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# Higher Education and National Development: Insights from Kazakhstan's Transition Economy

**Anel A. Kireyeva[1]***

[1] University of International Business named after K. Sagadiyev, Almaty, Kazakhstan

**Corresponding author**:
* Anel A. Kireyeva – Cand. Sc. (Econ.), Professor of the University, University of International Business named after K. Sagadiyev, Almaty, Kazakhstan.
Email: kireyeva.a@uib.kz

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**ABSTRACT**

To date, the analysis of issues related to developing educational potential and promoting intellectual development has not been conducted at the appropriate level, particularly in adapting higher education to current demands. In addition, a pressing issue exists in many countries of the CIS, including Kazakhstan, the question of whether education programs comply with international standards and labor market requirements remains significant. Therefore, this paper aims to empirically investigate the relationship between the performance of Kazakhstan's higher education system and key socio-economic indicators from 2004 to 2024, identifying systemic inefficiencies and potential directions for policy improvement. Drawing on official data from the Bureau of National Statistics, the World Bank, and the OECD, the study employs a comprehensive econometric framework, which includes correlation matrices, regression models, and principal component analysis (PCA). The results reveal a positive correlation between the contribution of education to GDP and R&D expenditure (r = 0.820) and average household income (r = 0.841), suggesting that education's economic effectiveness is strongly linked to innovation investment and income levels. Conversely, a negative relationship was observed with student enrollment, faculty size and the number of higher education institutions, suggesting that quantitative expansion alone does not enhance economic efficiency. The findings point to structural contradictions within the higher education sector, including a misalignment with labor market needs and limited integration into the innovation economy. Future research should aim to address gaps in understanding the internal quality and practical orientation of higher education programs.

**KEYWORDS:** Education, Higher Education, Education Policy, Transitional Economy, Economic Growth, Human Capital, University

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**JEL Code**: I23, O15, P20

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EJEBS

## 1. INTRODUCTION

In the context of rapid changes in the global economic landscape, higher education has become increasingly important as a crucial element of national development. Higher education serves not only to create and accumulate human capital but also to play an essential role in promoting innovation, social mobility, and international competitiveness. In several countries, including Kazakhstan, it is viewed not only as a means of building human capital but also as a strategic engine for innovation, technological advancement, and long-term success. However, international research indicates that the most significant benefits of higher education are realized in countries where it integrates seamlessly with the innovation economy and aligns with market demands, such as Finland, the United Kingdom, South Korea, and the Netherlands (OECD, 2024). In these countries, a system has been built to stimulate scientific research, commercialize knowledge, and train personnel flexibly to meet specific economic needs. However, in Kazakhstan, the actual contribution of higher education to economic growth remains a subject of debate, particularly in the context of institutional transformation and the transition to a knowledge-based economy.

One of the central problems is the discrepancy between the quantitative expansion of the system - the growth in the number of students and educational institutions - and its contribution to national development indicators, such as the growth in gross domestic product (hereinafter - GDP), employment, innovation potential, and the degree of social inequality. International studies emphasize that the effectiveness of higher education is determined not so much by its scale but by the quality of management, the degree of adaptation to labor market requirements, and integration into the national innovation system.

Considering Kazakhstan as a case study of a developing state under the stage of institution-building, this study focuses on quantifying the interrelationships between the higher education system and key socio-economic indicators. In particular, attention is paid to variables such as the unemployment rate, household incomes, research and development (hereinafter - R&D) expenditures, as well as the Gini coefficient, which reflects the degree of social inequality. It is assumed that the use of econometric tools can help identify non-obvious connections and dependencies, providing a new perspective on the role of higher education in the national development system.

Despite the formal successes and positive dynamics of individual indicators, there remains debate in the scientific community about the extent to which these transformations truly contribute to the growth of economic efficiency in the education system. One key problem remains the contradiction between the quantitative expansion of the system - an increase in the number of students, teachers, and institutions - and the relatively weak contribution to the country's GDP. The question arises: Does the current form of higher education development contribute to sustainable economic growth? Or is there a structural gap between educational goals and economic reality?

Thus, this paper approaches higher education not as an isolated sector but as a structural component of national development, one whose effectiveness is determined by its integration into the innovation-driven economy and alignment with labor market demands. Kazakhstan serves here as a representative case of a transition economy undergoing institutional transformation, shifting from a centralized administrative model to a market-oriented system. Institutional volatility, uneven reforms, and structural mismatches between educational outputs and the demands of the national economy mark this transformation.

In this context, higher education plays a crucial role by contributing to the formation of human capital, supporting scientific innovation, and promoting a knowledge-based, inclusive model of economic growth. This research aims to empirically investigate the relationship between the performance of

Kazakhstan's higher education system and key socio-economic indicators from 2004 to 2024, identifying systemic inefficiencies and potential directions for policy improvement.

## 2. LITERATURE REVIEW

Higher education plays a unique role in ensuring economic growth, social progress and government regulation. The development of human capital through education is considered one of the most critical factors for sustainable growth, particularly in post-industrial economies. Several scientific approaches exist to understanding the impact of education on economic and social indicators, including both theoretical and empirical studies. These approaches have evolved over time, reflecting shifts in academic perspectives, as well as the transformation of education systems under the influence of globalization and digitalization. Research on the relationship between education and growth began with classical economists' work on human capital, which laid the groundwork for neoclassical theories of human capital. According to their approach, investment in education is seen as an investment that increases individual productivity and, consequently, overall economic productivity (Becker, 1991). Later, endogenous growth theory was developed, which considers knowledge and education as internal engines of economic growth (Mincer, 1974; Lucas, 1988; Romer, 1990). Augmented neoclassical growth theories, such as those by Mankiw et al. (1992), emphasize education as a crucial component of human capital that enhances labor force productivity and raises long-term income levels. These theories have created a framework to explain why countries with high levels of education show more sustained growth. However, they have been criticized for focusing too much on quantitative indicators (enrollment rates, study duration), while underestimating the importance of educational quality and institutional conditions, as well as the context of the labor market.

Subsequently, researchers' attention shifted from classical models to empirical assessments of the impact of education on the economy. Methods for assessing the contribution of education to GDP growth, labor productivity, innovation, and social mobility have been particularly actively developed. Thus, some empirical studies of economic growth models emphasize the various mechanisms by which education influences economic growth (Acemoglu, 2009; Aghion & Howitt, 2009; Jones & Vollrath, 2013). In particular, Acemoglu (2009) emphasized the role of economic institutions as a fundamental cause of differences in economic development. In turn, Aghion and Howitt (2009) noted that higher education promotes innovation, particularly in economies transitioning to a post-industrial development path. Further, Jones and Vollrath (2013) found that a certain level of education can lead to a constant influx of new ideas, which allows education to influence long-term growth rates.

One of the most cited studies was a meta-analysis by Hanushek and Woessmann (2015), which demonstrated that the quality of education, as measured by international test scores, has a stronger impact on economic growth than the number of years of study. This has shifted the focus from quantity to effectiveness and content of educational systems. Additionally, Dragoescu (2015) examined the causal relationship between education, particularly higher education, and economic growth in Romania from 1980 to 2013 using a vector error correction model. Glewwe et al. (2014) found that education contributes less to economic development in sub-Saharan Africa compared to other regions, largely due to the lower quality of schooling. However, several studies have shown that the growth of educational indicators was not accompanied by corresponding economic growth (Delgado et al., 2014; Márquez-Ramos et al., 2019). This is due to the low quality of education, its gap with the economic structure, as well as insufficient institutional support.

Many studies emphasize that in developed countries, where deep institutional and

structural transformations are underway, the role of higher education is becoming increasingly ambiguous (Kubiatko & Halakova, 2009; Popescu & Crenicean, 2012; Charles & Issifu, 2015). Kubiatko and Halakova (2009) noted that the transformative impact of information and communication technologies on traditional educational practices has led to the emergence of new forms of learning. It is well known that developed countries, striving for sustainable economic growth and a high quality of life, give priority to the development of education, scientific research and innovation (Popescu & Crenicean, 2012). Complementing these findings, Charles and Issifu (2015) confirm the importance of introducing ICT into the educational process. An analysis conducted on a sample of 3,380 students from 24 public and private educational institutions in Ghana showed that the use of technology contributes to improving the quality of education, increasing student engagement, and improving preparation for real-world work. However, some studies indicate that the impact of expanding higher education on economic growth, productivity, and innovation is limited (Vitola & Erina, 2015).

Research in recent decades has highlighted that in transition economies, where deep institutional and structural transformations are underway, the role of higher education is becoming increasingly ambiguous (Larionova et al., 2018; Mkrtchian et al., 2020; Saparova et al., 2023). Unlike stable, developed economies, education operates in a distorted market environment here, characterised by institutional instability and limited innovation potential. An analysis of reports from international organizations reveals that the key factor for success in a transitional economy is institutional quality, the state's ability to establish sustainable mechanisms for interaction among universities, businesses, and government agencies (OECD, 2024; World Bank, 2024). Without this bundle, even high investments in education do not guarantee the desired economic effect.

The higher education system in Kazakhstan has been developing in the context of a transition economy and institutional transformation since the early 2000s. The country has actively implemented international standards and reformed its educational sector, including participation in the Bologna Process, the development of academic mobility, and the promotion of university autonomy. This demonstrates the desire to integrate into the global educational space and modernize the domestic system. However, researchers have noted that reforms have primarily been structural and formal while underlying problems inherent in the post-Soviet educational model persist (Tampayeva, 2015; Riklefs et al., 2018; Kireyeva et al., 2019). In particular, research shows that the key problems remain the low practice orientation of educational programs, limited communication between universities and employers, uneven quality of educational institutions, poor development of research and R&D in the university environment (Gubaydullina et al., 2016; Nurtayeva & Nurmukhanova, 2023; Urdabayev et al., 2024).

An analysis of domestic and international literature reveals that higher education is widely regarded as a crucial factor in economic development, particularly in post-industrial and transition economies. Neoclassical theories, such as those of Becker, Mincer, and Romer, suggest a direct relationship between the quality of education and sustainable economic growth through mechanisms including the accumulation of human capital, innovation, and increased labor productivity. However, in recent years, there has been a shift in emphasis from quantitative characteristics to quality of education, institutional conditions, and compliance with labor market requirements.

Despite the positive impact of Kazakhstan's reforms and integration into the global educational landscape, structural issues persist. Additionally, the experience of other transition economies demonstrates that even substantial investments in education do not yield significant economic benefits without effective

institutional coordination between the state and universities. There is a lack of empirical research that precisely quantifies the relationship between higher education and specific indicators, such as GDP, employment, R&D expenditure, and the Gini coefficient, in the context of Kazakhstan's economic transition. Therefore, this paper aims to fill this gap in scientific literature.

## 3. RESEARCH METHODS

To achieve the study's purpose and disclose the tasks set, an integrative approach to data analysis was employed, incorporating both statistical and econometric methods. At the initial stage, initial data was prepared and systemized, covering the period from 2004 to 2024. Official statistical data from reputable sources, such as the Bureau of National Statistics of the Republic of Kazakhstan, were utilised, along with statistical databases from the World Bank and materials from the OECD's annual reports.

The formation of a set of variables for analysis was based on the theoretical assumptions identified during the literature review, as well as empirical studies that highlighted the multidimensional impact of higher education on the country's economic and social development. Numerous studies emphasize that higher education promotes the growth of human capital, stimulates innovation and increases the competitiveness of the economy (Acemoglu, 2009; Aghion & Howitt, 2009; Hanushek & Woessmann, 2015). On this basis, variables were selected that reflect both the resource characteristics of the educational sector and the economic and social effects resulting from its functioning.

The set of variables used in the study are shown in Table 1 in more detail.

**Table 1.** Variables indicating units of measurement and data sources

| Code | Variable | Unit of measurement | Data source |
|---|---|---|---|
| GDP_edu | Education's contribution to GDP | Percentage of GDP | Bureau of National Statistics, World Bank |
| Stud | Number of students | Person | Bureau of National Statistics |
| Facul | Number of university teachers | Person | Bureau of National Statistics |
| Unempl_rate | Unemployment rate | Percentage of active population | Bureau of National Statistics, World Bank |
| Higher_ed_inst | Number of higher educational institutions | Units | Bureau of National Statistics, World Bank, OECD |
| Aver_income | Average income of the population | in tenge (KZT) | Bureau of National Statistics, World Bank |
| Expens_sc | R&D expenses | in tenge (KZT) | World Bank, OECD |
| Gini_index | The Gini coefficient | index (0 to 1) | Bureau of National Statistics, World Bank, OECD |

*Note:* compiled by author based on Bureau of National Statistics (2024), World Bank (2024), OECD (2024)

In this regard, the selected variables and the logic of their inclusion are shown below:

(1) education's contribution to GDP: The indicator was chosen as a key integral indicator reflecting the effectiveness of the educational system in terms of its contribution to the economy;

(2) number of students (students, undergraduates, doctoral students): an indicator that characterizes the coverage of higher education and the involvement of the population in the higher education system;

(3) the number of teachers in higher education institutions: the indicator reflects the

educational system's ability to provide an appropriate level of specialist training;

(4) unemployment rate: the indicator reflects the level of compliance of educational programs with the requirements of the labor market (including the educational potential of graduates);

(5) number of higher education institutions: the indicator characterizes the structural features of the higher education system and the level of regional distribution of educational infrastructure;

(6) average household income: an indicator of the level of accessibility and demand for educational services;

(7) R&D expenditure: the indicator reflects the level of innovation activity, which is closely related to the quality of education and its ability to generate innovation;

(8) Gini coefficient: an indicator that characterizes the degree of economic inequality, enabling the assessment of the social effectiveness of the educational system.

The presented set of variables reflects the nature of the interaction between education and key economic and social indicators, thereby enabling the construction of a comprehensive analytical model. Thus, the set of variables forms the basis for statistical and econometric analysis. These indicators were carefully selected, considering their importance for studying the economic and social impact of education. A detailed diagram of the methodology steps is shown in Figure 1, which clearly demonstrates the sequence of implementation of the methodological stages of the study, from the formulation of goals and the preparation of initial data.

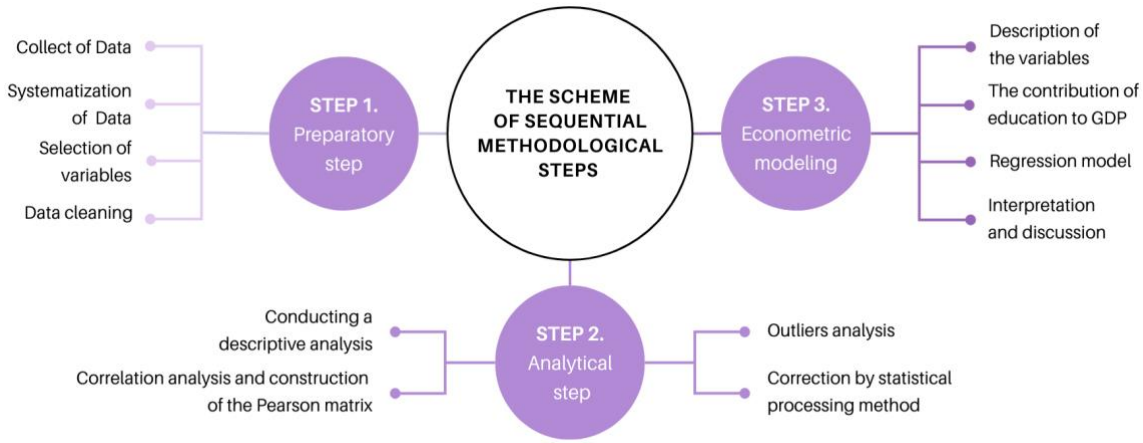


**Figure 1.** The scheme of the sequential methodological steps implemented in the study

The above diagram illustrates the sequence of methodological steps implemented in the study. Strict adherence to this logic has provided an integrative approach to analysis, starting with the preliminary preparation of data and ending in its in-depth statistical and economic interpretation. Using the methodology's step diagram will allow you to visualize the sequence and relationship of the analysis stages, such as data collection and preprocessing, descriptive analysis, correlation analysis, and the construction of regression models (stronger indicators). Furthermore, to determine the interrelationships between educational, economic and social variables, a complete matrix of paired Pearson correlation coefficients was constructed. This approach allowed us to establish the existence and strength of linear relationships between the studied indicators, as well as to identify the most significant variables affecting the economic contribution of education.

After forming a set of key variables and systematizing them, a descriptive statistical

analysis was carried out aimed at identifying common patterns and dynamics of changes and assessing the variability of data during the study period. Based on this, it is possible to track growth or decline trends, as well as evaluate the stability and volatility of indicators. Special attention is paid to the indicator of the contribution of education to GDP (GDP_edu), the dynamics of which are considered in the context of changes in other variables such as the unemployment rate, average income of the population, and R&D expenditure.

Table 2 presents summary statistics for all variables examined, highlighting key changes over a 20-year period.

**Table 2**. Summary statistics

| Year | Gdp_ edu | Stud | Facul | Unempl_ rate | Higher_ ed_inst | Aver_ income | Expens_ sc | Gini index |
|---|---|---|---|---|---|---|---|---|
| 2004 | 3,23 | 658106 | 40972 | 8,8 | 180 | 23128 | 11643,5 | 0,315 |
| 2005 | 2,26 | 747104 | 42333 | 8,4 | 181 | 28329 | 14579,8 | 0,305 |
| 2006 | 2,26 | 775762 | 43382 | 8,1 | 181 | 34060 | 21527,4 | 0,304 |
| 2007 | 2,63 | 768442 | 42788 | 7,8 | 176 | 40790 | 24799,9 | 0,312 |
| 2008 | 2,83 | 717053 | 41207 | 7,3 | 167 | 52479 | 26835,5 | 0,309 |
| 2009 | 2,59 | 633814 | 37814 | 6,6 | 143 | 60805 | 34761,6 | 0,288 |
| 2010 | 3,06 | 610264 | 39155 | 6,6 | 148 | 67333 | 38988,74 | 0,267 |
| 2011 | 3,59 | 620442 | 39600 | 5,8 | 149 | 77611 | 33466,82 | 0,278 |
| 2012 | 3,61 | 629507 | 40531 | 5,4 | 146 | 90028 | 43351,6 | 0,29 |
| 2013 | 3,9 | 571691 | 41224 | 5,3 | 139 | 101263 | 51253,1 | 0,284 |
| 2014 | 3,45 | 527226 | 41635 | 5,2 | 128 | 109141 | 61672,7 | 0,276 |
| 2015 | 3,43 | 477387 | 40320 | 5 | 126 | 121021 | 66347,6 | 0,278 |
| 2016 | 3,34 | 459369 | 38087 | 5,1 | 127 | 126021 | 69302,9 | 0,278 |
| 2017 | 3,56 | 477074 | 38241 | 5 | 125 | 142898 | 66600,1 | 0,278 |
| 2018 | 3,39 | 496209 | 38212 | 4,9 | 122 | 150827 | 68884,2 | 0,287 |
| 2019 | 3,15 | 542458 | 38275 | 4,9 | 124 | 162673 | 72224,6 | 0,289 |
| 2020 | 3,35 | 604345 | 38470 | 4,8 | 125 | 186815 | 82333,1 | 0,29 |
| 2021 | 4,45 | 576557 | 36307 | 4,9 | 125 | 213003 | 89028,7 | 0,291 |
| 2022 | 4,39 | 575511 | 36378 | 4,9 | 122 | 250311 | 109332,7 | 0,294 |
| 2023 | 4,46 | 578237 | 36404 | 4,9 | 116 | 309697 | 121560,1 | 0,285 |
| 2024 | 4,63 | 592694 | 37391 | 4,7 | 112 | 364295 | 172585,9 | 0,29 |

*Note*: compiled by author

Based on the above, pre-cleared statistics were used in the study to ensure the reliability and accuracy of the analysis. This step was necessary to eliminate possible errors related to missing data, outliers, or inconsistencies in methodological approaches across different data sources. Using purified information minimizes the risk of statistical errors and increases the accuracy of estimates of relationships between variables, ensuring the comparability of indicators over time. Purification of data is an integral part of the analytical process, particularly in long-term panel studies, where even small deviations can affect distribution structures and final conclusions. Therefore, the use of refined statistics aims to increase the validity and reliability of subsequent econometric calculations and interpretations.

## 4. RESULTS

Public policy in education plays a crucial role in shaping an accessible, high-quality, and effective educational system that addresses the challenges of globalization, digitalization, and socio-economic development. It determines the state's strategic priorities in education, funding mechanisms, quality standards, and measures for the integration of graduates into the labor

market. In recent decades, Kazakhstan has implemented a number of reforms aimed at modernizing higher education. One of the key areas of reform in recent years has been the reduction in the number of higher education institutions, aimed at concentrating resources, improving the quality of educational services, and strengthening control over compliance with academic standards. This has been accompanied by structural changes to the teaching staff, due to increasing demands on qualifications and increased competition for academic positions. Despite the quantitative reduction in numbers, there has been an increase in attention to research activities, as evidenced by the rise in graduate and doctoral student enrollment.

In this context, it is necessary to conduct a comprehensive assessment of the interrelationships between key variables that reflect the state and dynamics of the education system. These variables include the number of students and teachers, the unemployment rate, household income, R&D expenditure, inequality indicators, and the contribution of education to the country's GDP. Correlation analysis, which involves calculating correlation coefficients, enables the identification of the strength and direction of linear relationships between variables. This provides an empirical basis for constructing regression models and forming scientifically grounded conclusions.

Understanding correlations enables us to determine which aspects of educational policy have the greatest impact on the economy and social sphere, as well as identify possible contradictions and problem areas that require adjustments in government policies and development strategies. Additionally, the results obtained enable us to formulate recommendations for priority areas of educational policy, focusing on sustainable development and the efficient utilisation of the country's intellectual potential. Thus, to identify the relationship between the variables presented in the study, a correlation matrix was constructed (Table 3).

**Table 3.** Correlation matrix

| **Variable** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** | **(9)** |
|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | | | | | | | | |
| Student | -0,657 | 1 | | | | | | | |
| Facul | -0,815 | 0,560 | 1 | | | | | | |
| Unemp_rate | -0,899 | 0,814 | 0,702 | | | | | | |
| Higher_ed_ inst | -0,933 | 0,839 | 0,799 | 0,964 | 1 | | | | |
| Aver_income | 0,937 | -0,459 | -0,769 | -0,738 | -0,814 | 1 | | | |
| Expens_sc | 0,927 | -0,500 | -0,732 | -0,756 | -0,833 | 0,987 | 1 | | |
| Gini index | -0,450 | 0,744 | 0,426 | 0,692 | 0,674 | -0,283 | -0,331 | 1 | |
| Gdp_edu | 0,817 | -0,544 | -0,700 | -0,735 | -0,749 | 0,841 | 0,820 | -0,358 | 1 |

*Note*: compiled by author

The results showed that the contribution of education to GDP is most strongly correlated with macroeconomic indicators reflecting the country's overall development, such as the average income of the population (r = 0.841) and the amount of research and development expenditures (r = 0.820). All of this may be related to institutional reforms, increased investment in human capital, and the development of higher education infrastructure. At the same time, negative correlations of GDP_edu with a number of indicators were revealed: the number of students (- 0.544), the number of university teachers (- 0.700), the unemployment rate (- 0.735) and the number of higher education institutions (- 0.749). In other words, the quantitative growth of the higher education system does not lead to an increase in its contribution to GDP. These dependencies may indicate that the quantitative expansion of the educational sector does not always lead to a rise in its economic effectiveness, especially in conditions of uneven quality of training,

fragmentation of resources and insufficient adaptation of educational programs to the requirements of the labor market.

The results obtained suggest that there are structural contradictions in the higher education system. A corresponding increase in economic returns does not accompany an increase in enrollment and institutional capacity. Higher education is not an isolated field, but it is closely integrated into the broader context of economic development. The contribution of higher education to GDP proves to be more sensitive to economic conditions than to internal quantitative parameters of the system. This indicates that its effectiveness depends on the degree of involvement in the innovative economy, the level of research funding, and the effective demand of the population.

The weak connection between the expansion of educational infrastructure and economic growth suggests that the current model of management and regulation in higher education is not effectively transforming educational resources into economic benefits. There is a need to not only scale up but also improve the mechanisms for coupling education with the labor market and create incentives for universities to integrate into innovative value chains.

Based on the results of the correlation analysis, the variables with the strongest correlation with the indicator of education's contribution to GDP were identified. Linear regression models were constructed for further in-depth analysis of these key factors, such as the number of students, teaching staff, unemployment rate, and the number of higher education institutions. The purpose of the regression analysis was to determine the nature and direction of the influence of these variables on the economic efficiency of the higher education system. The obtained models enable a more accurate assessment of the impact of each variable on the target indicator, as well as the identification of potential structural limitations and growth opportunities in the educational sphere.

The regression results presented in Figure 2 reveal a statistically significant negative impact of both student enrollment and faculty size on GDP contribution from education.

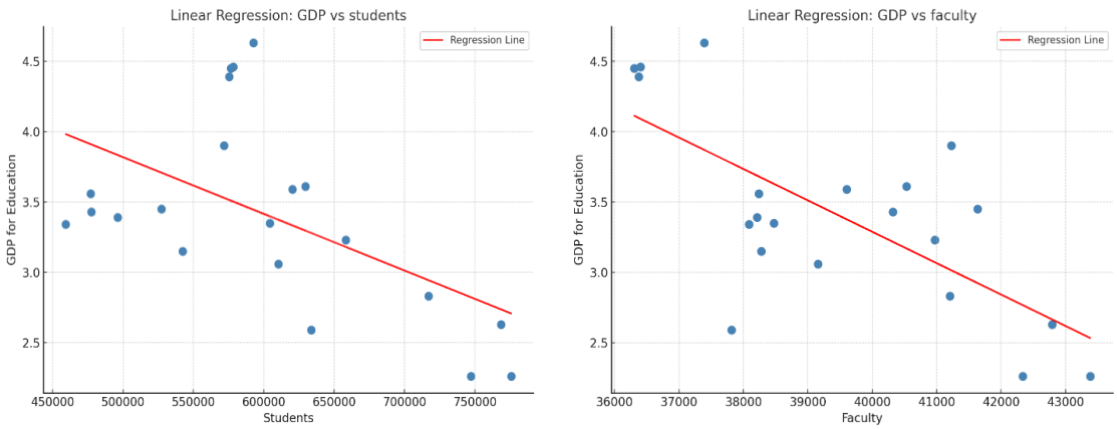


**Figure 2.** Relationship between student and faculty numbers and GDP contribution to education

The results of the linear regression models estimate the impact of the number of students and teaching staff on the economic contribution of the educational sector, measured through its share of GDP. Thus, both regression lines indicate that the predominance of quantitative growth without systematic quality support and strategic management does not ensure an increase in the economic efficiency of higher education. The estimates obtained indicate a statistically significant negative relationship between the independent variables and the target indicator. In particular, the increase in the number of students is associated with a

decrease in the economic impact of higher education. The growing number of students may be accompanied by an overload of the educational system, a lack of funding, or insufficient market demand for graduates. Similarly, an increase in the number of teachers also does not lead to an increase in sector's contribution to GDP, which may indicate inefficient use of human resources. This dependence may lead to a decrease in return on additional human resources, especially if growth of teaching staff is not accompanied by corresponding improvement in working conditions, motivation or quality of educational programs. These findings highlight the need for reviewing priorities of educational policies, focusing on institutional reforms, strengthening link between education and labor market, as well as developing mechanisms for assessing and improving university performance.

The regression results presented in Figure 3 reveal a statistically significant negative impact of both unemployment rate and higher education institutions on GDP contribution from education.

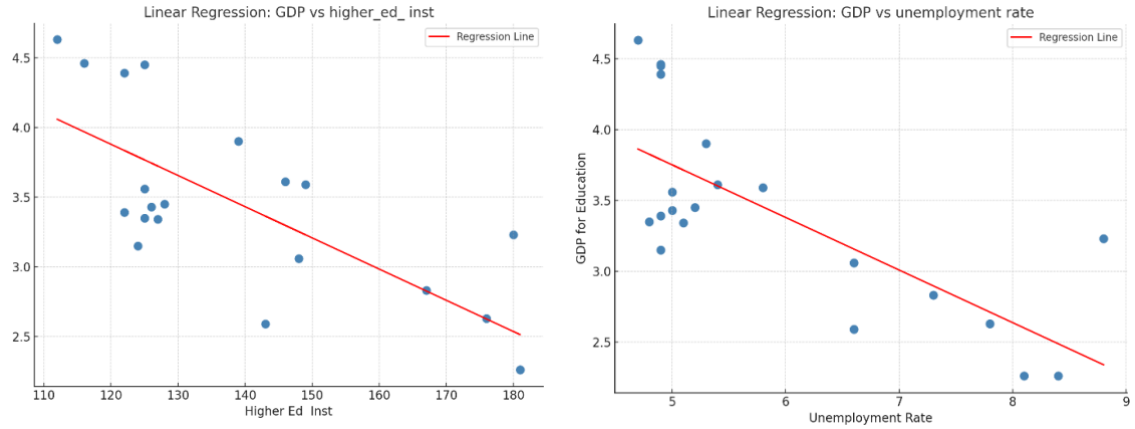


**Figure 3.** Relationship between unemployment rate and higher education institutions and GDP contribution of education

The results of a linear regression aimed at assessing the impact of unemployment rates and the number of higher education institutions on economic impact, measured through their contribution to GDP, demonstrate a downward trend in both regression lines. This indicates that increasing unemployment negatively affects the efficiency of the higher education system, which may be due to inconsistencies in personnel training structures with labor market requirements, poor adaptation of education programs to changing economic conditions, and a decrease in population motivation to invest in education due to limited employment opportunities. Furthermore, growth in university numbers does not necessarily lead to increased sectoral contributions to GDP. This could indicate fragmentation of education resources, uneven university quality, lack of standardization, and low concentration of scientific and financial potentials. At the same time, an increase in the number of institutions without proper institutional control and system policies can reduce the overall effectiveness of the system. This is clearly illustrated by the graph. The dependencies presented indicate that without high-quality coordination between the education system, labor market, and innovative economy, growth in institutional indicators can lead to a reduction in their actual contribution to the country's economy.

The drawing consists of two parts: the left panel and the right panel (see Figure 4). The left panel presents the results of cluster analysis based on principal component analysis (PCA) followed by the application of the K-means method for the number of clusters K=3.The clusters obtained demonstrate a clearly defined

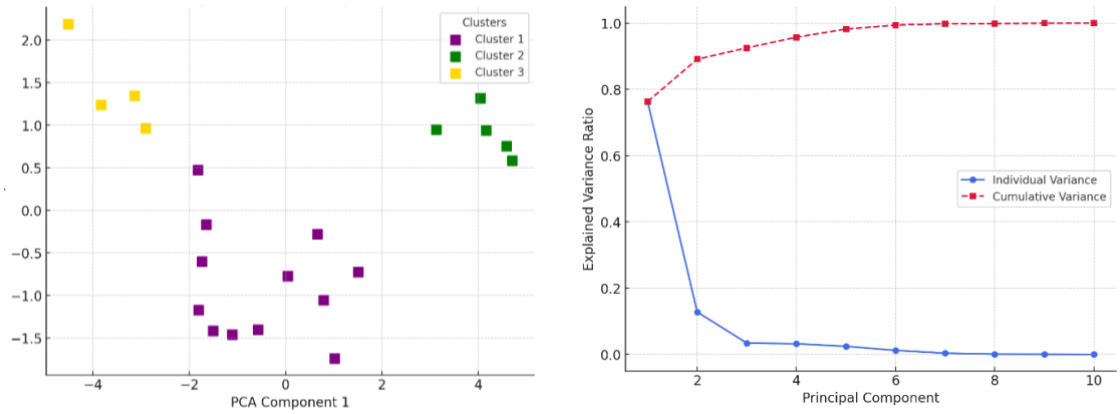


**Figure 4.** Clustering of education-related indicators based on PCA and Scree Plot

segmentation, reflecting the presence of three stable groups with different levels of effectiveness of the higher education system. These groups can be interpreted as clusters with similar characteristics in terms of the contribution of education to GDP, the unemployment rate, R&D spending, and household income. The identification of such groups makes it possible to substantiate the need for a differentiated approach to developing educational policy and prioritising investments in human capital. The right panel presents a Scree Plot showing the proportion of explained variance of each significant component. It can be seen from the graph that the first two components account for the most significant part of the variation, which justifies their use for visualizing clusters. The sharp decrease in the explained variance after the second component confirms the expediency of using a limited number of components in interpreting the data structure.

## 5. CONCLUSIONS

The purpose of this study was to examine the relationships between the development of Kazakhstan's higher education system and key socio-economic indicators for the period from 2004 to 2024. A review of scientific literature has shown that classical theories of human capital formed the basis for modern approaches to analyzing the role of education in sustainable economic growth. However, the emphasis in modern empirical research shifted, and research on countries with economies in transition was of particular interest due to the institutional instability and fragmentation of their education systems, which reduced the return on investment in human capital.

The results of the correlation analysis revealed several contradictions in Kazakhstan's higher education system. Despite an increase in the number of students and teachers, as well as universities, these quantitative indicators have a negative relationship with the economic contribution of this sector, specifically its contribution to GDP. However, indicators such as R&D spending and household income growth have a positive impact, indicating that the effectiveness of higher education is dependent on innovation and the economic environment.

The experience of Kazakhstan, as a country undergoing a transition to a market economy, demonstrates that formal reforms and the adoption of external standards, without creating a stable institutional environment, are insufficient to achieve the desired economic outcomes. Despite structural transformations aimed at integrating education into the global economy, there remains a lack of mechanisms to ensure the practical orientation of education and its integration with innovative economies.

The regression models constructed in the study demonstrated statistically significant negative correlations between the contribution of higher education to GDP and several quantitative indicators of the system. Regression analysis confirmed that quantitative parameters alone do not lead to an increase in efficiency, and emphasized the need to focus on qualitative and institutional aspects of education development. This serves as an essential argument in favor of a reorientation of public policy: from increasing the number of students to creating a highly effective, adaptive and economically closely related educational environment.

Based on the presented results, state policy in higher education requires revision of emphasis: from extensive growth and harmonization of regulations. A transition from formal expansion of the system to qualitative transformation is needed, involving the development of internal motivation for innovation among universities, responsibility for the employment of graduates, and active involvement in national and regional strategies. In a transitional economy, this implies the need for a flexible, sustainable education system capable of producing knowledge and transforming it into economic value.

The results obtained in this study raise several important issues that require further scientific investigation. Future research could focus on the internal structure of educational programs and the extent to which they are practice-oriented and meet the specific requirements of various industries. Additionally, regional analysis is a promising area, enabling the identification of differences in the effectiveness of higher education across multiple parts of the country. This is especially important for Kazakhstan, where there is a significant territorial differentiation in terms of socio-economic development, accessibility to educational services and innovation activity. Finally, the empirical base should be expanded to include data on the quality of education, such as international university rankings, test results, graduate employment rates, and the level of scientific publications.

## AUTHOR CONTRIBUTION

Writing – original draft: Anel A. Kireyeva.
Conceptualization: Anel A. Kireyeva.
Formal analysis and investigation: Anel A. Kireyeva.
Development of research methodology: Anel A. Kireyeva.
Resources: Anel A. Kireyeva.
Software and supervisions: Anel A. Kireyeva.
Data collection, analysis and interpretation: Anel A. Kireyeva.
Visualization: Anel A. Kireyeva.
Writing review and editing research: Anel A. Kireyeva.

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## AUTHOR BIOGRAPHIES

***Anel A. Kireyeva** – Cand. Sc. (Econ.), Professor of the University, University of International Business named after K. Sagadiyev, Almaty, Kazakhstan. Email: kireyeva.a@uib.kz, ORCID ID: https://orcid.org/0000-0003-3412-3706