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The infrastructural role of education in the social and investment model of economic growth: the specifics of emerging markets

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The purpose of this paper is to determine the directions and to specify the infrastructural role of higher education in the social and investment model of economic growth in view of the specifics and perspectives of emerging economies. Correlation analysis is used to determine the dependence between the directions of higher education's development and the target results of its contribution to the implementation of the social and investment model of economic growth in emerging economies. These connections are specified with the help of regression analysis. Then, the simplex method is used to determine target landmarks for the selected directions. According to the experience of the top emerging economies with the highest level of economic innovative development in 2020, maximization (up to 100%) of knowledge-intensive employment (+299.29%), medium-tech and hi-tech manufacturing (+223.42%) and e-participation (+19.98%) requires the increase in the number of students per 1 lecturer in higher education by 387.26%, growth of mobility in higher education by 1,116.27%, and increase in QS university ranking by 139.13%. It is proved that only three directions of higher education's development are significant and have to be implemented to support social and investment model of economic growth in emerging economies: increase in the number of students per 1 lecturer in higher education, growth of mobility in higher education, and increase in QS university ranking.

KEYWORDS

educational environment, educational governance, inclusive innovation, infrastructural role, higher education, emerging markets

1. Introduction

The social and investment model of economic growth has formed as a response to the three key challenges of the global economic system of recent years: formation of the "knowledge economy," which raised the value of the leading technologies and innovations; transition to the digital economy, which required the wide mastering of digital technologies in society and business and formed hi-tech markets; and the start of the process of formation of the social market economy, in which the most important milestone is quality of life, determined by the

creation of highly-efficient and highly-paid jobs that ensure the realization of human potential (Gevorgyan et al., 2021).

As the successful and leading experience of developed countries has shown, higher education plays the basic—infrastructural—role in the social and investment model of economic growth. However, the emerging economies' attempts to develop higher education to implement the social and investment model of economic growth do not bring the desired results. The problem is that higher education develops rapidly and in a systemic manner (in all directions at the same time) in developed countries—due to sufficient resources. In emerging economies, the deficit of resources allows implementing either certain directions of higher education's development or developing it systemically but slowly.

In both variants of higher education's development that are accessible for emerging economies, substantial results in the social and investment model of economic growth cannot be achieved. The essence of the problem posed consists in the uncertainty of the cause-and-effect relationships of higher education and the results of the implementation of the social and investment model of economic growth in developing countries. Traditional educational mechanisms, which are highly effective and are actively used by developed countries, demonstrate restrained effects in developing countries (Popkova, 2022).

This leads to the incorrectness of using the samples of developed countries during the implementation of the social and investment model of economic growth in developing countries (Zhang and Zhao, 2023). This model must take into account the specifics and be adapted to the unique experience of developing countries. Therefore, this paper strives to prove that, similarly to developed countries, education has an infrastructural (basic, system-forming) role in the implementation of the social and investment model of economic growth, but this role has its specific manifestations. That is why there is a need for an approach to university management in developing countries.

The hypothesis (H_0) of this research is as follows: the problem could be solved by high-precision and targeted development of higher education in emerging economies in the directions that contribute the most to the implementation of the social and investment model of economic growth. The purpose of this paper is to determine these directions and to specify the infrastructural role of higher education in the social and investment model of economic growth in view of the specifics and perspectives of emerging economies.

The novel aspect of this paper, compared to the existing studies, lies in the description of the poorly studied experience of developing countries in the implementation of the social and investment model of economic growth. Due to this, in this paper—for the first time—the specifics of the role of education in the implementation of this model are substantiated. The authors' recommendations for university management to support the social and investment model of economic growth given the specifics of developing countries are offered.

2. Literature review

The theoretical basis of this research is the concept of university management. According to this concept, the infrastructural role of education in the social and investment model of economic growth is substantiated and emphasized in the works Aleixo et al. (2020),

Finnveden et al. (2020), Neelam et al. (2020), and Pedro et al. (2020). The specifics of higher education's development in emerging markets are studied in the works Adeyinka-Ojo et al. (2020), Baartman et al. (2022), Fuchs (2022), Gonzales-Valdivia et al. (2022), Hassan (2020), Lohberger and Braun (2022), Saqib et al. (2020).

The following directions of higher education's development are distinguished in the existing literature:

- University/industry research collaboration for the improved mastering of applied competencies by university students, increase in the competitiveness of university graduates in the labor market, improvement of their employment opportunities and career building and creation of applied technologies and accelerated commercialization of university innovations (Fernandes and O'Sullivan, 2023; Zhuang and Zhou, 2023);
- Expenditure on education for the improvement of accessibility of higher education services, which, in particular, involves an increase in the scale of state order for the training of highly skilled and digital personnel by state-funded universities on budgetary places (Ali, 2022; Ojha et al., 2022);
- Pupil-teacher ratio for improvement of the quality of higher education services that are provided by universities (Pérez-Rodríguez et al., 2022; Valverde-Espinoza and Barja-Ore, 2022);
- Mobility in higher education for the free exchange of knowledge and technologies, international recognition of education diplomas, the attraction of foreign students and teachers, foreign internships, research by international scientific groups and strengthening of the international status of universities (Lo et al., 2022; Cuzzocrea and Krzaklewska, 2023);
- Gross expenditure on R&D, the centers of which are universities, for the acceleration of innovative development of the economy (Su et al., 2022; Weiyu et al., 2022);
- QS university ranking for strengthening of the global competitiveness of universities, which is demonstrated by their position in international university rankings, of which the QS ranking is one of the most respectable (Estrada-Real and Cantu-Ortiz, 2022; Moshtagh et al., 2023).

In the Decade of Action, the implementation of the social and investment model of economic growth should be considered through the lens of the sustainable development goals (SDGs), formulated by the UN. University management, which is aimed at the practical implementation of the five mentioned directions of higher education's development, supports SDG 4 (raises the quality of higher education). The target results of its contribution to the implementation of the social and investment model of economic growth are as follows:

- Increase in knowledge-intensive employment for the fullest unlocking of human potential to support SDG 8 (decent work and economic growth based on the “knowledge society”; Hrivnák et al., 2021; Markowska et al., 2022);
- Development of medium-tech and hi-tech manufacturing to strengthen the digital competitiveness of the economy and to improve its positions in the world markets under the conditions of the Fourth Industrial Revolution to support SDG 9 (Dyakov et al., 2022; Taleb and Pheniqi, 2023);
- Development of e-participation: more active involvement of wide groups of the population in the implementation of socially

important initiatives, development of civil society and development of responsible communities to support SDGs 10–12 and SDGs 16–17 (Quintana et al., 2022; Bouregh et al., 2023).

A large number of existing publications ensures a reliable theoretical base for this research. However, the existing literature is focused mainly on the experience of developed countries, while the experience of developing countries is poorly studied, and their specifics are unclear. This is a literature gap that this paper strives to fill. We can see the insufficient elaboration on the issue of implementing the infrastructural role of higher education in the social and investment model of economic growth in emerging economies. We try to fill this gap in the presented paper. For this, we study the experience of developing countries and clarify the specifics of the influence of university management on the implementation of the social and investment model of economic growth in developing countries.

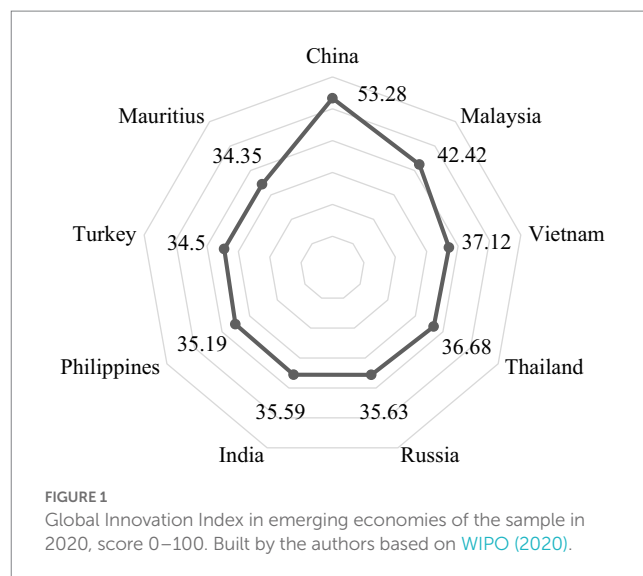
3. Materials and methodology

The economic and mathematical sense of the offered hypothesis (H_0) consists in the fact that only some (not all) directions of higher education's development contribute (in a serious way) to the implementation of the social and investment model of economic growth in emerging economies. To verify the offered hypothesis we use correlation analysis; we determine the dependence between the directions of higher education's development (university/industry research collaboration, expenditure on education, mobility in higher education, gross expenditure on R&D, and QS university ranking) and target results of its contribution to the implementation of the social and investment model of economic growth (knowledge-intensive employment, medium-tech and hi-tech manufacturing, and e-participation) in emerging economies.

In econometric analysis, the indicators of QS Ranking are used. QS Ranking is one of the leading international university rankings, which covers 1,500 universities around the world (as of 2023) and takes into account the characteristics of university management: from academic reputation to the number of international students enrolled (QS Quacquarelli Symonds Limited, 2023). The use of the QS ranking materials is important for this paper since it allows for the most correct determination of the global competitiveness of universities. Though there are many university rankings, the most authoritative ones are QS, THE, and QRWU.

We selected QS for this paper, not another ranking because the position of universities in the QS ranking is given as an individual indicator of WIPO (2020). This allows taking into account the data of the QS ranking with their full compatibility with other indicators that are studied in this paper. The role of the ranking in the studied context consists in the reflection of global competitiveness and world reputation of the top 3 universities of each considered developing country.

The hypothesis is deemed proven if the results have a higher (more than 45%) correlation with only certain directions. The research objects are the top emerging economies by the level of society and the economy's innovative development according to WIPO (2020). The values of the Global Innovation Index in the selected countries in 2020 are shown in Figure 1. In this paper, we studied the data for 2020, since



this period is the initial point for the Decade of Action and defines the state of affairs up until 2030. In addition to this, against the background of the start of the COVID-19 pandemic, the role of education and the significance of the social and investment model of economic growth grew significantly, which makes the experience of 2020 particularly interesting and useful in the context of this research.

During the selection of the data, we used, first, the criterion of completeness, to minimize the gaps in data and obtain the fullest possible picture of university management's contribution to the implementation of the social and investment model of economic growth in developing countries. Second, the criterion of the authority of data sources, to guarantee full objectivity, high precision and reliability of the research results.

As shown in Figure 1, the leader in the innovative development of the economy among developing countries is China (53.28 points). High level and rate of innovative development of the economy are demonstrated also by other countries of the sample: Malaysia (42.42 points), Vietnam (37.12 points), Thailand (36.68 points), Russia (35.63 points), India (35.59 points), the Philippines (35.19 points), Turkey (34.50 points) and Mauritius (34.35 points). The directions of higher education's development and the results for the social and investment model of economic growth in emerging economies of the sample in 2020 are presented in Table 1.

Systematization and generalization of data from Table 1 revealed high results of university management in support of the key directions of higher education's development in developing countries of the sample. Thus, on average for the sample, university/industry research collaboration equals 49.37% of involved universities. Expenditure on education is 3.89% of GDP. Number of students per 1 lecturer in higher education is 17.22. Mobility in higher education is 2.85%. Gross expenditure on R&D is 0.91% of GDP. QS university ranking, the average score of top 3 universities is 35.27 points. We also revealed high achieved serious target results of its contribution to the implementation of the social and investment model of economic growth. Thus, on average for the sample, knowledge-intensive employment is 25.04%. Medium-tech and hi-tech manufacturing equals 33.40%. E-participation is 88.34% of the economically active population.

TABLE 1 Directions of higher education's development and results for the social and investment model of economic growth in emerging economies in 2020.

Indicators' titles that are used in the paper	Knowledge-intensive employment, %	Medium-tech and hi-tech manufacturing, %	E-participation, % of the economically active population	University/industry research collaboration, % of involved universities	Expenditure on education, % of GDP	Number of students per 1 lecturer in higher education	Mobility in higher education, %	Gross expenditure on R&D, % of GDP	QS university ranking, average score of top 3 universities, points 1–100
Official indicators' titles	Knowledge-intensive employment	High- and medium-high-tech manufacturing	E-participation	University/industry research collaboration	Expenditure on education	Pupil-teacher ratio, secondary	Tertiary inbound mobility	Gross expenditure on R&D	QS university ranking, average score top 3
	Y_1	Y_2	Y_3	X_1	X_2	X_3	X_4	X_5	X_6
China	39.0	46.4	90.5	560.5	3.3	13.3	0.4	2.2	83.8
Malaysia	27.2	43.1	88.8	68.3	4.5	11.4	9.6	1.4	54.6
Vietnam	13.5	40.0	69.1	42.0	4.2	17.6	0.2	0.5	9.2
Thailand	13.8	43.8	65.2	54.1	4.1	25.9	1.3	1.0	30.6
Russia	44.1	25.6	92.1	46.8	3.7	8.8	4.3	1.0	47.5
India	15.7	34.1	95.5	47.7	3.8	25.8	0.1	0.6	47.2
Philippines	25.5	38.6	93.8	57.5	2.7	23.9	-	0.2	20.6
Turkey	21.6	25.8	86.0	40.6	-	17.3	1.5	1.0	23.9
Mauritius	25.0	3.2	69.1	30.8	4.8	11.0	5.4	0.3	0

Compiled by the authors based on [WIPO \(2020\)](#).

As a result of correlation analysis, we determine the key directions of higher education’s development, which are closely connected to the results for the social and investment model of economic growth in emerging economies in 2020. These connections are specified with the help of regression analysis (multiple and/or one-factor). Then, based on the determined regression dependencies, we use the simplex method to find the target landmarks (control values of the corresponding indicators) for the selected directions of higher education’s development for the purpose of full-scale implementation (maximization of results) of all results for the social and investment model of economic growth in emerging economies.

4. Results

To verify the offered hypothesis and to specify the infrastructural role of higher education, we use the data from Table 1 to find the correlation between the directions of this development and the results for the social and investment model of economic growth in emerging economies in 2020 (Figure 2).

As shown in Figure 2, results in the sphere of knowledge-intensive employment (y_1) are determined by such directions as mobility in higher education (x_4 , correlation—69.32%) and QS university ranking (x_6 , correlation—55.00%). Results in the sphere of development of medium-tech and hi-tech manufacturing (y_2) are determined by such direction as the number of students per 1 lecturer in higher education (x_3 , the correlation—46.79%). Results in the sphere of e-participation (y_3) are determined by QS university ranking (x_6 , correlation—59.70%).

To specify the determined correlation connections, let us find regression dependencies of the considered results on the selected directions of higher education’s development (x_3 , x_4 , and x_6), based on the data from Table 1. The regression dependence of knowledge-intensive employment (y_1) on mobility in higher education (x_4) and QS university ranking (x_6) is the following: $y_1 = 19.78 + 2.21x_4 - 0.1271x_6$.

In the multiple regression equation, the dependence of knowledge-intensive employment (y_1) on QS university ranking (x_6) is negative. Therefore, this direction shall not be further considered here. We build a regression curve that reflects the isolated (one-factor) dependence $y_1(x_4)$. Thus, an increase in mobility in higher education by 1% leads to growth of knowledge-intensive employment by 1.7307%, a correlation between the indicators is moderately high—48.05%.

Regression dependence of medium-tech and hi-tech manufacturing (y_2) on the number of students per 1 lecturer in higher education (x_3) is the following: $y_2 = 1.0733x_3 + 13.082$ and dependence of e-participation (y_3) on QS university ranking (x_6) is the following: $y_3 = 0.2786x_6 + 73.518$. An increase in the number of students per 1 lecturer in higher education (x_3) by 1 leads to growth of the share of medium-tech and hi-tech production (y_2) by 1.0733%, the correlation between the indicators is moderately high, constituting 21.90%.

An increase in QS university ranking (x_6) by 1 point leads to growth of the share of e-participation (y_3) by 0.2786%, the correlation between the indicators is moderately high, constituting 35.64%. Based on the determined regression dependencies, we find the perspective of improving the implementation of the infrastructural role of higher education in the social and investment model of economic growth in emerging economies (Figure 3).

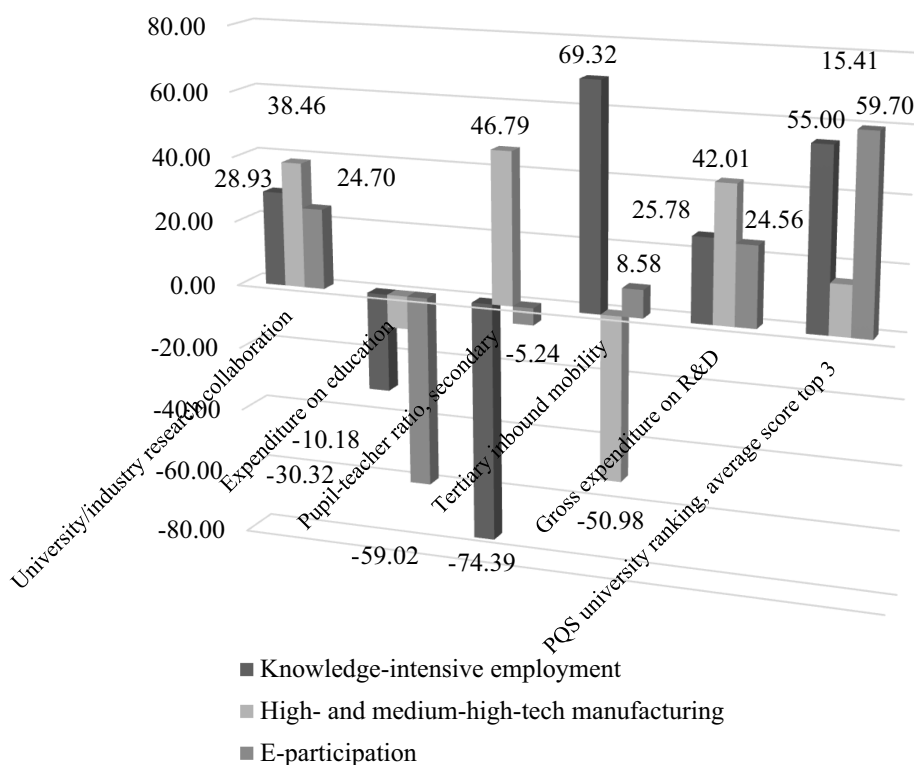


FIGURE 2 Correlation between the directions of higher education’s development and the results for the social and investment model of economic growth in emerging economies in 2020, %. Calculated and built by the authors.

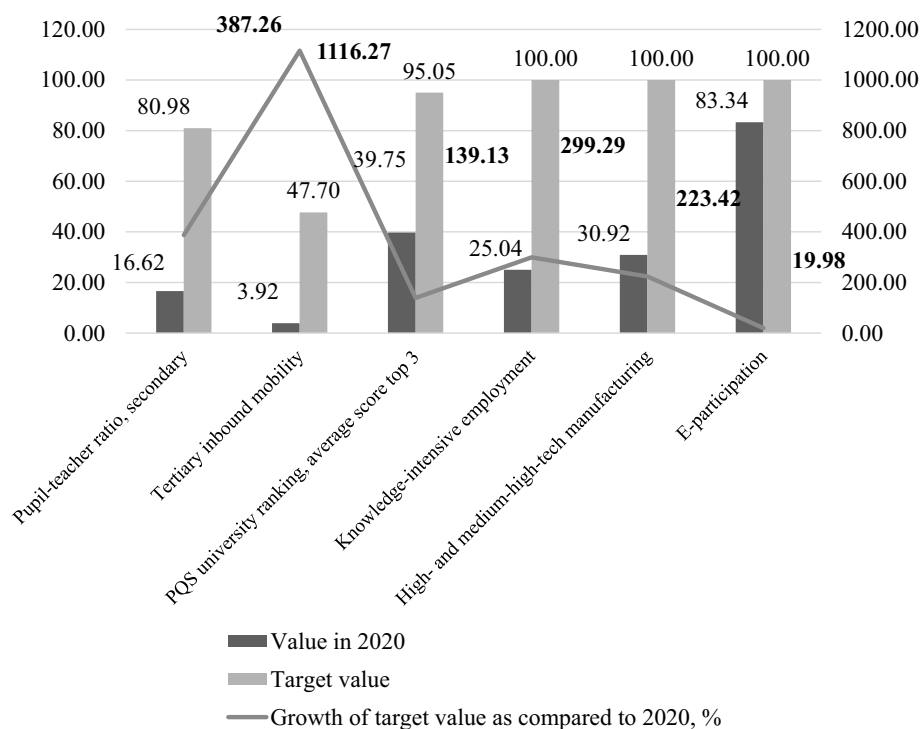


FIGURE 3

Perspectives of improving the implementation of the infrastructural role of education in the social and investment model of economic growth. Calculated and built by the authors.

As shown in Figure 3, improvement of university management will allow maximization of all results (up to 100%) of implementation of the social and investment model of economic growth in emerging economies. In the Decade of Action (until 2030), it is possible to achieve the growth of knowledge-intensive employment by 299.29%, medium-tech and hi-tech manufacturing—by 223.42% and e-participation—by 19.98%, compared to 2020. To achieve these advantages in the practice of developing countries in the Decade of Action, the authors' suggestions for public and social policy in higher education are as follows. First, to increase the number of students per 1 lecturer in higher education from 16.62 up to 80.98, i.e., by 387.26%. Second, the growth of mobility in higher education—from 3.92% up to 47.70%, i.e., by 1,116.27%. Third, an increase in QS university ranking from 39.75 points up to 95.05 points, i.e., by 139.3%.

5. Discussion

This paper's contribution to the literature consists in the development of the concept of university management by clarifying the specifics of the influence of university management on the implementation of the social and investment model of economic growth in developing countries. This paper rethought, from the position of the SDGs, and described the connection with education management and the target results of its contribution to the implementation of the social and investment model of economic growth: an increase in knowledge-intensive employment (in support of Hrivnák et al., 2021; Markowska et al., 2022); development of medium-tech and hi-tech manufacturing (strengthening the factual base Dyakov et al., 2022; Taleb and Pheniqi, 2023); development of

e-participation: (in support of Quintana et al., 2022; Bouregh et al., 2023).

This paper contributes to the ongoing scientific discussion on the issues of university management through the justification of the following directions of higher education's development: pupil-teacher ratio (in support of Pérez-Rodríguez et al., 2022; Valverde-Espinoza and Barja-Ore, 2022); mobility in higher education (in support of Lo et al., 2022; Cuzzocrea and Krzaklewska, 2023); QS university ranking (in support of Estrada-Real and Cantu-Ortiz, 2022; Moshtagh et al., 2023).

Contrary to the experience of developed countries, we did not reveal a significant contribution to the implementation of the social and investment model of economic growth in developing countries of such factors of university management as university/industry research collaboration (unlike Fernandes and O'Sullivan, 2023; Zhuang and Zhou, 2023), expenditure on education (unlike Ali, 2022; Ojha et al., 2022) and gross expenditure on R&D (unlike Su et al., 2022; Weiyu et al., 2022).

6. Conclusion

The main research result is that the infrastructural role of university management in developing countries is no less important implementing the social and investment model of economic growth, but it is different from this role in developing countries. Developed countries have a wider circle of effective tools of university management. Unlike them, the capabilities for university management in support of the implementation of the social and investment model of economic growth in developing countries are limited by such tools

as pupil-teacher ratio, mobility in higher education and QS university ranking.

Thus, hypothesis (H_0) has been proved as a result of the performed research; it has been shown that only three directions of higher education's development are significant and require implementation for the purpose of supporting the social and investment model of economic growth in emerging economies. According to the experience of the top emerging economies with the highest level of economic innovative development in 2020, to maximize (up to 100%) knowledge-intensive employment (+299.29%), medium-tech and hi-tech manufacturing (+223.42%), and e-participation (+19.98%) it is necessary to increase the number of students per 1 lecturer in higher education by 387.26%, growth of mobility in higher education by 1,116.27%, and QS university ranking by 139.13%.

The theoretical significance of the authors' conclusions is that they described the cause-and-effect relationships of the development of higher education and the results of implementing the social and investment model of economic growth in developing countries. The practical significance of this paper lies in its offering qualitative criteria and quantitative benchmarks for improvement of the public and social policy in higher education, pointing to three directions for higher education in developing countries in the Decade of Action: increase in the number of academic staff per number of students, increase in scientific and educational mobility and improvement of positions in international university rankings, in particular, in the ranking QS.

The managerial significance of the paper consists in offering applied recommendations for the improvement of university management. If the management of universities supports and starts the process of implementation of these recommendations now, the potential of the social and investment model of economic growth will be developed in full in developing countries by the end of the Decade of Action (2030). The social significance of the paper is its forming a theoretical vision, strengthening the scientific and methodological base and suggesting a range of applied recommendations for the systemic implementation of SDG 4, SDG 8, SDG 9, SDGs 10–12 and SDGs 16–17.

It should be concluded that developing countries are much more differentiated than developed countries. Therefore, the proposed

quantitative benchmarks are of the framework character, while universities of each developing country should detail and specify these benchmarks given its specifics. A generalized view of developing countries, on the whole, is a limitation of this paper. Future scientific studies should embark on in-depth research of the experience of individual developing countries and offer unique recommendations for each of them for improvement of higher education management in support of the implementation of the social and investment model of economic growth.

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/s.

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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