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Perspectives of using the integration mechanisms of education's development for accelerating Russia's economic growth

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The article aims at selecting the most perspective mechanisms and finding the perspectives of using the integration mechanisms of education development for accelerating Russia's economic growth. The methods of correlation and regression analysis are used. It is proved – by the example of top universities in Russia in 2020 – that the development of higher education and maximization of its contribution to the acceleration of economic growth could be achieved based on the integration mechanisms with the participation of universities. It is determined that optimization should be applied to educational (quality of higher education), scientific (R&D), and international (globalization) activities of universities, which could reach its maximum in case of an increase in the number of incubators in each university up to 5units, number of centers of shared use of scientific equipment up to 40units, and number of small companies up to 41. It is determined that citations and profitability (effectiveness) of universities do not depend on integration mechanisms in higher education. Such integration mechanisms as employer-sponsored education, practice bases, and technological parks do not contribute to the improvement of the indicators of universities' activities and thus their development is inexpedient. The practical significance of the authors' conclusions and recommendations is that they allow raising the effectiveness of university management and optimizing the organizational and managerial conditions under which the potential of universities in the sphere of support for the implementation of the social and investment model of economic growth is unlocked in the most comprehensive way.

KEYWORDS

educational environment, educational governance, inclusive innovation, higher education, integration of universities, Russia

1. Introduction

In the post-industrial economy, the markets of higher education services are a perspective vector of economic growth based on the popularization of life-long learning, supported by quick technological progress, and internationalization of the educational markets, which leads to an

increase in its capacity. In addition to this, the development of higher education allows accelerating other accessible vectors of the economy's growth through the increase in personnel qualification and development of leading technologies, supporting the growth of labor efficiency and production capacities.

In the conditions of economic recession amid the COVID-19 pandemic, the development of education for accelerating economic growth becomes especially important. This is necessary for developing countries, which strategic plans of rapid progress were disrupted by the crisis. On a global scale, the slowdown of economic growth of developing countries in which its rate is very high means not only the reduction of global GDP but also the unattainability of sustainable development in the aspect of reduction of countries' inequality and reduction of disproportions in the global economy.

Thus, the search and activation of the mechanisms of education's development for accelerating emerging economies' economic growth are expedient. A vivid example of such economies is Russia, which has been demonstrating a high level of education and a moderate level of economic growth in recent years, which makes its experience useful for most of the other emerging economies. Education does not turn into economic growth because of the gap between the market of higher education services and the labor market and between universities and business (Bolshakov and Walker, 2022; Frolova et al., 2022; Yakovleva, 2022; Bogoviz et al., 2023; Isakova, 2023).

Russia is peculiar for delayed upgrade of educational programs of universities, which is slower compared to quick market transformations and quick technological progress, which accelerated during the Fourth Industrial Revolution (Adonina and Kokodey, 2022; Vatlina and Evdokimov, 2022). In the course of the growth of the gap between universities and business, the contribution of higher education to economic growth is limited, which slows down the implementation of its social and investment model (Kulikova et al., 2021; Pirogova et al., 2021).

While the substantial contribution of higher education to economic growth is confirmed by many publications (Bořoroga et al., 2022; Gruševá and Blašková, 2022; Zhang and Liu, 2022; Almutairi, 2023; Fahim et al., 2023; Li and Wye, 2023), which, in particular, are based on the experience of modern Russia (Agasisti et al., 2021; Gruzina et al., 2022; Krupnov et al., 2023), there is still uncertainty as to cause-and-effect links between university organization and management and their results, which accelerate economic growth; they include educational activities (quality), scientific activities (quality and effectiveness), scientometrics (citations), profitability (effectiveness), and international activities (globalization).

This paper strived toward filling this literature gap, through the determination of the influence of universities' participation in various integration mechanisms on the mentioned activities of universities, which are significant for economic growth. The initial point of this research is the hypothesis that the development of higher education could be achieved based on integration mechanisms with the participation of universities. The goal of this paper is to select the most perspective mechanisms and find the perspectives of activation of integration mechanisms of education's development for accelerating Russia's economic growth.

The paper's originality lies in its determining a new, previously unknown condition for the maximization of universities' contribution to economic growth in Russia: universities' involvement in the processes of integration with business. Due to this, the paper allows

improving the organization and management of universities in Russia by including this condition in the programs of universities' development and as a criterion of assessment of the effectiveness of universities' activities.

2. Literature review

The theoretical framework of the conducted research is the concept of the development of higher education to support economic growth. According to this concept, universities perform a central role in the implementation of the social and investment model of economic growth. The essence of this modern model is that higher education and innovations facilitate the increase in economic growth rate.

The contribution of higher education to the acceleration of the rate of economic growth in view of the emerging economies' experience is analyzed in the works Anetor (2020), Karambakuwa et al. (2020), Liu (2020), and Tahir et al. (2020). An overview of the integration mechanisms of higher education's development and the international experience of using these mechanisms are given in Butt et al. (2020), Finnveden et al. (2020), Johler (2022), Letzel-Alt et al. (2022), Petousi et al. (2022), and Wallwey et al. (2022).

In the works by De los Ríos-Carmenado et al. (2021), Mok et al. (2022), Pan et al. (2022), and Veltri et al. (2022), the mechanism of the development of higher education to speed up the rate of economic growth is the independent development of universities through training of personnel and R&D. In the works by Li and Yin (2022), Paswan et al. (2022), Saleem et al. (2023), and Wijesundara and Prabodanie (2022), the prospective spheres of the development of higher education are the improvement of the indicators of scientometrics (citation) and growth of profitability (effectiveness) of universities.

In the works by Fernandes et al. (2023), Ismail et al. (2022), and Liu et al. (2022), the facultative bases of practice and technological parks are listed as the prospective integration mechanisms in higher education. It is possible to conclude that only certain aspects of the studied problem are considered in the existing works, which does not allow solving the problem. That's why the perspectives of activation of the integration mechanisms of education's development for accelerating economic growth require additional research – by the example of modern Russia – which is done in this paper.

In the concept of higher education development in support of economic growth, Al-Zoubi et al. (2023), Chaudhry (2023), and Huang et al. (2022) note the contribution of universities to economic growth through educational activities (quality), scientific activities (quality and effectiveness), scientometrics (citations), profitability (effectiveness) and international activities (globalization). Benson and Chau (2022), Borda-Rivera and Ortega-Paredes (2021), Damar et al. (2022), Marra et al. (2022), Ryazanova et al. (2021), Santos and Thune (2022), and Terán-Bustamante et al. (2021) state that results of universities' activities are largely determined by the degree of their connection with business. Based on this, we offer the following hypothesis: universities' involvement in the processes of integration with business determines the contribution of universities to economic growth.

3. Materials and methodology

This paper uses the econometric methodology to determine the degree of connection and character of the influence of alternative integration mechanisms on the results of universities' activities. To verify the offered hypothesis, we use correlation and regression analysis. The connection between the universities' characteristics and the integration mechanisms that are used in higher education in Russia is determined. A significant (more than 35%) positive correlation with at least certain mechanisms is proof of the hypothesis.

To obtain the results that would be of interest not only to Russia but also to other emerging economies we consider the top 10 universities according to [World University Rankings 2020 \(2020\)](#). The sample of this research includes the following universities: Lomonosov Moscow State University, Moscow Institute of Physics and Technology (MIPT), National Research University "Higher School of Economics," ITMO University, National Research Nuclear University MEPhI, Novosibirsk State University, Peter the Great St. Petersburg Polytechnic University, Tomsk State University, Kazan Federal University and National University of Science and Technology (MISIS). University's characteristics that reflect its potential contribution to the acceleration of Russia's economic growth are sub-indices of [World University Rankings 2020 \(2020\)](#):

- educational activities (quality, indicator "Teaching");
- scientific activities (quality and effectiveness, indicator "Research");
- scientometrics (indicator "Citations");
- profitability (effectiveness, indicator "Industry Income");
- international activities (globalization, indicator "International Outlook").

The indicators that reflect the involvement of the integration mechanisms of development in universities are the indicators from the [Ministry of Science and Higher Education of the Russian Federation \(2020\)](#):

- number of companies with contracts for specialists' training;
- number of companies that are practice bases, with contracts;
- number of business incubators;
- number of technological parks;
- number of centers of shared use of scientific equipment;
- number of small companies.

The factual research materials are presented in [Table 1](#).

This research consists of three consecutive stages. At the first stage, correlation analysis is used, based on the data from [Table 1](#), to determine the connection (correlation coefficients are calculated) between various integration mechanisms of education development (x_1-x_6) and results of universities' activities, which potentially increase the rate of economic growth in its social and investment model (y_1-y_5) in Russia. We choose indicators for which statistically significant and expedient for further consideration connection is revealed: correlation coefficients exceed 35%. The presence of such indicators (with close connection) is the confirmation of the proposed hypothesis – proof that integration with business facilitates the increase in results of universities that support economic growth in its social and investment model in Russia.

At the second stage of the research, to specify the results of correlation analysis, we use the method of regression analysis, based on the data from [Table 1](#), to compile models of multiple linear regression, which characterize the character of dependence of the selected resulting variables (y) on the selected (closely connected with them) factor variables (x). At the third stage of the research, based on the results of regression analysis, we use the simplex method to determine the perspectives (control values of the indicators) of activation of the integration mechanisms of education's development to accelerate (maximize) Russia's economic growth.

4. Results

To determine the contribution of various integration mechanisms of education's development to the acceleration of Russia's economic growth, let us use the results of the correlation analysis of data from [Table 1](#) and [Figure 1](#).

As shown in [Figure 1](#), a connection that is statistically significant and expedient for further consideration is observed with the following indicators:

- educational activities (y_1) – with business incubators (x_3 , correlation – 51.50%) and centers of shared use of scientific equipment (x_5 , the correlation – 52.72%);
- scientific activities (y_2) – with business incubators (x_3 , correlation – 51.17%) and centers of shared use of scientific equipment (x_5 , the correlation – 38.57%);
- international activities (y_5) – with centers of shared use of scientific equipment (x_5 , the correlation – 46.05%) and small companies (x_6 , the correlation – 41.06%).

To clarify the determined connections, which are characterized with the help of correlation coefficients, let us compile the equations of multiple linear regression. Regression dependence of educational activities (y_1) on business incubators (x_3) and centers of shared use (x_5):

$$y_1 = 24.55 + 13.80x_3 + 1.66x_5 \quad (1)$$

According to the regression Equation 1, the effectiveness of educational activities (y_1) grows by 13.80 points due to an increase in the number of business incubators (x_3) by 1 and grows by 1.66 points due to an increase in the number of centers of shared use (x_5) by 1. Multiple correlation is rather large for confirming the statistical significance of the regression equation – 66.40%. Regression dependence of scientific activities (y_2) on business incubators (x_3) and centers of shared use (x_5):

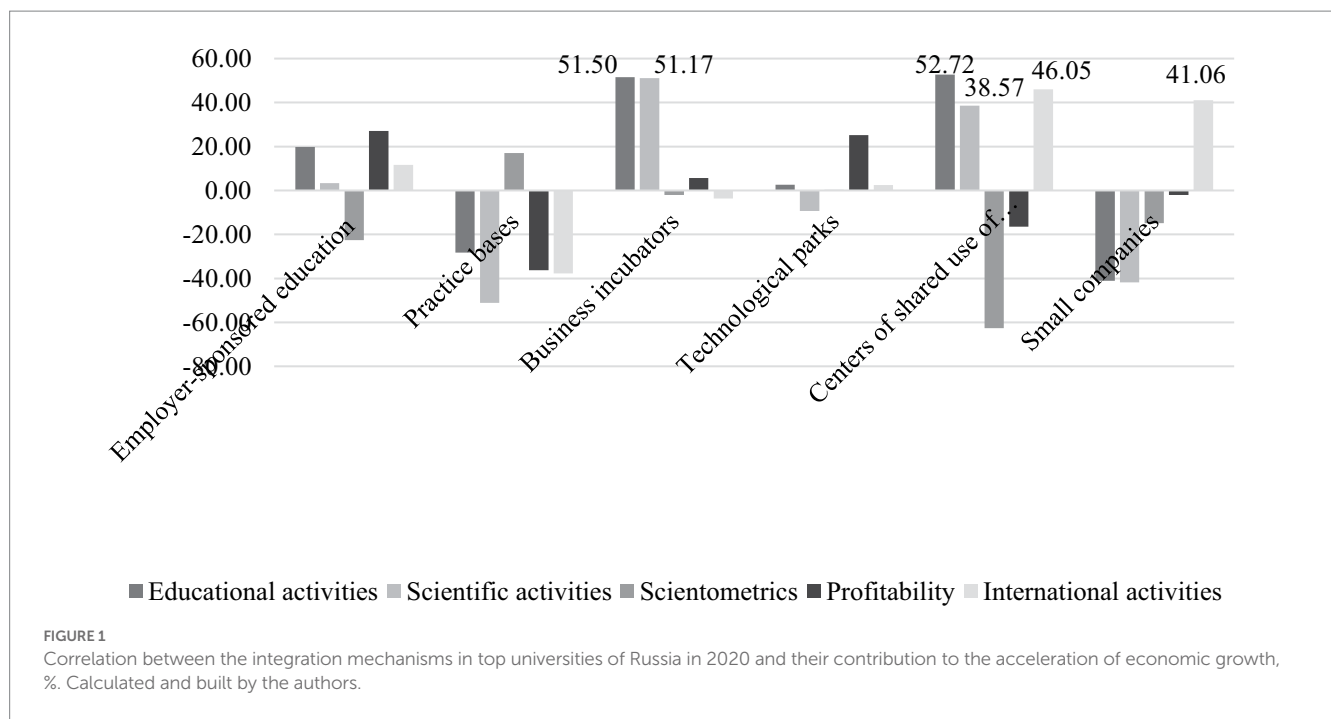
$$y_2 = 20.98 + 12.88x_3 + 0.94x_5 \quad (2)$$

As shown in the regression Equation 2, the effectiveness of scientific activities (y_2) grows by 12.88 points in case of an increase in the number of business incubators (x_3) by 1 and grows by 0.94 points in case of an increase in the number of centers of shared use (x_5) by 1. Multiple correlation is rather large to confirm the statistical

TABLE 1 Statistics of the integration mechanisms in top universities of Russia in 2020 and their potential contribution to the acceleration of economic growth.

University	Characteristics, points 1–100					Integration mechanisms					
	Educational activities (quality)	Scientific activities (quality and effectiveness)	Scientometrics (citations)	Profitability (effectiveness)	International activities (globalization)	Number of companies with contracts for specialists' training	Number of companies that are practice bases, with contracts	Number of business incubators	Number of technological parks	Number of centers of shared use of scientific equipment	Number of small companies
	y_1	y_2	y_3	y_4	y_5	x_1	x_2	x_3	x_4	x_5	x_6
Lomonosov Moscow State University	78.2	63	15.6	90.7	66.6	161	1,113	1	1	10	11
Moscow Institute of Physics and Technology (MIPT)	53.3	45.6	47.2	99.9	58.7	104	97	1	0	1	16
National Research University "Higher School of Economics"	35.9	37.3	78.1	56.5	42	1	93	1	0	0	6
ITMO University	30.6	28	49.8	84.6	62.1	30	685	0	1	1	49
National Research Nuclear University MEPhI	37.5	36.1	33.6	100	63.7	218	218	1	1	1	18
Novosibirsk State University	42.8	31.9	30.3	35.7	43.8	82	82	1	0	2	6
Peter the Great St. Petersburg Polytechnic University	26.2	15.9	61.8	71.2	52.6	219	2,586	1	1	2	16
Tomsk State University	41	33.7	23.4	53	71.6	88	343	1	0	12	42
Kazan Federal University	28.7	16.9	47.8	40	42.6	126	5,058	0	1	4	37
National University of Science and Technology (MISIS)	24.3	23.7	29.1	84.2	68.9	36	670	0	0	1	30

Compiled by the authors based on the Ministry of Science and Higher Education of the Russian Federation (2020) and World University Rankings 2020 (2020).



significance of the regression equation – 58.08%. Regression dependence of international activities (y_5) on centers of shared use (x_5) and small companies (x_6):

$$y_3 = 48.26 + 1.04x_5 + 0.23x_6 \tag{3}$$

According to the regression Equation 3, the effectiveness of scientific activities (y_5) grows by 1.04 points in case of an increase in the number of centers of shared use (x_5) by 1, and grows by 0.23 points in case of an increase in the number of small companies (x_6) by 1. Multiple correlation is rather large to confirm the statistical significance of the regression equation, constituting 55.64%.

Based on the identification regression dependencies, we use the simplex method to determine the target values of the indicators of activity of integration processes in higher education in Russia to reach a 100% (100 points for all indicators) contribution of universities to the acceleration of economic growth (Figure 2).

As shown in Figure 2, to maximize (bring up to 100%, and in case of certain indicators even exceed 100%) the effectiveness of educational (+307.56%), scientific (+277.363%), and international (+74.645) activities of universities in Russia, it is necessary to raise the number of incubators in each university up to 5, the number of centers of shared use of scientific equipment up to 40, and the number of small companies up to 41.

5. Discussion

This paper contributed to the literature through the development of scientific provisions of the concept of higher education development to support economic growth. The paper specified the organizational and managerial conditions under which the potential of universities in the sphere of support for the implementation of the social and

investment model of economic growth is unlocked in the most comprehensive way. The results obtained are compared with the existing literature in Table 2.

As shown in Table 2, unlike De los Ríos-Carmenado et al. (2021), Mok et al. (2022), Pan et al. (2022), and Veltri et al. (2022), this paper proved that the most prospective mechanism for higher education development to increase the rate of economic growth is not independent development of universities through training of personnel and R&D but universities' integration with business. This allows offering a new criterion of the optimality of organization and management of universities: their involvement in the processes of integration with business.

Unlike Li and Yin (2022), Paswan et al. (2022), Saleem et al. (2023), and Wijesundara and Prabodanie (2022), we proved that the most prospective spheres of higher education development are not the improvement of the indicators of scientometrics (citation) and growth of profitability (effectiveness) of universities but the development of educational (quality of higher education), scientific (R&D), and international (globalization) activity of universities.

Unlike Fernandes et al. (2023), Ismail et al. (2022), and Liu et al. (2022), we proved that the most promising integration mechanisms in higher education are not the facultative base of practice and technological parks but incubators in universities, centers of joint use of scientific equipment and small companies based on universities.

The theoretical significance of the research lies in its strengthening the evidence based on the assumption that the results of universities' activities are largely determined by the degree of their connection with business, in support of the works by Borda-Rivera and Ortega-Paredes (2021), Benson and Chau (2022), Damar et al. (2022), Marra et al. (2022), Ryazanova et al. (2021), Santos and Thune (2022), and Terán-Bustamante et al. (2021). The authors' conclusions and recommendations allow reducing in the short term and fully overcoming in the long-term the gap between the market of higher education services and the

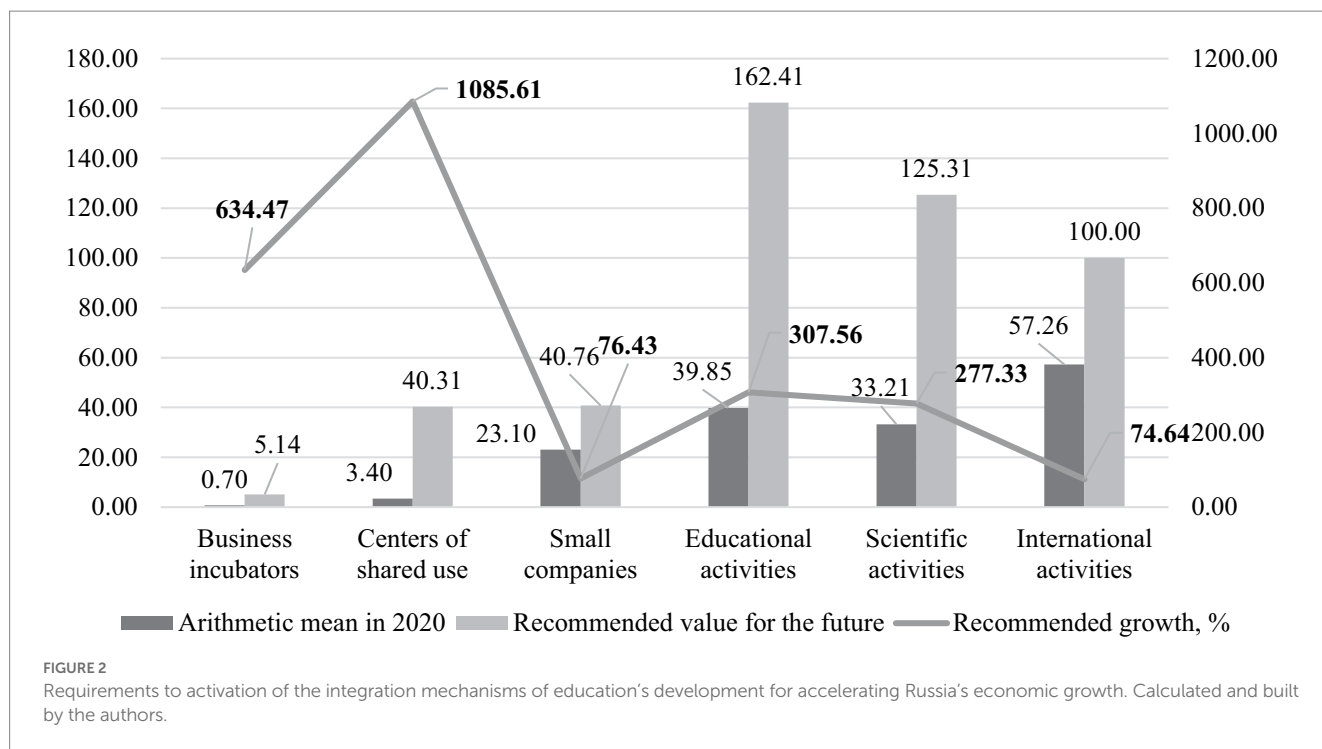


TABLE 2 Perspectives of using the integration mechanisms of education's development for accelerating Russia's economic growth: comparison of the results obtained with the existing literature.

Sphere of comparison	Existing literature		Results obtained in the paper
	Provisions	Sources	
Mechanism of higher education development to speed up the rate of economic growth	Independent development of universities through training of personnel and R&D	De los Ríos-Carmenado et al. (2021), Mok et al. (2022), Pan et al. (2022), and Veltri et al. (2022)	Integration of universities with business
Prospective spheres of higher education development	Improvement of the indicators of scientometrics (citation) and growth of profitability (effectiveness) of universities	Li and Yin (2022), Paswan et al. (2022), Saleem et al. (2023), and Wijesundara and Prabodanie (2022)	Development of educational (quality of higher education), scientific (R&D) and international (globalization) activity of universities
Prospective integration mechanisms in higher education	Facultative based of practice and technological parks	Ismail et al. (2022), Liu et al. (2022), and Fernandes et al. (2023)	Incubators in universities, centers of joint use of scientific equipment, small companies based on universities

Authors.

labor market in Russia. This can be achieved with the help of the integration of universities and business, which is recommended in this paper.

The advantages of this integration include a direct, clear and regular order of business for training of personnel in universities, for which practice-oriented educational programs will be developed. This will allow developing targeted training, creating guarantees of employment of university graduates and raising their opportunities in the development of human potential and career building. In its turn, business will receive promising young personnel from university graduates with the relevant set of competencies, who are ready to start performing their professional duties at once.

Integration of universities and business will also ensure the advantage that is connected with the order from business for the development of innovations by business. It is also possible to conduct joint R&D, by universities and business, and increased engineering support for implementing innovations from universities. This will accelerate the commercialisation of university innovations and will ensure the most complete and effective satisfaction of business needs for innovations.

Thus, closer cooperation of universities and business, which was substantiated in this paper, based on the recommended integration mechanisms will increase the contribution of universities to the implementation of the social and investment model of economic growth, since it guarantees the training and graduation of personnel who are in demand and competitive in the labor market, as well as universities' creating innovations that are required by business and are quickly commercialized. As a result, the educational and research results of universities will be most applied and will ensure a quick and maximum contribution to economic growth.

6. Conclusion

As a result of the performed research, the goal was achieved: we identified the most promising mechanisms – incubators in a university, centers for joint use of scientific equipment, small companies based on universities – and prospects for accelerating the integration mechanisms of education development to accelerate Russia's economic growth.

Thus, the hypothesis has been proved. It has been shown – by the example of top universities in Russia in 2020 – that the development of higher education and maximization of its contribution to the acceleration of economic growth could be achieved based on the integration mechanisms with the participation of universities. It has been determined that optimization should be applied to educational (quality of higher education), scientific (R&D), and international (globalization) activities of universities, which could reach their maximum in case of an increase in the number of incubators in each university by 634.47%, number of centers of shared use of scientific equipment by 1,085.61%, and number of small companies by 76.43%.

It has also been found that scientometrics (citations) and profitability (effectiveness) of universities do not depend on the integration mechanisms in higher education. Such integration mechanisms as employer-sponsored education practice bases and technological parks do not contribute to the improvement of the indicators of universities' activities and thus their development is inexpedient.

The theoretical significance of the results obtained is that they offered new – integration – mechanisms of education development for accelerating Russia's economic growth. The advantage of the integration mechanisms, compared to the independent development of universities, is universities' larger support for the implementation of the social and investment model of economic growth.

The practical significance of the authors' conclusions and recommendations is that they allow raising the effectiveness of university management and optimizing the organizational and managerial conditions under which the potential of universities in the sphere of support for the implementation of the social and investment model of economic growth is unlocked in the most comprehensive way.

The managerial significance of the authors' conclusions and recommendations is that they allow improving the methodology and practice of monitoring of the effectiveness of higher education organizations' activities, which is done annually by the [Ministry of Science and Higher Education of the Russian Federation \(2020\)](#). The proposed new criterion of assessing the optimality of the organization and management of universities – the degree of universities' involvement in the processes of integration with business – allows for

a more precise determination of the effectiveness of universities' activities.

The new criterion can be used for the rationalization of selecting the universities for participation in the program of strategic academic leadership and the following programs of higher education development in Russia. Due to this, the authors' recommendations, proposed in this paper, support the practical implementation of "Priority 2030" and allows for the fullest realization of the potential of universities' support for the social and investment model of economic growth in the Decade of science and technologies in the Russian Federation.

The new criterion may also be an additional benchmark and priority in the programs of Russian universities' development. The social significance of the paper's results is that they support the practical realization of the following Sustainable Development Goals: SDG 4, SDG 8, SDG 9, SDG 11, SDG 16, and SDG 17.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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