Organization of Research Activities as a Factor in Increasing the Efficiency of Training International Students in Host Russian Universities

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Abstract: This article summarizes the practices of organizing research activities that can improve the training of international students in Russian universities. The authors analyzed and identified the correlation between the internal costs of research and development (R&D), the equipment in university research laboratories, and the number of foreigners studying at Russian universities. The authors used the methods of analysis and synthesis and a systematic approach to explore the experience of Russian universities in the training of international students. To identify the impact of internal R&D costs and the equipment of university research laboratories on the number of foreigners studying in Russian universities, the authors applied correlation and regression analysis, which included building a regression equation, calculating the correlation coefficient, the t-test, the coefficient of elasticity, and the coefficient of determination. This research paper revealed a strong correlation between the number of international students in the Russian Federation on the internal R&D costs and the cost of fixed assets and the equipment of Russian universities, which was proven by the calculated correlation coefficients, elasticity coefficients, and determination coefficients. The authors concluded that universities could influence the number of international students. This article proposes some methods for organizing the research activities of international students that increase their academic mobility and form the most relevant scientific and professional competencies. Higher educational institutions of any major can implement these recommendations for managing the research activities of international students. The novelty of this study lies in the fact that the authors performed the correlation and regression analysis and revealed the dependence of the number of international students in the Russian Federation on internal R&D costs, the cost of fixed assets, and the equipment of Russian universities. The authors illustrated the analysis results with the trend predictive values of factorial features and the value of the effective feature estimated according to the regression equations built. Using the calculated MAPE and Forecast Accuracy indicators for these predicted values, the authors concluded that the level of factorial features and the effective feature were predicted with high accuracy. Thus, host Russian universities can increase the number of international students through effective organization of research activities.

Keywords: Research activities, international students training, the global market for educational services, international education.

INTRODUCTION

Currently, the Russian Federation is expanding scientific and educational relations with different countries, and the interest in Russian higher education is growing. Russian universities annually enroll hundreds of foreigners to study at various departments. International students who come to Russia not only find themselves in unfamiliar sociocultural circumstances but also have to face numerous challenges associated with learning in a foreign language. Therefore, an efficient organization of research activities can improve the instruction of international students in host universities (Abramova, Ageeva, Shapoval, Lysenko,

and Samofalova, 2018; Vasiljeva, Ponkratov, Volkova, Khairova, Nikitina, Dudnik, Alimova, Kuznetsov, and Elyakova, 2020). Identifying the forms, methods, and techniques of research work that enable international students to obtain high-quality higher education and additional R&D competencies remains an urgent task for researchers and educators.

The goal of this article was to summarize the practices of organizing research activities that can improve the education of international students in Russian universities. Additionally, the authors analyzed the correlation between internal R&D costs, the equipment of university research laboratories, and the number of foreigners studying at Russian universities.

Research is a crucial component of training modern highly qualified specialists in economics, management,

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and other sciences. To involve international students in this activity, a university should group them according to their scientific interests and establish student science clubs that allow the learners to become more independent when making a decision, setting a goal, and reaching it.

We fully agree with Máiquez, Fontes, and Martínez (2017) that student science clubs increase the cognitive activity of students, which, in turn, contributes to their self-education, development, and professional training. Practice shows that student science clubs encourage the professional, intellectual, and social creativity of international students and provide conditions for their self-education (Roga, Lapiņa, and Müürsepp, 2015). To evaluate the efficiency of a science club, one can apply the following indicators: participation in student scientific and practical conferences; the number of publications of the club members; the number of research papers written by the club members; participation in competitions, exhibitions, and Olympiads; and the number of diplomas, certificates, and other awards received by the club members for the external scientific activities.

When developing criteria for evaluating student research papers, we paid special attention to the novelty and practical significance of the work and to the students' ability to participate in a scientific discussion on their research topic.

The main task for university teachers and administration is to create necessary conditions for talented students so that they can reveal and develop their creative potential. This, in turn, will help young people to use their free time rationally. The active involvement of international students in research helps them to become more competitive professionals in the future. To preserve its intellectual potential, the country should identify, encourage, and support talented students (Orlova, Sakhabieva, Vasyaycheva, and Pronina, 2016).

LITERATURE REVIEW

Many researchers have explored the methods for increasing the efficiency of international students' research in host universities. For example, the papers (Macionis, Walters, and Kwok, 2019; Pekerti, Moelle, Okimoto, and Van De Vijver, 2020; Rahmawati, Suwandi, Saddhono, and Setiawan, 2019) studied the perception and interaction of international students with the culture of the host country and the specifics of

education in it. The researchers revealed that the more active they participate in various scientific and practical educational events, the better their acculturation, attitudes, and learning outcomes are.

The works (Abbas, 2019; Ng, Wang, and Chan, 2017) focused on the challenges that educators face when they implement the cognitive and communicative approach to develop international students' skills in writing research and qualification papers, reports, and scientific articles, as well as the skills of speaking at scientific and practical conferences.

Some international scientists (Farrell, 2020; Chen, 2007; Mazzarol and Soutar, 2002; Rodionova, 2017) considered the factors underlying the choice of a host country by international students.

When choosing a Russian educational institution, international students pay the most attention to the availability of Russian language courses for foreigners (Rodionova, 2017). The overwhelming majority of Russian universities provide these courses at preparatory departments or faculties (McMahon, 1999).

The critical factor in increasing the efficiency of international students' education is the availability of appropriate training and research activities adapted for this category of learners (Pekerti *et al*., 2020). At the same time, according to the results of the study (Setiadi and Piyakun, 2017), the most significant factors that directly and indirectly affect the preferences of an international applicant when choosing a host country and a university are the research work at the educational institution and its results, as well as the practical focus of educational programs

Most educational programs of Russian universities have a particular "Practice and R&D Work" section, which contains a description of various stages of planning, organizing, and monitoring the R&D work of undergraduate and graduate students (Le and Gardner, 2010). Having analyzed the activities of Russian universities, we found out that international students' involvement in the learning process is the key factor defining their research work in higher educational institutions (Rodionova, 2017).

Research activities of international students can be classified as follows:

1.　Research work as part of the educational process (essays, abstracts, reports, creative homework assignments, coursework, laboratory

classes, graduation thesis, and other projects with the research elements implied by the curriculum) (Karatas, Alci, Bademcioglu, and Ergin, 2016).

2. Extracurricular research work:

– Work within the framework of a grant (internal or external), and contractual R&D activities of departments and faculties (Tarasova, 2017);

– Participation in conferences, symposia, and research paper competitions (Bondarenko, Zaugarov, Seleznev, and Yudina, 2018);

– Membership in student science clubs (Gural and Shulgina, 2015)

Apart from developing the relevant competencies and creating motivation for active engagement in research throughout the entire period of study, international students should master professional terminology and methods of scientific cognition. When international students use general concepts in their speech, they can work with the sources of information in the Russian language faster and more efficiently, as well as participate in the work of student science clubs and intra-university conferences (Kazakova and Shastina, 2019)

In general, Russian educators and psychologists have studied in sufficient detail the organizational and methodological forms of organizing research activities of Russian and international students. For instance, some researchers (Kazakova and Shastina, 2019; Tarasova, 2017) examined the main ways of engaging students in the classroom and extracurricular work. Other educators (Barieva, 2017; Vershinina, Kurbanov, and Panich, 2016) considered methodological approaches to modeling student research activities.

For instance, bachelor programs should include research and educational seminars at which international students can develop their skills in organizing and conducting research according to the following model:

1. Classifying and determining the main stages of the research (Kolster, 2000);

2. Determining the goal and objectives of the study;

3. Building the theoretical, methodological, and empirical base of the research;

4. Writing the summary of the research done with the justification of the conclusions drawn;

5. Stating the theoretical and practical significance of the results obtained;

6. Using a range of information technologies in scientific research (Tarasova, 2017).

Scientific and educational seminars are part of the research work, and for international students, they have the same objectives as for Russian-speaking students:

- Developing the skills required for conducting research, also in collaboration with others, with statistical observations, surveys, and questionnaires (Sarıçoban, 2014);

- Developing the ability to evaluate, generalize, and interpret the results obtained, to substantiate conclusions, and to build models of the studied processes, phenomena, and objects within one's professional field (Motos, 2016);

- Developing the skills required to present the research results in the form of an independent scientific project, a term paper, a graduate thesis, an article, or a report (Kazakova and Shastina, 2019);

Research topics are chosen according to the field of the graduating department, the scientific interests of the workshop leader, and the interests and capabilities of learners. As practice shows, the primary condition for the successful completion of the assignment is students' interest and involvement in the problems of the work done (Barieva, 2017).

An important area of research for international students is their participation in joint scientific projects in the most relevant areas of fundamental science, which includes studying the experience of global teams working on similar topics (Bondarenko, Tanina, Yudina, and Kharitonova, 2019).

The significance of international students' research is also confirmed by the fact that the state system for monitoring the effectiveness of universities includes indicators for assessing international activities: the number of international scientific and pedagogical staff; the funds received by an educational organization from R&D work from foreigners and foreign legal entities; and the share of international students. For instance,

the total number of international graduate students, house staff, residents, assistant trainees at flagship universities was 465 people as of the end of 2017. The share of the foreigners among the total number of the teaching staff in five flagship universities ranged from 3 to 1% (Belgorod State University – 3.35%, Altai State University – 3.02%, Siberian State Medical University – 1.84%; Novosibirsk State Technical University – 1.31%; and Pskov State University – 1.01%). In other universities, this indicator was below 1%, and in nine universities, there were no international teachers. As we can see, this indicator is significantly lower than in the leading Russian universities, for example, National Research Nuclear University, where it exceeds 13%.

Another important aspect is the students' readiness for research activities. Many students do not have the full picture of research work or lack the skills required for it. The study (Vershinina *et al*., 2016) established that 70% of students are poorly prepared for conducting research, and 30% have an average level. The high level of students' readiness implies an interest in the subject and research work and understanding its significance (Hamdan, Sarea, Khamis, and Anasweh, 2020). The average level means a superficial understanding of research work. Students with a low level have a poor understanding of research work, and they cannot identify the problem, highlight contradictions, or independently build the logic of the research (Bondarenko, Gokhberg, and Kovaleva, 2019). Consequently, the main task for the researchers and educators at any university is to find methods for stimulating students' extracurricular research activities to develop and maintain their interest in it.

METHODOLOGY

Since the organization of research activities of international students in a host university directly depends on the equipment and quality of its fixed assets, measuring and control tools and devices, laboratory equipment, as well as internal R&D costs, we performed the correlation and regression analysis of the impact of these factors on the number of foreigners studying in Russian universities, which involved calculating a correlation coefficient, a regression equation, the t-test, elasticity coefficient, and a determination coefficient.

Our methodology for studying the influence of the cost of fixed assets, measuring and control tools and devices, laboratory equipment, as well as internal R&D costs in the Russian Federation on the number of

foreigners studying in Russian universities included the following stages:

1. Calculating the values of the indicators of the cost of fixed assets, measuring and control tools and devices, laboratory equipment, as well as internal R&D costs based on statistical data (a factorial feature);

2. Estimating the number of foreigners studying in Russian universities under statistical data (an effective feature);

3. Performing the correlation and regression analysis by calculating the correlation coefficient, the regression equation, the t-test, the coefficient of elasticity, and the coefficient of determination;

4. Building trend lines and estimating the predicted level of indicators of the cost of fixed assets, measuring and control tools and devices, laboratory equipment, as well as internal R&D costs in the Russian Federation (a factorial feature);

5. Substituting the calculated predicted values of the indicators of the cost of fixed assets, measuring and control tools and devices, laboratory equipment, as well as internal R&D costs in the Russian Federation into a regression equation and obtaining the predicted values of the number of foreigners studying in Russian universities (an effective feature);

6. Checking the accuracy of the forecasts made using the MAPE and Forecast Accuracy criteria and confirming the reliability of the forecasts and calculations done.

The effective feature in the correlation and regression analysis is the correlation coefficient (*r*). To calculate this coefficient, we estimated several intermediate values using the formulas given below (Gromyko, 2015).

$$\sigma_x = \sqrt{\overline{x^2} - (\overline{x^2})} , \tag{1}$$

$$\sigma_y = \sqrt{\overline{y^2} - (\overline{y^2})} , \tag{2}$$

$$r = \frac{\overline{xy} - \overline{x}\,\overline{y}}{\sigma_x \sigma_y} , \tag{3}$$

$$a_1 = \frac{n\sum xy - \sum x * \sum y}{n\sum x^2 - \left(\sum x\right)^2} , \tag{4}$$

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$$a_0 = \overline{y} - a_1\overline{x} \, , \qquad (5)$$

$$\overline{y_x} = a_0 + a_1 x \, , \qquad (6)$$

$$t_{calculated} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \, , \qquad (7)$$

where:

y – individual values of the effective feature;

x – individual values of the factorial feature;

n – the number of observations.

The linear regression is reduced to finding an equation of the form $\overline{y_x} = a_0 + a_1 x$, where x is an individual value of the factorial feature; a_0, a_1 are the parameters of the straight-line equation (regression equation), and $\overline{y_x}$ is the theoretical value of the effective factor.

This equation presents the average value of the change in the effective feature x per one unit of its measurement. The parameter sign indicates the direction of this change. In practice, the construction of linear regression is reduced to the estimation of its parameters a_0, a_1.

Within the classical approach, the parameters of the equation a_0 and a_1 are found by the least-squares method (formulas 4 and 5), which allows one to obtain estimates of the parameters with the minimal sum of the squares of the deviations of the actual values of the effective feature y from the calculated, theoretical ($\overline{y_x}$).

At the same time, $t_{calculated}$ (the t-test) should exceed $t_{table} = 2.1604$ (Gromyko, 2015). Only then, the calculated correlation coefficient r will be significant.

The examined characteristics are often measured in different units. Therefore, to assess the influence of the factorial feature on the effective one, one should use the elasticity coefficient. It is calculated for each point and as an average for the entire population by the formula:

$$E = Y'_x \frac{X_i}{Y_x} \qquad (8)$$

where y'_x is the first derivative of the regression equation.

The average coefficient of elasticity was determined for the straight-line equation by the formula:

$$\overline{E} = a_1 \frac{\overline{x}}{\overline{y}} \qquad (9)$$

The coefficient of elasticity shows what percentage the effective feature changes when the factorial feature changes by 1%.

An alternative indicator of the dependence between two variables is the linear coefficient of determination, which is the square of the linear correlation coefficient (r^2). Its numerical value must range from 0 to 1. It characterizes the ratio of variation (dispersion) of the dependent variable. The value of the determination coefficient directly indicates the impact of the independent factor on the effective feature.

We applied statistical apparatus to assess the selected method of correlation and regression analysis and the predicted values of the indicators of the cost of fixed assets, measuring and control tools and devices, laboratory equipment of Russian universities, as well as internal R&D costs in the Russian Federation estimated on its basis. For example, the MAPE indicator (mean absolute percentage error) was calculated for each factorial feature (the indicator of the cost of fixed assets, measuring and control tools and devices, laboratory equipment of Russian universities, as well as internal R&D costs in the Russian Federation) and for the effective feature (the number of foreigners studying at Russian universities). We calculated the MAPE indicator using the formula:

$$MAPE = \frac{1}{N} \sum_{t=1}^{N} \frac{\left| Z(t) - \hat{Z}(t) \right|}{Z(t)} \, , \qquad (10)$$

where $Z(t)$ is the actual value of the time series;

$\hat{Z}(t)$ is the predicted value of the time series;

N is the number of periods.

In this case, the value of the calculated MAPE indicator should tend to 0 (MAPE→0).

The accuracy of the forecast was estimated using the Forecast Accuracy indicator, which was calculated with the formula:

Forecast Accuracy = (1- *MAPE*)×100%   (11)

In this case, the value of the calculated Forecast Accuracy indicator should tend to 100% (Forecast Accuracy→100%).

RESULTS/FINDINGS

Responding to the active internationalization of education, Russia has created organizational and methodological prerequisites and accumulated considerable experience and expertise for promoting international cooperation.

According to the Higher School of Economics (Bondarenko, Gokhberg, *et al*., 2019), there were 278,000 international students enrolled in college and university programs in Russia as of January 01, 2019, or 4.1% of the total number of students (Table **1**).

Foreigners (and Russians living abroad) can enroll under a government quota in more than 450 state universities in Russia. Since 2003, Russia has provided 15,000 places to foreigners for studying at universities, including master programs and preparatory courses. For example, China annually increases the number of government quotas for international students by 3,000 places. The total number of foreigners studying in Chinese universities, academies, and institutes has reached almost half a million. Russian missions worldwide also report a stable growth in the number of applications. For instance, in 2019, this figure ranged between 100-150,000, whereas at the end of February 2020, there were about 100,000 applications.

Table **1** demonstrates that the US, UK, Canadian, and French universities enroll most international students. An effective long-term national educational policy is what mostly attracts students to these countries.

The study (Bondarenko, Gokhberg, *et al*., 2019) analyzed the indicators describing the state and trends in the education of foreigners. The researchers group the data by the type of a higher educational institution (classical universities, teacher training universities, and branch universities with various majors).

In this study, we used the materials of a statistical survey of 818 Russian universities, 693 of which enrolled 229,320 full-time international students from 176 countries. As secondary data, we used the results of a survey conducted by the International Department and the Center for Sociological Research of the Ministry of Education and Science of Russia (from November 2017 to January 2018).

In the 2016-2017 academic year, the total number of foreigners studying at Russian universities increased by 28,600 people, or by 14.2% compared to the 2015-2016 academic year. This growth was mainly due to students from Asian countries (primarily Kazakhstan, China, Turkmenistan, Tajikistan, Uzbekistan, and India). In the 2016-2017 academic year, most international full-time students were (as in the previous year) from Kazakhstan (39,700 people), China ranked the second (26,800 people), and Turkmenistan was the third (17,300 people).

The share of foreigners whose training was covered by the Russian budget was steadily increasing since the early 2000s (22.8% in the 2003-2004 academic year, 29.5% in 2009-2010, and 40.0% in 2015-2016), but later decreased slightly (to 39.1% in 2016-2017).

The number of full-time international students mainly increased in the universities of the Ministry of Education and Science of Russia (by 13,700 people) and universities with other departmental affiliation (primarily the Ministry of Health, by 14,600 people)

Table 1:   The Number of International Students at Colleges and Universities (Bondarenko, Gokhberg, *et al*., 2019)

Country	International students		Number of students from Russia, thousand people
	Thousand people	**The percentage of the total**	
Russia	278.0	4.1	-
UK	432.0	18.1	4.0
Germany	244.6	8.0	9.7
Italy	92.7	5.1	2.2
Canada	189.5	11.9	1.7
The Republic of Korea	61.9	1.9	0.4
USA	971.4	5.0	5.2
France	245.3	9.9	3.6
Sweden	28.0	6.6	0.4
Japan	143.5	3.7	0.4

Source: Compiled by the authors.

located in three federal districts: Central (by 9,500 people), Privolzhsky (by 6,400 people), and Siberian (by 4,300 people). The increase in the number of international students, trainees, graduate students, students of preparatory departments, and other categories of students was mainly registered in universities located in republican and regional centers (in total by 17,000 people), as well as universities in two megacities – Moscow and St. Petersburg (in total by 10,500 people).

One of the objectives of this study was to identify a set of indicators describing the availability of material resources at Russian universities, including measuring and control tools and devices, laboratory equipment, and internal R&D costs, which determine the attractiveness of Russian universities to international students and affect their number.

To identify the influence of these indicators of the cost of fixed assets, measuring and control tools and devices, laboratory equipment, as well as internal R&D costs on the number of foreigners studying in Russian universities, we performed a correlation and regression analysis.

Table **2** presents the results of the correlation and regression analysis that revealed the dependence of the number of international students in the Russian Federation on the volume of internal R&D costs.

The obtained correlation coefficient *r* is significant only if t_{calc} (the t-test) exceeds t_{tab} = 2.1604 (Gromyko, 2015).

Using the formulas (1 – 7), let us estimate intermediate values: $\sigma_x = 67.37$, $\sigma_y = 35101.62$, $r = 0.98$, $a_1 = 218$, $a_0 = -2080$, $\overline{y_x} = -2080 + 218x$, $t_{calc} = 16.15 > t_{tab}$; therefore, the calculated correlation coefficient *r* is significant, as is the relationship between variables *x* and *y*. Table **3** presents the interpretation of the values of the correlation coefficient.

Following the data in Table **2**, the estimated value of the correlation coefficient $r = 0.98$ corresponds to a strong direct correlation between the number of international students in the Russian Federation, and the size of internal R&D costs. The result obtained allows us to conclude that the size of internal R&D costs directly affects the number of international students in Russian universities.

Next, we performed a correlation and regression analysis of the dependence of the number of international students in the Russian Federation on the cost of universities' fixed assets (Table **4**).

Using the formulas (1 – 7), let us calculate intermediate values: $\sigma_x = 77.37$, $\sigma_y = 35101.62$, $r = 0.99$, $a_1 = 173$, $a_0 = -2064$, $\overline{y_x} = -2064 + 173x$, $t_{calc} = 23.15 > t_{tab}$; therefore, the calculated correlation coefficient *r* is significant, and so is the relationship of variables *x* and *y*.

To interpret the value of the calculated correlation coefficient, let us consider the data presented in Table **3**. As we can see, the estimated value $r = 0.99$ denotes a strong direct correlation between the number of international students in the Russian Federation and the value of fixed assets of Russian universities.

Table 2: The Correlation and Regression Analysis of the Dependence of the Number of International Students in the Russian Federation on the Volume of Internal R&D Costs (Federal State Statistics Service, n.d.)

No	Year	Internal R&D costs in the Russian Federation, billion rubles x	The number of foreigners studying at Russian universities, people y	x^2	xy	y^2	$\overline{y_x}$
1	2014	847.50	156 211	718256.3	132388822.5	24401876521.0	182740.8
2	2015	914.70	183 065	836676.1	167449555.5	33512794225.0	197395.6
3	2016	943.80	200 750	890758.4	189467850.0	40300562500.0	203741.6
4	2017	1 019.20	229 320	1038768.6	233722944.0	52587662400.0	220184.7
5	2018	1 028.20	256 864	1057195.2	264107564.8	65979114496.0	222147.4
6	Total	4753.4	1026210.0	4541654.7	987136736.8	216782010142.0	1034529.2
7	Mean	950.7	205242.0	908330.9	197427347.4	43356402028.4	205242.0
8	Mean square	903792.5	42124278564.0	825065082028.0	38977557485606100.0	1879777596848250000000.0	197094602.7

Source: Compiled by the authors.

Table 3:   Interpretation of the Values of the Correlation Coefficient (Gromyko, 2015)

No	The value of the correlation coefficient r	Interpretation describing the strength of the relationship
1	$0 < r \leq 0.2$	Very weak direct correlation
2	$0.2 < r \leq 0.5$	Weak direct correlation
3	$0.5 < r \leq 0.7$	Medium direct correlation
4	$0.7 < r \leq 0.9$	Strong direct correlation
5	$-0.2 \leq r < 0$	Very weak inverse correlation
6	$-0.5 \leq r < -0.2$	Weak inverse correlation
7	$-0.7 \leq r < -0.5$	Medium inverse correlation
8	$-0.9 \leq r < -0.7$	Strong inverse correlation

Source: Compiled by the authors.

Table 4:   Correlation and Regression Analysis of the Dependence of the Number of International Students in the Russian Federation on the Cost of Universities' Fixed Assets (Ministry of Science and Higher Education of the Russian Federation, n.d.)

No	Year	Fixed assets of universities at gross book value, billion rubles x	The number of foreigners studying at Russian universities, people y	x^2	xy	y^2	$\overline{y_x}$
1	2014	1 080.40	156 211	1167264.6	168770393.7	24401876521.0	185064.3
2	2015	1 144.15	183 065	1309081.1	209453973.2	33512794225.0	196106.0
3	2016	1 207.90	200 750	1459026.0	242486223.8	40300562500.0	207147.8
4	2017	1 254.41	229 320	1573551.4	287661932.3	52587662400.0	215203.7
5	2018	1 297.63	256 864	1683831.7	333313253.6	65979114496.0	222688.2
6	Total	5984.5	1026210.0	7192754.8	1241685776.5	216782010142.0	1034464.5
7	Mean	1196.9	205242.0	1438551.0	248337155.3	43356402028.4	205242.0
8	Mean square	1432565.1	42124278564.0	2069428847682.0	61671342703568100.0	1879777596848250000000.0	248121651.4

Source: Compiled by the authors.

Table **5** presents the results of the correlation and regression analysis revealing the dependence of the number of international students in the Russian Federation on the cost of measuring and control tools and devices and laboratory equipment of universities.

Using the formulas (1 – 7), let us calculate intermediate values: $\sigma_x = 14.65$, $\sigma_y = 35101.62$, $r = 0.99$, $a_1 = 1584$, $a_0 = -1991$, $\overline{y_x} = -1991 + 1584x$, $t_{calc} = 36.1 > t_{tab}$; therefore, the calculated correlation coefficient *r* is significant.

To interpret the value of the calculated correlation coefficient, let us refer to Table **3**. The estimated value $r = 0.99$ denotes a strong direct correlation between

the number of international students in the Russian Federation and the cost of measuring and control tools, devices, and laboratory equipment of Russian universities.

Table **6** presents the results of the performed correlation and regression analysis that illustrate how the internal R&D costs and the cost of fixed assets and equipment affect the number of international students in the Russian Federation.

The results of the analysis performed to prove that the indicators of internal R&D costs and the cost of fixed assets and equipment at Russian universities have a direct impact on the number of international students in the Russian Federation.

Table 5: Correlation and Regression Analysis of the Dependence of the Number of International Students in the Russian Federation on the Cost of Measuring and Control Tools, Devices, and Laboratory Equipment of Universities

No	Year	The cost of measuring and control tools, devices, and laboratory equipment of universities, billion rubles x	The number of foreigners studying at Russian universities, people y	x^2	xy	y^2	$\overline{y_x}$
1	2014	111.04	156 211	12330.2	17345901.6	24401876521.0	173923.5
2	2015	120.25	183 065	14459.9	22013420.2	33512794225.0	4945.6
3	2016	129.46	200 750	16759.1	25988476.3	40300562500.0	5325.8
4	2017	140.86	229 320	19842.0	32302361.6	52587662400.0	5796.6
5	2018	152.44	256 864	23239.0	39157193.6	65979114496.0	6274.7
6	Total	654.1	1026210.0	86630.1	136807353.4	216782010142.0	26982.6
7	Mean	130.8	205242.0	17326.0	27361470.7	43356402028.4	5381.6
8	Mean square	17111.4	42124278564.0	300190957.3	748650077781585.0	1879777596848250000000.0	706390.6

Source: Compiled by the authors.

Table 6: Summary Results of the Correlation and Regression analysis Illustrating the Influence of the Internal R&D Costs, the Cost of Fixed Assets and Equipment on the Number of International Students in the Russian Federation

No	X – influence factors	The number of foreigners studying at Russian universities, people (Y – dependent factor)			
		Correlation coefficient r	Type of the relationship	The significance of r according to the t-test	Regression equation Y=A0+A1X
1.	Internal R&D costs in the Russian Federation, billion rubles	0.98	Strong direct (0.7 < r <= 0.9)	Significant tcalc(16.15)> ttab (2.1604)	$\overline{y_x} = -2080 + 218x$
2.	Fixed assets of universities at gross book value, billion rubles	0.99	Strong direct (0.7 < r <= 0.9)	Significant tcalc (23.15)> ttab (2.1604)	$\overline{y_x} = -2064 + 173x$
3.	The cost of measuring and control tools, devices, and laboratory equipment of universities, billion rubles	0.99	Strong direct (0.7 < r <= 0.9)	Significant tcalc (36.1)> ttab (2.1604)	$\overline{y_x} = -1991 + 1584x$

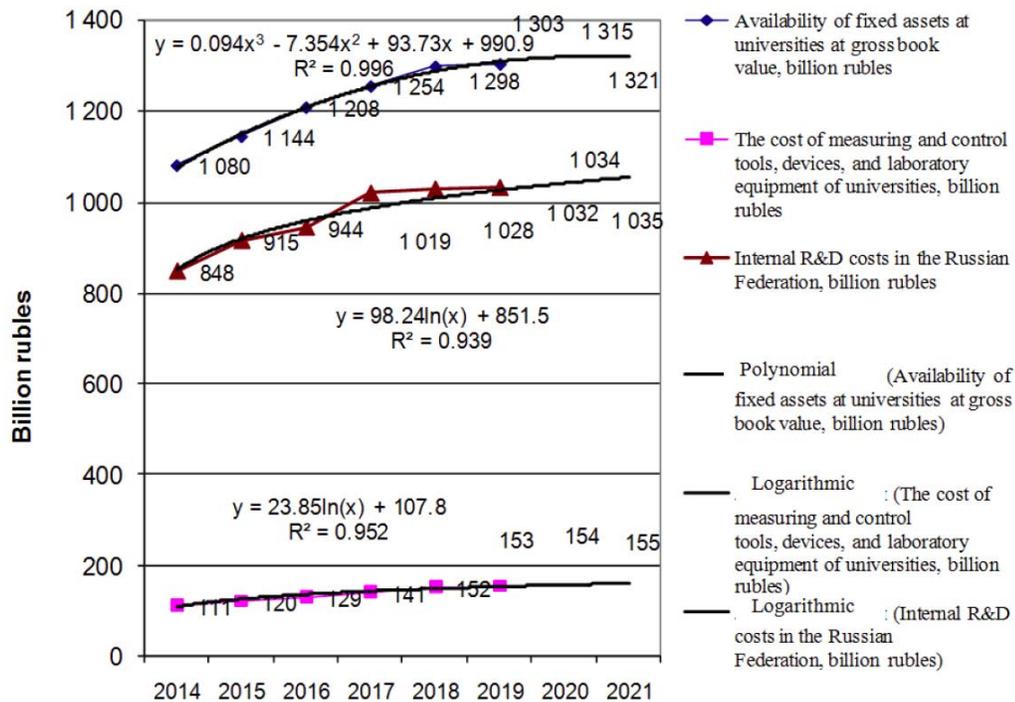**Source:** Compiled by the authors.

Therefore, effective policy on determining the R&D costs and the replenishment and renewal of fixed assets and equipment at Russian universities will help attract more international students. This will have a positive impact on the socio-economic situation in Russian higher education.

Figure **1** presents a graphical interpretation of the obtained regression equations reflecting the dependence of the number of international students in the Russian Federation on internal R&D costs and the cost of fixed assets and equipment at Russian universities.

As we can see, the revealed strong correlation of the number of international students in the Russian Federation on internal R&D costs and the cost of fixed assets and equipment at Russian universities, based on the calculated correlation coefficients (r), elasticity coefficients ($\overline{E}$), and determination coefficients (r^2), proves that universities can influence the number of international students. Let us illustrate this assumption with the help of trend predictive values of factor indicators (internal R&D costs and the cost of fixed assets and equipment of Russian universities) and the calculated value of the effective feature (the number of international students in the Russian Federation) based on the obtained regression equations.
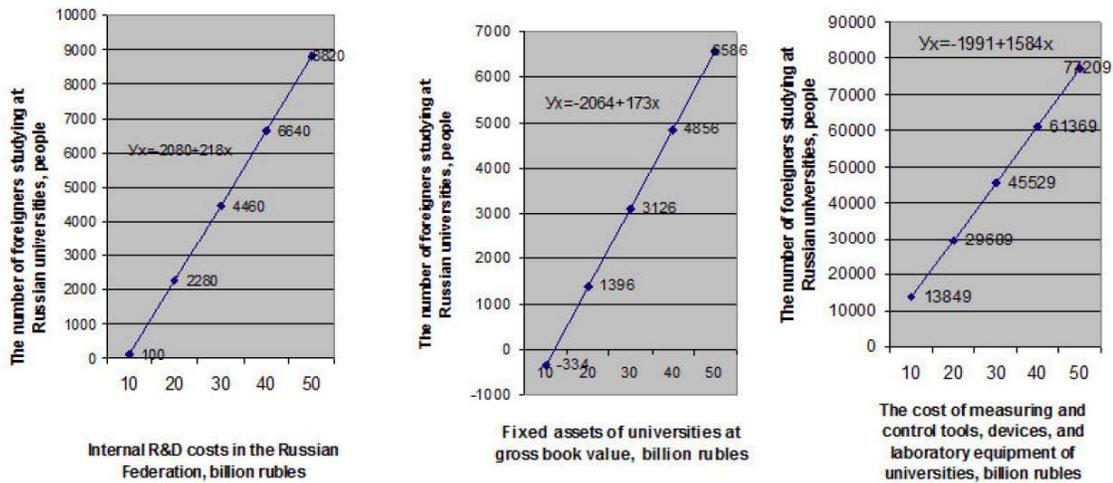
Figure 1: Graphical interpretation of the obtained regression equations reflecting the dependence of the number of foreign students in the Russian Federation on the internal costs of research and development and the cost of fixed assets and equipment of Russian universities (compiled by the authors).

Figure 2: Trend lines and the predicted values of influence factors (internal R&D costs and the cost of fixed assets and equipment of Russian universities in the Russian Federation) (compiled by the authors).

Figure **2** presents the trend lines and projected values of indicators of internal R&D costs and the cost of fixed assets and equipment of Russian universities.

Using these predicted values, let us calculate the indicator "The number of foreigners studying in Russian universities" for three years based on the regression equations obtained (Table **7**).

The data in Table **7** demonstrate that the predicted values of factorial features (internal R&D costs and the cost of fixed assets and equipment of Russian universities) have a positive trend in the next three periods. The indicators of the effective feature (the number of foreigners studying at Russian universities), obtained using the regression equation, also have a positive trend in the next three periods.

DISCUSSION/ANALYSIS

To assess the reliability of the forecasts, let us calculate the MAPE and Forecast Accuracy indicators

Table 7: Calculation of the Predicted Values of the Effective Feature (the Number of Foreigners Studying in Russian universities) Based on the Obtained Predicted Values of Factorial Features and Regression Equations

Indicators of research activities of universities	Predicted values of the indicators of influence factors			Regression equations	Predicted values of the number of foreigners studying in Russian universities, obtained with the regression equation		
	2018	**2019**	**2020**		**2018**	**2019**	**2020**
Fixed assets of universities at gross book value, billion rubles	1302.84	1315.05	1321.26	$\overline{y_x} = -2064 + 173x$	223 327	257 440	258 515
The cost of measuring and control tools, devices, and laboratory equipment of universities, billion rubles	152.80	153.80	154.90	$\overline{y_x} = -1991 + 1584x$	254 044	255 628	257 371
Internal R&D costs in the Russian Federation, billion rubles	1031.50	1033.80	1035.20	$\overline{y_x} = -2080 + 218x$	256 787	257 288	257 594

Source: Compiled by the authors.

Table 8: The Calculated MAPE and Forecast Accuracy Indicators for the Factorial Features and the Effective Feature (the Number of Foreigners Studying in Russian Universities, People)

Indicator	2014	2015	2016	2017	2018	(MAPE→0)	Forecast Accuracy →100%
The actual value of the time series (fixed assets of universities at gross book value). The predicted value for 2021 is 1,321.26 billion rubles	1080.4	1144.2	1207.9	1254.4	1297.6		
$\|Z(t) - \hat{Z}(t)\|$	240.86	177.11	113.36	66.85	23.64		
$\dfrac{\|Z(t) - \hat{Z}(t)\|}{Z(t)}$	0.22	0.15	0.09	0.05	0.02	0.109	89.1%
The actual value of the time series (the cost of measuring and control tools, devices, and laboratory equipment of universities). The predicted value for 2021 is 154.9 billion rubles	111.0	120.2	129.5	140.9	152.4		
$\|Z(t) - \hat{Z}(t)\|$	43.86	34.65	25.44	14.04	2.46		
$\dfrac{\|Z(t) - \hat{Z}(t)\|}{Z(t)}$	0.39	0.29	0.20	0.10	0.02	0.199	80.1%
The actual value of the time series (internal R&D costs in the Russian Federation). The predicted value for 2021 is 1,035.20 billion rubles	847.5	914.7	943.8	1019.2	1028.3		
$\|Z(t) - \hat{Z}(t)\|$	187.7	120.5	91.4	16	6.9		
$\dfrac{\|Z(t) - \hat{Z}(t)\|}{Z(t)}$	0.22	0.13	0.10	0.02	0.01	0.094	90.6%

(Table 8). Continued.

Indicator	2014	2015	2016	2017	2018	(MAPE→0)	Forecast Accuracy →100%
The actual value of the time series (the number of foreigners studying at Russian universities, people). The predicted value for 2021 estimated based on the indicator "Fixed assets of universities at gross book value, billion rubles" is 258,515 people	156211	183065	200750	229320	256864		
$|Z(t) - \hat{Z}(t)|$	102303.57	75449.57	57764.57	29194.57	1650.57		
$\dfrac{|Z(t) - \hat{Z}(t)|}{Z(t)}$	0.65	0.41	0.29	0.13	0.01	0.298	70.2%
The actual value of the time series (the number of foreigners studying at Russian universities, people). The predicted value for 2021 estimated based on the indicator "The cost of measuring and control tools, devices, and laboratory equipment of universities" is 257,371 people	156211	183065	200750	229320	256864		
$|Z(t) - \hat{Z}(t)|$	101159.60	74305.60	56620.60	28050.60	506.60		
$\dfrac{|Z(t) - \hat{Z}(t)|}{Z(t)}$	0.65	0.41	0.28	0.12	0.00	0.292	70.8%
The actual value of the time series (the number of foreigners studying at Russian universities, people). The predicted value for 2021 estimated based on the staff engaged in research and development, is 257,594 people	156211	183065	200750	229320	256864		
$|Z(t) - \hat{Z}(t)|$	101382.60	74528.60	56843.60	28273.60	729.60		
$\dfrac{|Z(t) - \hat{Z}(t)|}{Z(t)}$	0.65	0.41	0.28	0.12	0.00	0.293	70.7%

Source: Compiled by the authors.

(Table **8**). To evaluate the accuracy of the predicted values of the indicators, we used the data for 2021, and the indicator $\frac{1}{N} = \frac{1}{5} = 0.2$, since we evaluated five periods of the time series.

Therefore, according to the calculated MAPE and Forecast Accuracy indicators for the predicted values obtained, we can conclude that the level of factorial features (internal R&D costs and the cost of fixed assets and equipment at Russian universities) and the effective feature were forecasted with a high degree of accuracy: for all factorial features, MAPE ≤ 0.2, and Forecast Accuracy ≥ 80%; for the effective indicator (the number of foreigners studying in Russian universities), MAPE ≤ 0.3, and Forecast Accuracy ≥

70%. The obtained MAPE and Forecast Accuracy values confirm the reliability of the proposed method for assessing the impact of internal R&D costs and the cost of fixed assets and equipment on the number of foreigners studying at Russian universities.

To stimulate students' research activities, universities should increase the practical significance of student work, provide them with an opportunity to publish research results in scientific journals and collections, establish regular contacts with students and professors at universities abroad, identify students with the best research abilities, and provide moral and material incentives for students. Research activities of international students also reflect the external effectiveness of educational organizations.

CONCLUSION

From our perspective, grants are an essential factor in increasing the competitive advantage. Most countries with which Russia competes for talented students use a mechanism of grant support: in addition to a free place at university, they provide a monthly payment, which covers students' accommodation. For instance, in China, the monthly state scholarship is equivalent to 20,000 rubles. The master's scholarship offered by German agency DAAD is 750 euros per month plus partial travel reimbursement and medical insurance.

The above statistical data indicates that the number of international students in Russian universities is growing, both in Moscow and Russian regions. In this research paper, we analyzed the motivation of foreign applicants who chose to study at a Russian university.

Considering all of the above, we can conclude that when organizing the research work of international students, universities should carefully plan not only its formal elements (types, stages, and assessment forms) but also the topic of student projects. It can vary, but at the same time, its content must meet the following characteristics: reflect vivid cultural specifics, be diverse and complex, have a practical focus, allow students to set scientific tasks of gradually increasing complexity, and contribute to the development of students' creative potential and professionally significant communication skills.

In the process of organizing students' research work, the university should group the students according to their scientific interests and create scientific clubs within these interests.

LIMITATION AND STUDY FORWARD

This study was carried out based on an analysis of the experience of organizing research work of foreign students from various universities. In the future, it is planned to conduct a study in this area, taking into account the profile of the educational activities of universities to identify industry characteristics and trends. Also, in the future, it is planned to conduct a correlation-regression analysis of the dependence of the number of foreign students in the Russian Federation on other indicators, such as the level of tuition fees, the inclusion of universities in international rankings, which will reveal the factors of competitiveness of Russian higher education in the international arena.

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