, 36 / 23% technical sciences, and 0 / 23% others (Law, Education, Administration, Business, Psychology) correspondingly. As for the age of engaging into research, 12% of Russian interviewees chose school age (6% in other countries), 24% – beginning of the university education (23%), 24% (47%) – senior university courses, and 40% (23% correspondingly) answered that they started their research after graduation. So, we can see the difference between Russia and other countries, though the difference can be explained by the fact that in Russia until recently post-graduate courses were considered as a separate, research level, while in Europe and America it is a part of higher education in general.

The average age of obtaining Master's degree is 26 years in Russia and 33 in the other countries (taking into account that most Russian researchers do not have it because of another degree system). The age of obtaining Russian candidate's degree is 32 years old, the average age of getting PhD in the world is 41. From all the Russian interviewees, only 3 answered the question about their doctor's degree: one answer from Russia is 52 years old and two answers followed as «I am going to do it in future». As we can see, world's PhD is usually obtained at the age which is in the very middle between Russian's candidate and doctor.

The results of the interviews as to the basic question in the survey are given in Table.

So, the results show some differences in opinion about the age of starting research. At the same time, most indices are nearly the same, and the differences can be explained by the different scientific degrees systems worldwide.

Opinion about the necessity of the early engagement of students into research

Is it necessary to start research activities as soon as possible?		
Respondent feedback	Russia	Other countries
Yes, it is necessary	57,7%	47,6%
Yes, but only for some students	26,9%	35,3%
May be	15,4%	5,9%
No, it is not necessary	0%	11,8%

Ways of solving the existing problems. We suppose that the development of supportive scientific environment and the optimization of methods and technologies of students' engagement into scientific activities will increase the efficiency of students' research. This optimization should be connected with all the levels of scientific environment in a technical university.

These levels are: institutional (research management), information and technological (methodical), didactic (technologies of engaging students into research and supervising the research itself).

1. **Institutional level** includes objectives, forms, and supporting programmes for young researches. *Objectives*: The university corporate culture should be oriented on engaging students into research beginning with their first years of education. Of course, not many of them might be interested, but the more motivated they will be, the more positive results such orientation could bring in the future. Student research should be seen and developed as a system, and realized as a complex process with its quality criteria and improvement opportunities.

Forms: New forms of student research are students' business incubators, or techno-parks, students' participation in the university projects financed by the state and the private sector, young researchers' schools, student research councils. All of them can now take form of distance learning.

Supportive programmes: Such programmes should define who can have financial support from the university and on what conditions. In the Siberian Automobile and Highway Academy (Omsk), as well as in some other technical universities, the programme called «Student-researcher» includes all the documents and indicators connected with young researchers and is aimed to motivate and support such students.

There should also be created supportive programmes for scientific supervisors. Their aim should be to improve teachers' psychological competence, to provide them with such information as types and dynamic of students' motivation, psychological characteristics of different generations, and so on. Financial support of teachers interested in working with young researches should be an obligatory part of this programme.

2. **Information and technological (methodical) level.** Information support includes free Internet access, free library recourses access (both to paper and electronic documents), informing students about scientific conferences, seminars, competitions. It is a main tool of scientific communication, both formal and informal, both distance and face-to face. Technological support may have a form of «how-to-do-research», «how-to-write-a-scientific-article» and materials like these, database; or students' Research centre (laboratory) with functions of providing students with methodical support on any stage of their research.

3. **Didactic level.** Here, the main principles of teaching students to do research may include:

● implementing the person-oriented approach in the form of individual learning trajectories;

• creating and implementing a course programme «Student research in a technical university» for the needs of young researchers' schools (centres) or for an optional course as a part of student education programme;

• paying special attention to the subjects which form communicative skills (humanities);

• making strong interrelations with industrial enterprises with the aim to give a student opportunity to implement his research results;

• engaging students in various kinds of international cooperation, which will let them enter international scientific environment and improve both communicative and social skills.

So, variety of students' research organizational forms is a sign of the student research system modernization. We found out that there are little Student Research Councils in Russian technical universities. At the same time their specialization determines creation of business-incubators (technoparks) and Student-Researcher programmes. On condition that traditional and innovative forms of student research management, and criteria of students' research activity are combined in a system of University Student Research and are connected with the University Research as a whole, and implemented in the educational process, we could speak about the final stage of student research institutionalization and predict its high results.

As it is stated in the report «Knowledge, Networks and Nations: Global scientific collaboration in the 21st century» [12, p. 6–9], «the primary driver of most collaboration is the scientists themselves». Among the authors' recommendations are the following:

1. Support for international science should be maintained and strengthened.

2. Internationally collaborative science should be encouraged, supported and facilitated.

3. National and international strategies for science are required to address global challenges.

Conclusion. Research has globalized, so the system of engaging students into research should include best world practices. The analysis of articles devoted to students' research abroad, as well as the surveys held can draw the following conclusions concerning developing students' research in Russia:

1) effectiveness of internships and training courses, which includes research elements;

2) importance of engaging students in scientific activities through participation in projects carried out by universities;

3) significance of the supervisor's personality in motivating students;

4) flexibility of reward system: the possibility of financial support or obtaining extra credits for scientific research.

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