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Public-private partnership as a mechanism of education management in the structure of the social and investment model of economic growth

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The goal of this research was to find the influence of each mechanism of financial management of education—in the structure of the social and investment model of economic growth—on the results in the sphere of its development: quality, quantitative accessibility, and development of digital skills with students. The study's methodological approach involved the economic and mathematical modelling of (with the help of regression analysis) of the contribution of alternative investment mechanisms to the development of digital skills of the economically active population. We compared the contribution of isolated public and private investments to public-private partnership and proved its preference. We determined the place of the mechanism of education management based on public-private partnership in the structure of the social and investment model of economic growth. It was determined that the only manifestation of higher education's development, which largely depends on financial support, is digital skills among the active population. The connection between digital skills among the active population and investments in higher education by the terms of public-private partnership is clear (regression—0.47 points). An increase in the share of public-private partnership in the structure of financing of the development of higher education by up to 90% allows increasing digital skills among the active population from 61.49 points to 94.54 points—i.e., by 53.75%. Therefore, practical implementation of the social and investment model of economic growth should envisage financing of the development of higher education based on the mechanism of public-private partnership. It was proved that public-private partnership is a perspective mechanism of education management, which has an important role in the structure of the social and investment model of economic growth.

KEYWORDS

inclusive innovation, higher education, public-private partnership, financing of education, investments in education

1. Introduction

The global economic crisis, which began in 2020 under the influence of the COVID-19 pandemic and which could last for several years, became a critical factor in the development of the knowledge economy. In the latest global innovation report, WIPO (2020) has formulated and considered the issue of the sources of financing for science and innovations. In the main conclusions of this report, the most recent factual statistical data are the 2019 data, but there is a negative forecast, which is connected to the reduction of GDP growth (up to −5%) and the manifestations of R&D growth.

Based on the data on innovations' cyclicity, experts of WIPO (2020) consider the reduction of investments to be the decisive factor in the innovative development of the economy in the conditions of the 2020 crisis. Since innovations are closely connected to higher education and are generated in the university environment, it is possible to expect—based on the given expert evaluations—limited financing of education and a decrease in investment support in the near future. Thus, there is a problem of search for the best financial mechanism of education management in the structure of the social and investment model of economic growth. This paper is aimed at contributing to the resolution of the problem posed and is focused on higher education as the central element of the social and investment model of economic growth.

At present, most countries of the world use one source of financing, which could be either the state budget (in this case educational services are financed by the government and are free for students) or students' payment for educational services. In many other sectors, which provide services at the intersection of economic and public benefits, the mechanism of public-private partnership is used effectively. Among the countries of the OECD and, in particular, the top 10 countries selected for this research by the criterion of the largest share of public-private partnerships in the structure of investments in education, the sources of financing of higher education are very differentiated.

In some countries, private financing of higher education dominates. Examples are Belgium (85%), Poland (81%), France (79%) and Ireland (72%) (OECD, 2019). Their experience was studied in detail by Alfarizi et al. (2023), Geryk (2023), Herrmann and Nagel (2023), Pangarso and Setyorini (2023) and Selim and Kee (2023). These authors note the advantages of private universities and paid services of higher education.

In other countries, investments in higher education are based on public financing from the national budget. Examples are Chile (54%), South Korea (47%) and the UK (39%) (OECD, 2019). Their experience was studied by Frei et al. (2023), He and Ismail (2023), Hong et al. (2023), Jaafar et al. (2023), Salman et al. (2023), and Zigmont et al. (2023). These authors elaborated on the advantages of state universities and proved the necessity for financial support for the development of higher education from the national budget.

Investments in higher education based on the mechanism of public-private partnership account for a small share of financing of higher education even in the top 10 countries of the world by the development of this mechanism (from 3% in France to 29% in the UK) (OECD, 2019). The mechanism of public-private partnership in the activity of universities was not studied or presented sufficiently in the existing literature. Due to this, the contribution of this mechanism to the financing of higher education development was not clearly determined—which is a literature gap.

It is important to fill this gap and to study the phenomenon of public-private partnership in higher education because public-private partnership is a promising mechanism of managing education in these countries. It allows improving this management. Even with a small share of public-private partnership in the structure of investments in higher education, the considered top 10 countries are recognized world leaders by the competitiveness and effectiveness of universities, as well as by the quality of higher education services. Thus, it is important to study their experience, since it is useful for other countries of the world. These top 10 countries are progressive knowledge economies with progressive societies, in which digital skills are common among wide groups of the population.

This is important now in the sphere of educational management, for, under the conditions of the ongoing pandemics and long recession in the world economy, which is accompanied by the increased inflation and the reduction of real disposable incomes of the population, national budgets' assets are limited, similarly to the population's abilities to pay for the services of higher education in private universities. It is important to avoid the deficit of financing of universities, to prevent the slowdown of higher education development.

In this regard, a promising mechanism of public-private partnership is interesting. It allows unifying public and private financial resources and developing highly effective joint management of universities, which is based on public-private monitoring and independent control of quality, affordability and effectiveness of higher education services. Due to this, public-private partnership allows for the full realization of the potential of universities' development and an increase in the affordability and quality of higher education services.

The following hypothesis was offered here: this mechanism is in high demand in the system of higher education. The goal of this research was to determine the role of the mechanism of education management based on public-private partnership in the structure of the social and investment model of economic growth.

2. Literature review

This research is based on the existing concept of higher education as the core of the social and investment model of economic growth. The essence and specifics of using public-private partnerships in the modern economy, as well as specific experience of using this mechanism in education, are considered in the works Mitra (2020), Nayak (2019), Opawole and Jagboro (2018), Opawole et al. (2019), and Zhu et al. (2019). The financial aspects of education management in the structure of the social and investment model of economic growth are studied in the works Abildaeva et al. (2022), Annamalai (2022), Ashour et al. (2019), Dobrosotskiy et al. (2019), Ramaditya et al. (2022), Sanz and López-Iñesta (2022), Wright and Horta (2018).

The importance of public-private partnership is that it allows for a simultaneous increase in the investment support for higher education (due to joint public and private financing) and an increase in the effectiveness of university management—due to the flexibility of private investors and public control (Termes et al., 2020; Barrera-Osorio et al., 2022).

Results obtained in similar studies show that the development of higher education in the social and investment model of economic growth is determined by the quality of vocational training (Olmedo-Moreno et al., 2021; Vanderburg et al., 2022) and ease of finding skilled employees (Halili et al., 2022; Maddah et al., 2023) (quantitative accessibility of skilled employees).

Patrinos et al. (2021) and Piurcosky et al. (2022) indicate that the largest contribution to the development of higher education in the social and investment model of economic growth is made by private investments in universities. Contrary to them, Ojha et al. (2022), Pan et al. (2022) and Villela and Paredes (2022) note that public financing of universities makes the largest contribution to the development of higher education in the social and investment model of economic growth.

Under the conditions of the digital economy, the most important contribution of universities to the implementation of the social and investment model of economic growth is the training of digital personnel (Arslantas and Gul, 2022; Gómez-Poyato et al., 2022; Spada et al., 2022).

That is why we should focus on this result. Based on the works by Musenero et al. (2023) and Uddin et al. (2023), which note the advantages of public-private partnership, we propose the following hypothesis (H): for the development of digital skills among the active population, public-private partnership is more preferable than private investments and public investments separately.

It is possible to see that the given literature sources provide a detailed elaboration of the issues of using the mechanism of public-private partnership and the issues of financial education management. However, the issue of using the public-private partnership as a mechanism of education management in the structure of the social and investment model of economic growth needs further consideration and solution. We try to find this solution in the presented paper.

3. Materials and methodology

The experience of the development of higher education in the social and investment model of economic growth is studied in this paper. The methodological approach of the research involves the economic and mathematical modelling of the contribution of alternative investment mechanisms to the development of digital skills of the economically active population. We compare the contribution of isolated public and private investments to public-private partnership and prove its preference. To strengthen the verifiability of the suggested hypothesis, let us present it in economic and mathematical form. The research model is as follows:

$$D = a + b_1{}^{*}pr + b_2{}^{*}ppp + b_3{}^{*}pu$$

where
D—digital skills among the active population;
pr—private expenditure (private investments);
ppp—public-to-private transfers (public-private partnership);
pu—public expenditure (public investments);
a—constant;
b—coefficients of regression.

H: $b_2 > (b_1 + b_3)$. That is, public-to-private transfers (public-private partnership) make a larger contribution to the development of digital skills among the active population than private expenditure (private investments) and public expenditure (public investments) separately.

Verification of the offered hypothesis envisages determining the influence of each mechanism of financial management of education (in the structure of the social and investment model of economic growth) on the results in the sphere of its development: quality, quantitative accessibility, and development of digital skills with students—which is a new educational service, the popularity of which grows in the digital economy.

Regression analysis was used in this research. The hypothesis was deemed proven if coefficients of regression and correlation between the indicators of development of higher education and public-private partnership were larger compared to other mechanisms of financing of higher education—private and public investments. The data on the mechanisms of financing of higher education are materials of the report by OECD (2019), from which we selected the top 10 countries of the OECD with the largest share of public-private partnerships in the structure of investments in education. The indicators of the development of higher education in the social and investment model of economic growth were taken from World Economic Forum (2020). Statistics for the research are given in Table 1.

The procedure of selecting countries from the list of OECD countries in the context of public-private partnership was based on the choice of countries in which the share of this mechanism in the structure of financing of the activity of universities is the highest. Due to this, the formed sample allows for the most correct determination of the contribution of public-private partnership to the investment support of universities' activity and the increase in affordability and quality of higher education services.

4. Results

4.1. Modelling of the contribution of alternative mechanisms of financing of higher education to the development of digital skills among the economically active population

To identify the place of public-private partnership in the social and investment model of economic growth, let us perform the modelling of the contribution of alternative mechanisms of financing of higher education to the development of digital skills among the economically active population. To check the offered hypothesis and to determine the contribution of each accessible mechanism of financing of education to its development, we obtained (based on Table 1) the following equations of multiple linear regression:

– Q = 76.78–0.20*pr-0.26*ppp + 0*pu, multiple r = 43.50%;
– D = 52.36 + 0.04*pr + 0.47*ppp + 0*pu, multiple r = 56.88%;
– E = 67.87–0.12*pr-0.04ppp + 0*pu, multiple r = 41.00%.

The obtained regression equations show that the quality of vocational training and ease of finding skilled employees demonstrate inverse regression dependence on all mechanisms of financing.

TABLE 1 The structure of investments in higher education and the indicators of its development in the countries of the sample in 2020.

Country	Share of social investments of the given type in their general structure, %			Indicators of the development of higher education in the social and investment model of economic growth, points 1–100		
	Private expenditure (private investments)	Public-to-private transfers (Public-private partnership)	Public expenditure (public investments)	Quality of vocational training	Digital skills among the active population	Ease of finding skilled employees (Quantitative accessibility of skilled employees)
	pr	ppp	pu	Q	D	E
UK	32	29	39	64.7	65.6	67.5
Australia	39	24	37	63.8	67.0	59.6
New Zealand	51	18	31	63.2	65.5	52.5
Ireland	72	18	10	64.1	66.5	652.0
South Korea	38	15	47	63.9	66.5	65.1
Poland	81	12	7	42.2	54.5	51.6
Italy	63	11	26	58.4	52.9	54.6
Chile	36	10	54	65.3	54.4	64.4
Belgium	85	4	11	67.8	63.8	62.1
France	79	3	18	62.1	58.2	59.6

Source: compiled by the authors based on OECD (2019), and World Economic Forum (2020).

Therefore, these characteristics of higher education cannot be managed with the help of investments.

Digital skills among the active population are by 56.88% determined by the influence of investing. Growth of the share of private investments in the structure of social investments, aimed at the financing of higher education, by 1% leads to growth of digital skills among the active population by 0.04 points (small attention). Growth of the share of public-private partnership in the structure of social investments, aimed at the financing of higher education, by 1% leads to growth of digital skills among the active population by 0.47 points (large attention). The results obtained demonstrate that public-private partnership has an important place in the social and investment model of economic growth.

4.2. Alternative scenarios of education management in the social and investment model of economic growth

To determine the role of public-private partnership as a mechanism of education management in the structure of the social and investment model of economic growth, let us consider different scenarios of financing of higher education in the short term (until 2022) (Figures 1, 2).

As shown in Figure 1, the scenario of reliance on the mechanism of private investments envisages an increase in their share by up to 90% in the structure of investments in higher education. This will lead to a decrease in digital skills among the active population by 4.93% and a moderate deficit of digital personnel.

The scenario of reliance on the mechanism of public investments envisages an increase in their share of up to 90% in the structure of investments in higher education. This will lead to a decrease in digital skills among the active population by 10.72% and a strong deficit of digital personnel.

As shown in Figure 2, the scenario of equal use of all mechanisms envisages the distribution of shares among them, each share constituting 33.33%. This will lead to the growth of digital skills among the active population by 12.70%.

The scenario of reliance on the mechanism of public-private partnership envisages an increase in the share of this investment mechanism up to 90%. This will lead to an increase in digital skills among the active population by 53.75% and will allow overcoming their deficit. Thus, the scenario that is based on the development of public-private partnership as a mechanism of education management in the social and investment model of economic growth is most promising and preferable.

5. Discussion

This paper's contribution to the literature was the clarification of the role of university management in the implementation of the social and investment model of economic growth. We proved that the development of higher education in the social and investment model of economic growth is determined not by the quality of vocational training (unlike Olmedo-Moreno et al., 2021; Vanderburg et al., 2022) and not by the ease of finding skilled employees (unlike Halili et al., 2022; Maddah et al., 2023) (that is, not by quantitative accessibility of skilled employees) but by digital skills among the active population.

We also proved that financial support of universities and the effectiveness of their management are the highest not in the case of

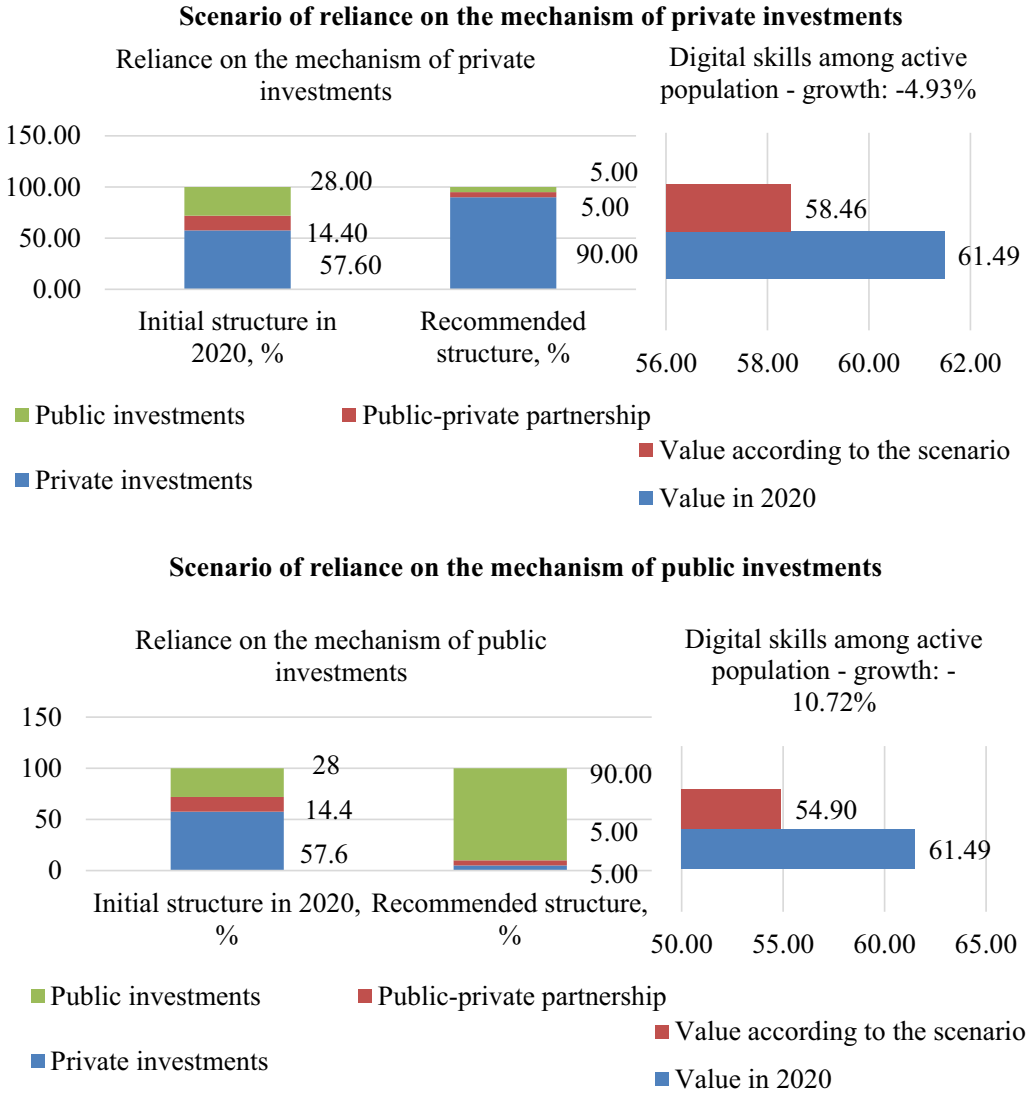

FIGURE 1
Education management in the social and investment model of economic growth according to the scenario of reliance on the mechanism of private investments and according to the scenario of reliance on the mechanism of public investments.

domination of private investments in universities (unlike Patrinos et al., 2021; Piurcosky et al., 2022) and not in the case of preferential public financing of universities' activities (unlike Ojha et al., 2022; Pan et al., 2022; Villela and Paredes, 2022) but in the case of public-private partnership, which ensures joint financing and control over the activities of universities by the government and by the public investors.

This paper is a part of the chain of productive scientific research on the social and investment model of economic growth; it strengthens the evidence base of Arslantas and Gul (2022), Gómez-Poyato et al. (2022) and Spada et al. (2022) with proofs of the key role of universities in the training of digital personnel based on public-private partnership. The novel contribution of this research and its theoretical significance consists in proving the important role of public-private partnership as a mechanism of education management in the implementation of the social and investment model of economic growth.

6. Conclusion

Thus, the research results confirm the hypothesis - public-private partnership is a perspective mechanism of education management, with an important place in the structure of the social and investment model of economic growth. It has been determined that contrary to the existing beliefs, the quality of higher education and quantitative accessibility of education and skilled employees do not depend on investments in higher education and thus are not subject to financial management.

The only manifestation of the development of higher education, which does depend a lot on financial support, is digital skills among the active population. Public investments have zero connection with this manifestation, and private investments have a weak connection (regression—0.04 points). The connection between digital skills among the active population and investments in higher

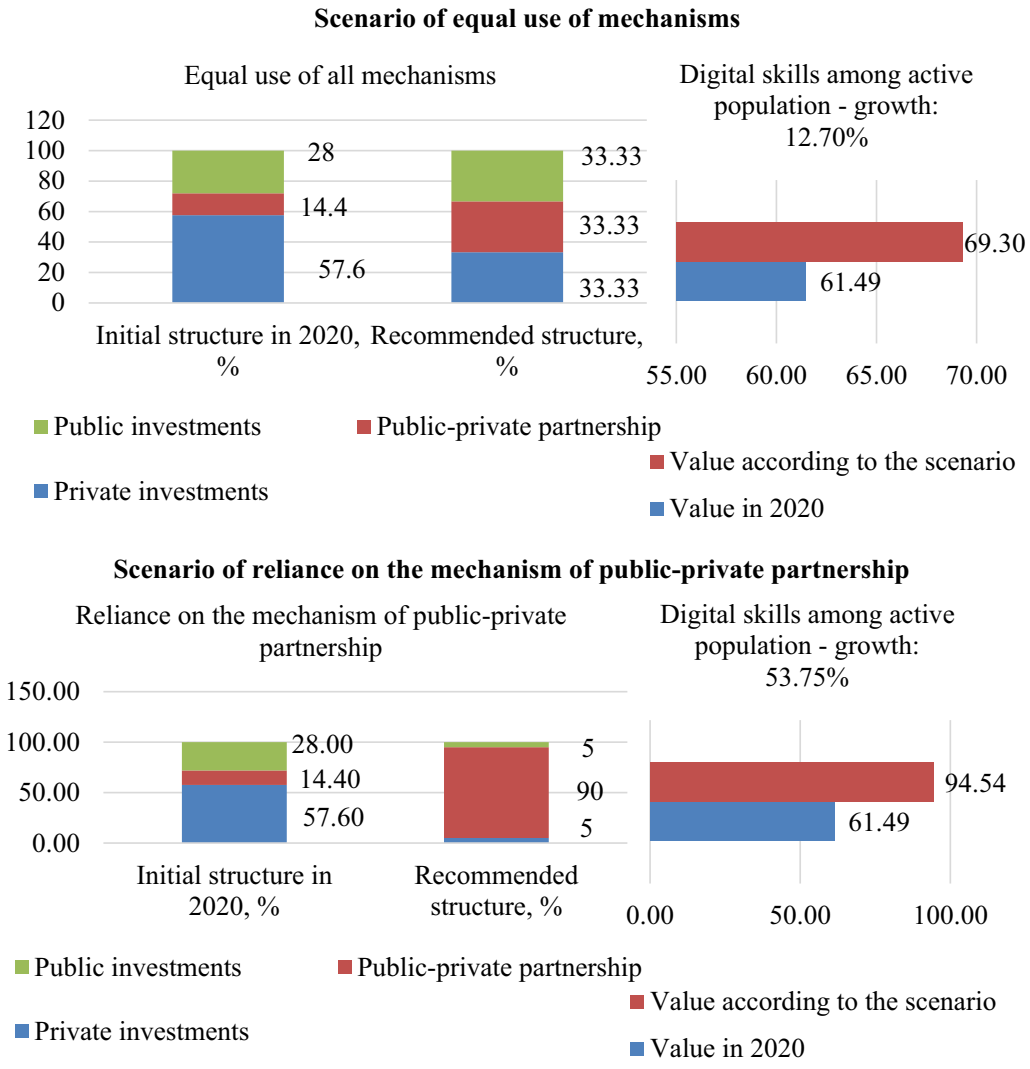

FIGURE 2
Education management in the social and investment model of economic growth according to the scenario of equal use of mechanisms and according to the scenario of reliance on the mechanism of public-private partnership Source: calculated and built by the authors.

education the terms of public-private partnership is very clear (regression—0.47 points).

Scenario analysis has shown that a combination of public and private investments ensures better results for the development of higher education than the domination of one type of investment. The public-private partnership allows combining not only financial resources but also management practices, thus providing the highest effectiveness.

It was proven that an increase in the share of public-private partnerships in the structure of financing of the development of higher education by up to 90% allows raising digital skills among the active population from 61.49 points to 94.54 points—i.e., by 53.75%. Therefore, practical implementation of the social and investment model of economic growth should envisage financing of the development of higher education based on the mechanism of public-private partnership.

Thus, the most important results of this research and its key factors are as follows. The most prospective vector of the development of higher education in the social and investment model of economic growth is the increase in digital skills among the active population. The most promising scenario of this vector realization is the reliance on public-private partnership.

The implications of the results obtained for stakeholders are as follows: universities receive a clearer view of how to improve the management of universities—with the help of the mechanism of public-private partnership. The government gets the opportunity to increase the rate of economic growth in its social and investment model through the activation of the mechanism of public-private partnership in higher education. Private investors can increase return on investments in higher education due to the use of the public-private partnership mechanism in university management.

The managerial significance of the conclusions made and results obtained is that they demonstrated the prospects for an increase in the effectiveness of education management based on the mechanism of public-private partnership. Collectively, this paper's results

systemically support the implementation of the social and investment model of economic growth.

The social significance of the results obtained is that the better realization of the potential of the mechanism of public-private partnership based on the authors' recommendations will allow increasing the affordability and quality of higher education services for wide groups of the population and ensuring better mastering of digital skills by them. Due to this, the paper supports the practical achievement of SDG 4 (Quality education), SDG 8 (Decent work and economic growth) and SDG 9 (Industry, innovation and infrastructure).

Thus, the paper strengthened the scientific arguments in favor of public-private partnership being a prospective mechanism of education management in the structure of the social and investment model of economic growth. However, specific roles of the public and private partners in university management remained outside of the scope of this research, which is its limitation.

As is known, there are many models of public-private partnership, all of which can be used in higher education, but the specific investment project of a university requires an independent choice of the appropriate model given its specific features. Therefore, future scientific studies should pay attention to the issue of distribution of the roles of the public and private partners during university management based on the mechanism of public-private partnership, in particular, with the help of case studies based on the experience of specific universities.

Another promising area for future research in the continuation of this paper is the study of possibilities and perspectives for combining various mechanisms of university management during the implementation of investment projects in higher education. In particular, attention should be paid to the cluster mechanism, as well as the mechanism of collaboration of universities and businesses based on technological parks and innovative networks, which can be used in combination with the mechanism of public-private partnership, acquiring new flexible and highly effective forms in practice. Thus, an in-depth elaboration of the issues of comprehensive activation of the integration mechanisms in higher education with various lists of participants is a prospective area for future scientific studies.

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

MD, MK, TB, and SK participated in the preparation of the manuscript. All authors contributed to the article and approved the submitted version.

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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