“Analysis of the development level of higher educational institutions in the regions of Kazakhstan”

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ANALYSIS OF THE DEVELOPMENT LEVEL OF HIGHER EDUCATIONAL INSTITUTIONS IN THE REGIONS OF KAZAKHSTAN

Abstract

Higher education institutions are the core of the nation's vocational education. This study aims to analyze the features of higher education institutions and their functioning in all Kazakhstan regions, allowing equal access to high-quality and necessary education. The data were collected from official statistical data by the Statistical Bureau of Kazakhstan and other official statistics for 2002–2021. The collected data were processed, and multivariate regression equations for each Kazakhstan region were constructed using the EViwes10 Atlas.ti software to illustrate the algorithm and hierarchy of the educational system of Kazakhstan. The regression results showed that in some regions, the relationships are differentiated, and the correlation values indicate a significant relationship between the indicators. In particular, Akmola, Karaganda, Kostanay, North Kazakhstan, Astana city, and Almaty city demonstrated strong relationships between the indicators. 11 out of 17 created models were excluded from the evaluation process due to the absence or low connection with the dependent factor, the lack of statistical significance of the coefficients, and the low level of reliability of the models obtained. In turn, within particular regions, the degree of such a relationship was weak. Moreover, there are grounds to assert the need to stimulate public policy and implement systemic measures to create favorable conditions to strengthen educational potential.

Keywords education, social capital, higher education institutions, students, education analysis

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INTRODUCTION

In recent years, due to the crisis and post-Covid-19 consequences, the world has changed from the traditional view of understanding the acquisition of knowledge to a more advanced form of obtaining knowledge through various programs and applications – online learning. To date, all functioning schools and universities have shown their ability to adapt quickly to these changes. However, special attention should be paid to educational services' quality and content since the basis of intellectual potential is nothing but the level and quality of education of society and nation. The world is experiencing an oversaturation of information flows from various communication sources, ranging from social networks to specialized platforms. Ultimately, all this leads to the confusion of those in search of information directly, especially students of different generations, in the question of what is right and what is needed. Timely and proper control, for example, by the government, interested persons such as a student or a teacher, can increase society's intellectual potential. Therefore, for each country, developing intellectual potential is one of the state policy priorities and the key to economic growth, starting from preschool institutions to getting a professional training.

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Higher education is a strategic resource, thanks to which the state can be competitive on the global labor market. Also, higher education testifies to the professional and cultural level of a significant part of the population, especially young people. The desire of young people to obtain higher education in the regional context is especially relevant with the increasing modern role of the educational system in the socio-economic development of society and the state. This is also because higher education is the basis for the stability of the state in the long term.

Despite the importance and necessity of higher education institutions for society, there has been a tendency to reduce the number of functioning higher education institutions in the regions of Kazakhstan. This trend can be explained by the increasingly growing competition at the regional and global levels or the strengthening of qualification requirements for licensing higher education institutions. In addition, in the middle of 2022, Kazakhstan's educational system underwent radical reform for the first thirty years of operation, which continues to this day. Now, at the state level, two ministries govern the educational system. Thus, higher education institutions in Kazakhstan are now subordinate to a separate ministry and require unique management and functioning mechanisms involving interested departments, mainly engaging foreign individuals and organizations. In developing these relations, the functioning of universities in the regions needs to be studied more.

For the full and competitive functioning of universities, it is necessary to improve the management mechanism through the expansion of academic and managerial independence, updating educational programs taking into account the professions of the future, infrastructure development at the regional and national levels, and the development of a digital ecosystem.

1. LITERATURE REVIEW

In current conditions, further innovative development and achieving high competitiveness in the country's economy are among the priority areas, and the quality of human capital largely determines their success. At the same time, modern society is in a state of constant changes that have contributed to the social adaptation of the population to new conditions. This is especially true for improving the quality of human resources by developing educational potential and social resources. The social processes occurring in the modern world objectively lead to an awareness of the importance of education, which plays a significant role in the country's development. As a result, education functions are transformed: attention is focused on the formed and stable socio-value elements of educational activity. Thus, the issues of education development and educational potential inspired many authors who argued that the main characteristics of educational systems had undergone fundamental changes, one of which is a comprehensive "competitive" education system (Cotgrove, 2020).

It is necessary to form and enhance the educational potential of younger generations. Getting and improving education by young people, firstly, are processes of accumulation of human capital, and secondly, they cause an increase in their cultural level. In general, it is crucial to study the influence and role of the educational system for the population in the context of preschool, school, secondary, higher, and postgraduate education. Thus, studies on the short- and long-term impact of preschool education on the learning and development of young children are relevant (Barnett, 1992; Magnuson et al., 2004; Zigler et al., 2006). Collier (1995), Prauzner (2017), Gil-Flores et al. (2017), and Ibrokhimovich et al. (2022) noted that factors affecting school education, such as information and communication technologies, natural sciences, and language subjects, are significant in assessing educational potential. In turn, Aron and Loprest (2012) and Michielsen and Brockschmidt (2021) evaluated the school education system of students with disabilities and the need for their education.

The competitiveness of higher educational institutions significantly contributes to the development of educational potential theoretically and methodologically. Thus, Barnett (1990) proposed a new approach to the theory of education, covering the

debate in the field of social view based on a deep study of culture, rationality, research, and academic freedom in higher education. Meyer et al. (2007) considered higher education as a factor influencing social values and society through the socialization of individuals. When considering the contribution of universities to the development of human and social capital through education and training, it is likely to have a much more significant impact than the production of scientific knowledge alone (Pinto et al., 2015).

Watson and Mathew (2021) viewed social capital and social background as essential factors affecting students' education level to a greater extent than the type of school. In some studies, when assessing the level of education in higher education institutions, a critical significance was placed on technical equipment, administrative management, financial and other narrow academic components (Heck et al., 2000; Barr & McClellan, 2011; Alyahyan & Duştegör, 2020). Nevertheless, there was only a fragmentary approach, which did not consider the importance of studying the results of higher education institutions and their impact on educational potential.

Various opinions exist in the scientific literature about how universities can increase their incomes. Some researchers believe that income growth, mainly due to higher tuition fees, is a process of replacing the attraction of external financial resources due to reduced public spending on education. However, Mughan et al. (2022) and Monk (2012) believe that investing in higher education is a critical factor in developing society and the nation, as shown by the example of the growth of countries such as the "Asian Tigers." According to Geiger (2000) and Thanassoulis et al. (2011), high education means an increase in the level of human capital, which should lead to an increase in the population's income.

Universities play an essential role in the region, influencing knowledge generation, social development, technology transfer, and commercialization of innovations. Thus, Lendel (2010) conducted a detailed review of the relationship between the higher education system and regional development. Most papers highlight the important role of higher education institutions in local and regional development. For example, Schiuma and Lerro (2010), Harrison and Turok (2017), Faggian et al. (2019), Mellander and Florida (2021), and Fonseca and Nieth (2021) adhere to the socio-constructivist view of human capital development studying regional development through the presence of educational institutions and the contribution of universities.

A detailed literature review shows that various indicators assess educational potential's contribution to regional development. In particular, some studies aimed at assessing the impact of educational potential, considering the influence of social factors affecting the population's well-being. Part of the papers assessed educational potential from preschool to postgraduate education. Moreover, finally, papers that examined the statistical significance and signs of regression coefficients confirming the positive impact of universities on the economy of developed regions and megacities are fundamental in this study. Since universities play an essential role in the region, influencing not only traditional educational processes but also the social well-being of the population is vital.

2. AIM AND HYPOTHESIS

This paper aims to analyze the development level of higher education institutions in the regions of Kazakhstan based on selected variables. In this regard, the following hypothesis is put forward:

H1: The selected education indicators affect the number of functioning higher education institutions in the regions of Kazakhstan.

3. METHODS

The paper evaluates the contribution of universities to regional development based on available and open data from the statistical yearbooks of Kazakhstan's regions from 2002 to 2021 to assess the degree of mutual influence. A matrix of correlation coefficients was used to construct a multivariate regression model. The dependent variable is the number of functioning universities in Kazakhstan, unit (Y). To verify the set goal, fixed factors of the proposed model (dependent variables) are presented in Table 1.

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Table 1. Regression model factors

Source: Authors' compilation.

Code	Variable	Unit of measurement
Y	Number of functioning universities	unit
X1	Number of students at all levels of higher education at the beginning of the academic year	count
X2	Number of the teaching staff of higher education organizations	count
X3	Current income of universities	bln. KZT
X4	Current expenses of universities	bln. KZT
X5	General coverage of higher education in the region	percentage
X6	Number of accepted students at all levels of higher education at the beginning of the academic year	count
X7	Number of graduates at all levels of higher education at the end of the academic year	count
X8	Youth unemployment rate (15-28 years old)	in percentage

A regression analysis is carried out for each independent factor, in which special attention is paid to the correlation assessment. To ensure high reliability of calculations, the EViews 10 program was used – a statistical package mainly for the analysis of econometric time series data, analysis and modeling of panel data, and the construction of regression models. The regression analysis algorithm is presented in Figure 1 and is implemented in the EViews 10 program.

The analysis includes several stages. The first is the construction of the correlation matrix. A correlation matrix is created for each region separately. The correlation coefficient is obtained from the pairs of observations extracted from the two-dimensional normal distribution $(x_1, y), ..., (x_n, y)$ for all the presented regions.

The second is the exclusion of unrelated factors based on the correlation. Related factors include those correlation coefficients that show a value above 0.800. If at least one factor shows above 0.7 among X_1-X_8, the region is included in the construction of the model. Further, an assessment of the degree of influence of all factors on the number of functioning universities is carried out with regions with a strong connection.

The third is correlation estimation. The indicators of R-square, adjusted R-square, F-statistics, and Probability (F-statistics) are studied. R-square is a universal measure of the dependence of one random variable on the parameters X_1-X_n. It is usually equal to the square of the correlation coefficient between Y and X. Adjusted R-square defines the percentage of variance in the destination field,

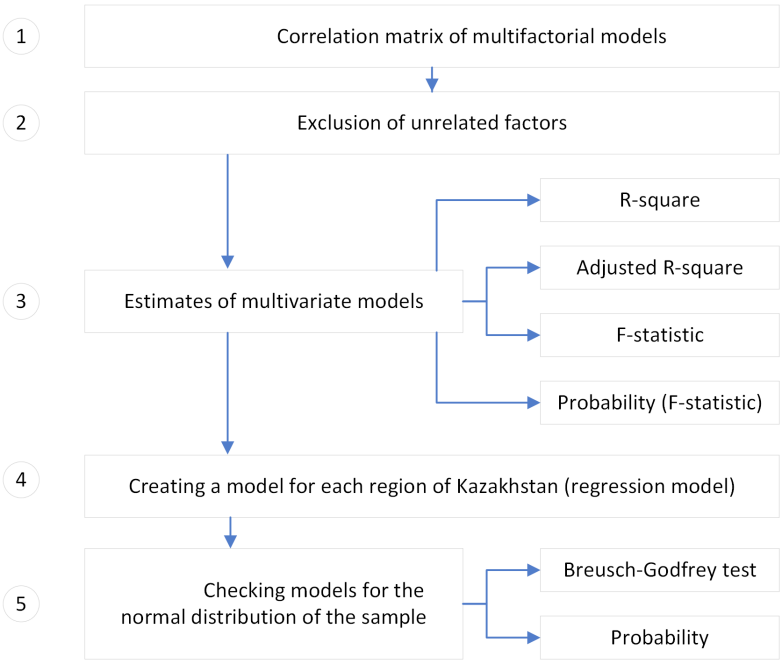

Figure 1. Stages of scientific research

explained by the input variables X_1-X_n. Those regions where the coefficients were higher move to the next stage 0.800.

Fischer's F-criteria is not accepted if $P \leq \alpha$, and if $P > \alpha$, it is accepted. Here α is the level of potential error of the first order and the selected significance. The calculation results are considered reliable according to probability $\gamma = (1 - \alpha)\%$, and $\alpha = 0.05$. In these calculations, the entire sample P = Prob (F-statistical) = 0.0000 < 0.05. This means that the general equalities are statistically significant. F-statistical obeys the Fisher distribution (a two-parameter family of absolutely continuous distributions) and is determined by the formula (1):

$$F = \frac{Y_1 / d_1}{Y_2 / d_2}, \quad (1)$$

where d_1 and d_2 – degrees of freedom.

The fourth stage is creating a multiple regression model for each region of Kazakhstan. The coefficients of the regression equation are determined by the following formula (2):

$$\begin{aligned} Y = {} & C(1)\cdot X_1 + C(2)\cdot X_2 + C(3)\cdot X_3 + \\ & + C(4)\cdot X_4 + C(5)\cdot X_5 + C(6)\cdot X_6 + \\ & + C(7)\cdot X_7 + C(8)\cdot X_8 + C(9), \end{aligned} \quad (2)$$

where Y – the observed factor, $\boldsymbol{X}_n$ – the value of variable C, the independent factor.

The fifth is checking the residuals for autocorrelation. The Breusch-Godfrey test is conducted. The test is based on the following idea. If there is a strong and positive correlation between neighboring observations, the value of the coefficient p will be very different from zero by the following formula (3):

$$e_t = p \cdot e_{t-1} + v_t, \quad t = 1, \ldots, n, \quad (3)$$

where e_t – these are the regression residuals calculated by the least squares method.

The analysis is based on secondary data for 2002–2021 from the Bureau of National Statistics, the National Bank of Kazakhstan, and other official statistical bodies and reporting indicators. Thus, due to data limitations, indicators up to 2001 were not included in the sample. The results are analyzed in interrelation, contributing to the achievement of comprehensiveness, reliability, and completeness of scientific research and for the derivation of proven conclusions.

4. RESULTS

4.1. Statistical analysis of Kazakhstan's higher education structure

Over the past twenty years, Kazakhstan's higher education system has been constantly reformed to adapt to the pan-European one, where education is considered a way of mastering effective means of obtaining knowledge and acquiring self-education skills. Current challenges require comprehensive development of educational potential based on an educated society, social capital, and the high quality of competence of the population. In other words, the higher education system in Kazakhstan should be focused on moving away from old approaches, such as bureaucracy and technocracy, and orientation to memorization and reproduction of academic knowledge. New trends in higher education, especially after the influence of Covid-19, have shown the relevance of the transition from the traditional format, considering the formation of future specialists' competence. The reorientation to social values and the coverage of education by various social strata of the population have become essential landmarks.

Nevertheless, there is a complex structural organization of the education system in Kazakhstan, which requires the search for new original ways to solve its problems and further development. The development of strategic approaches and management decisions on the development of educational potential requires a detailed analysis of its structure. Therefore, one of the state policy initiatives for 2016–2019, the primary goal is to ensure equal access to quality education and training at all levels of education. The solution to the problems of preschool education coverage is a social task, and the success of the implementation of this policy lies in the maximum coverage of preschool education for children 3-6 years old. Further, a special place in Kazakhstan's education structure is

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given to the school, technical, and special education (from 10 to 18 years).

Considering national specifics, the search for new original ways to solve its problems is being carried out. Nevertheless, developing national strategies for education requires a comprehensive analysis of past and current situations with a focus on the country's internal needs. A critical indicator characterizing the current situation in education is the dynamics of the number of higher educational institutions in Kazakhstan. Most regions of Kazakhstan have shown a decrease in the number of universities over the past 20 years. Thus, Table 2 presents a comparative analysis of the ratio dynamics in 2002, 2010, 2011 and 2021.

There has been a decline in the number of universities across the country from 177 to 149 (–16%), and in 2021, they amounted to only 122 higher education institutions (–31%). Until 2015, the country pursued a policy to reduce the number of universities by merging, absorbing, and liquidating higher education institutions and forming specialized educational centers following their territorial location. In this regard, the reasons for a negative reaction can be objective and subjective.

The objective reason follows from the fact that the affiliated university, as a rule, has lower performance indicators and can negatively affect the parent university's competitiveness. Objective reasons also include the requirements of state policy for closer involvement of higher education institutions in economic and social development and the transition of domestic higher education institutions to the requirements of the European Higher Education Area, according to the Bologna Declaration. Many higher education institutions do not get applicants, and funding is economically unprofitable.

The subjective reasons are interpersonal relationships, individualistic managerial decision-making, increased internal competition, excessive subjectivity in assessing the criteria for the inefficiency of higher education institutions, and reaction to increased competition between universities in the region. So, for 2002–2011 and 2012–2021, the worst indicators were recorded in four regions: Kyzylorda (–29% and –25%), Mangystau (–25% and –33%), East Kazakhstan (–17% and –30%), and Shymkent (–38% and –33%).

In Astana city, there has been more than a twofold increase in higher education institutions over the study period. An increase in the number of universities in Astana city with the improvement in the demographic situation has led to an increase in the number of students in this region. However, it may also encourage higher education institutions to

Table 2. Dynamics of changes in the number of universities by region from 2002 to 2010 and 2011 to 2021

Source: Bureau of National Statistics (n.d.).

Region	2002	2010	Growth rate, %	2011	2021	Growth rate, %	Overall growth rate, %
Akmola	7	6	–14	6	4	–33	–43
Aktobe	6	8	33	8	6	–25	0
Almaty	3	2	–33	2	2	0	–33
Atyrau	3	3	0	3	3	0	0
West Kazakhstan	5	4	–20	4	4	0	–20
Zhambyl	4	5	25	5	2	–60	–50
Karaganda	14	13	–7	13	9	–31	–36
Kostanay	8	7	–13	7	6	–14	–25
Kyzylorda	7	5	–29	4	3	–25	–57
Mangystau	4	3	–25	3	2	–33	–50
Pavlodar	4	4	0	4	4	0	0
North Kazakhstan	4	2	–50	2	2	0	–50
Turkestan	4	2	–50	2	3	50	–25
East Kazakhstan	12	10	–17	10	7	–30	–42
Astana city	7	13	86	14	15	7	114
Almaty city	69	52	–25	47	42	–11	–39
Shymkent city	16	10	–38	12	8	–33	–50

tighten requirements for applicants and dictate unfair competition with corporate or political interests. These changes may lead to a change in people's social attitudes about improving the quality of education and qualifications in higher education institutions.

When studying the dynamics of the functioning of higher education institutions in the regions, several important points were revealed concerning the Kazakh system. First, the mass character of higher education is associated not so much with the desire of young people for knowledge but with the prevailing idea that higher education is a prerequisite for belonging to the middle class. In addition, according to the annual statistical data, the total number of students in higher education institutions will be more than 800 thousand people in 2026, which is 39.3% higher than in 2021 (Bureau of National Statistics, n.d.). Therefore, it is essential to remember that Kazakh higher education institutions will not be able to accept so many students in a couple of years. To test this opinion, this study applies econometric calculations.

4.2. Correlation matrix of multifactorial models

As the correlation matrix shows, the number of functioning higher education institutions in the regions is significantly influenced by the number of students at all levels of higher education at the beginning of the academic year (regression X_1) in Akmola, Karaganda, Kostanay, Kyzylorda, North Kazakhstan, East Kazakhstan regions, and in Astana city. There is a relationship between the dependent factor and the number of students at all higher education levels at the beginning of the academic year. The number of teaching staff of higher education organizations (regression X_2) shows an equally close relationship with the dependent factor in the Karaganda, Kostanay, North Kazakhstan, East Kazakhstan region, and Astana city.

The current income and expenses of universities (regressions X_3 and X_4) have a strong negative correlation only in three regions of Kazakhstan (Akmola, North Kazakhstan, and Almaty city). This means that, despite the reduction in the number of functioning universities in Kazakhstan, the current income and expenses of universities are increasing. This is because smaller universities in these regions have merged and enlarged, but their current expenses and incomes have remained the same or decreased.

The total coverage of higher education in the region (regression X_5) shows a close relationship with the dependent factor only in the Mangystau region, just as the number of graduates at all levels of higher education at the end of the academic year (X_7) shows a close relationship only in Astana city. Furthermore, the number of students enrolled at all levels of higher education at the beginning of the academic year (X_6) has a close relationship with the number of functioning higher education institutions in four regions, while the unemployment rate among young people aged 15-28 (X_8) in seven regions of Kazakhstan.

For further calculation, correlation coefficients (greater than 0.79) are selected, which are used for further analysis and model construction. Moreover, regions in which correlation coefficients for independent factors show results below 0.79 are considered. The correlation matrix is presented in Table 3.

Thus, due to the low correlation coefficients with the dependent factor Y, a regression model cannot be built for the Aktobe, Almaty, Atyrau, West Kazakhstan, Zhambyl, Pavlodar, and Turkestan regions. Correlation analysis shows that in Akmola, Karaganda, Kostanay, Kyzylorda, Mangistau, North Kazakhstan and East Kazakhstan regions, Astana city, and Almaty city, indicators show a high correlation (above 0.800). The number of functioning universities in Kazakhstan directly depends on the following indicators:

- the number of students at all levels of higher education at the beginning of the academic year,
- the number of teaching staff of higher education organizations,
- current income and expenses of universities,
- the total coverage of higher education in the region,
- the number of accepted students at all levels of higher education at the beginning of the academic year,

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Table 3. Correlation matrix of multifactor models by regions of Kazakhstan for 2002–2021

Source: Authors' compilations.

Region	X1	X2	X3	X4	X5	X6	X7	X8
Akmola	0.82	0.28	–0.89	–0.86	0.01	0.77	0.17	0.81
Aktobe	0.27	0.40	–0.36	–0.39	–0.36	0.57	–0.07	0.17
Almaty	0.49	0.24	–0.43	–0.40	–0.14	0.26	–0.37	0.48
Atyrau	0.33	0.17	–0.38	–0.38	0.44	0.32	–0.54	0.47
West Kazakhstan	0.24	0.77	–0.73	–0.72	–0.41	0.11	–0.62	0.70
Zhambyl	0.58	0.66	–0.49	–0.46	0.14	0.51	0.33	0.51
Karaganda	0.97	0.82	–0.62	–0.62	–0.07	0.91	0.13	0.89
Kostanay	0.83	0.79	–0.64	–0.65	0.36	0.88	0.01	0.73
Kyzylorda	0.82	0.76	–0.54	–0.63	0.43	0.60	–0.01	0.87
Mangystau	0.75	0.69	–0.45	–0.45	0.80	0.63	0.35	0.87
Pavlodar	0.51	0.43	–0.35	–0.35	0.12	0.60	–0.07	0.37
North Kazakhstan	0.93	0.92	–0.80	–0.81	0.24	0.88	0.60	0.87
Turkestan	0.04	0.69	–0.59	–0.59	–0.30	0.10	–0.68	0.76
East Kazakhstan	0.83	0.81	–0.61	–0.61	–0.43	0.78	0.20	0.80
Astana city	0.91	0.88	0.76	0.72	0.75	0.90	0.90	–0.73
Almaty city	0.59	0.09	–0.91	–0.90	0.04	0.44	–0.15	0.92

- the number of graduates at all higher education levels at the end of the academic year,
- and the unemployment rate among young people (15-28 years).

4.3. Estimates of multivariate models

When calculating the indicators of multifactor models for each fixed factor for the remaining nine regions, a regression analysis is performed with special emphasis on correlation estimation. The factors determine the most critical indicators that play an essential role in the functioning of higher education institutions in Kazakhstan. The estimated indicators as the results of regression modeling for each fixed factor are presented in Table 4.

Based on the results obtained, it is possible to interpret how significant and whether the selected independent factors influenced the functioning of higher education institutions in the above regions of Kazakhstan during 2002–2021. Regression modeling results showed high R-Squares in all selected regions, and the models were distinguished by a high degree of reliability. High coefficients of determination in variables are shown in Karaganda (0.9815), North Kazakhstan (0.9906), Almaty city (0.9815), and Astana city (0.9516). The results indicate the high reliability of the constructed models; that is, the selected determinants are significant. Thus, the values of indicators from X_1 to X_8 showed great significance for the sample in these regions.

The indicator Adjusted R-square has the highest indicators in North Kazakhstan, Almaty city,

Table 4. Estimated indicators of multifactor models by regions of Kazakhstan for 2002–2021

Source: Authors' compilations.

Region	R-square	Adjusted R-square	F-statistic	Probability (F-statistic)
Akmola	0.9391	0.8781	15.4118	0.0004
Karaganda	0.9815	0.9629	52.9153	0.0000
Kostanay	0.9054	0.8108	9.5732	0.0022
Kyzylorda	0.8912	0.7823	8.1888	0.0037
Mangystau	0.8712	0.7424	6.7648	0.0070
North Kazakhstan	0.9906	0.9812	105.5472	0.0000
East Kazakhstan	0.7867	0.5734	3.6882	0.0416
Astana city	0.9516	0.9087	22.1397	0.0000
Almaty city	0.9821	0.9642	54.8336	0.0000

and Karaganda (0.9812, 0.9642, and 0.9629, respectively). Nevertheless, regions are selected to build a regression model with an Adjusted R-square above 0.800. Thus, in further evaluation, the results of Kyzylorda region (0.7823), Mangystau (0.7424), and East Kazakhstan (0.5734) are not used in the results due to the low coefficients of explanation of the behavior of the dependent variable Y.

The F-statistical indicator evaluates the significance of the model, and the coefficient should be higher than 0.05. As seen from Table 3, in all models, the coefficients correspond to the condition, confirming the overall statistical significance of the model.

Further, the statistical significance of the sampling coefficients in the regression is determined by the Fisher F-criterion. The paper studies the column P = Prob(F-statistical) in the presented regression model. In the case of a significance level of 0.05, it can be concluded that all coefficients are statistically significant since P = Prob(F-statistical) = 0.0000 < 0.05 in the entire sample. The value of P-value (Probability (F-statistical)) confirms that the observed variables for all except the East Kazakhstan region are statistically significant (significance p-level < 0.05).

Thus, the assumption about the influence of factors X_1-X_8 on the number of functioning universities in Akmola, Karaganda, Kostanay, and North Kazakhstan regions, as well as in the cities of Astana and Almaty, has not been confirmed. There is no consistent correlation up to second-or-

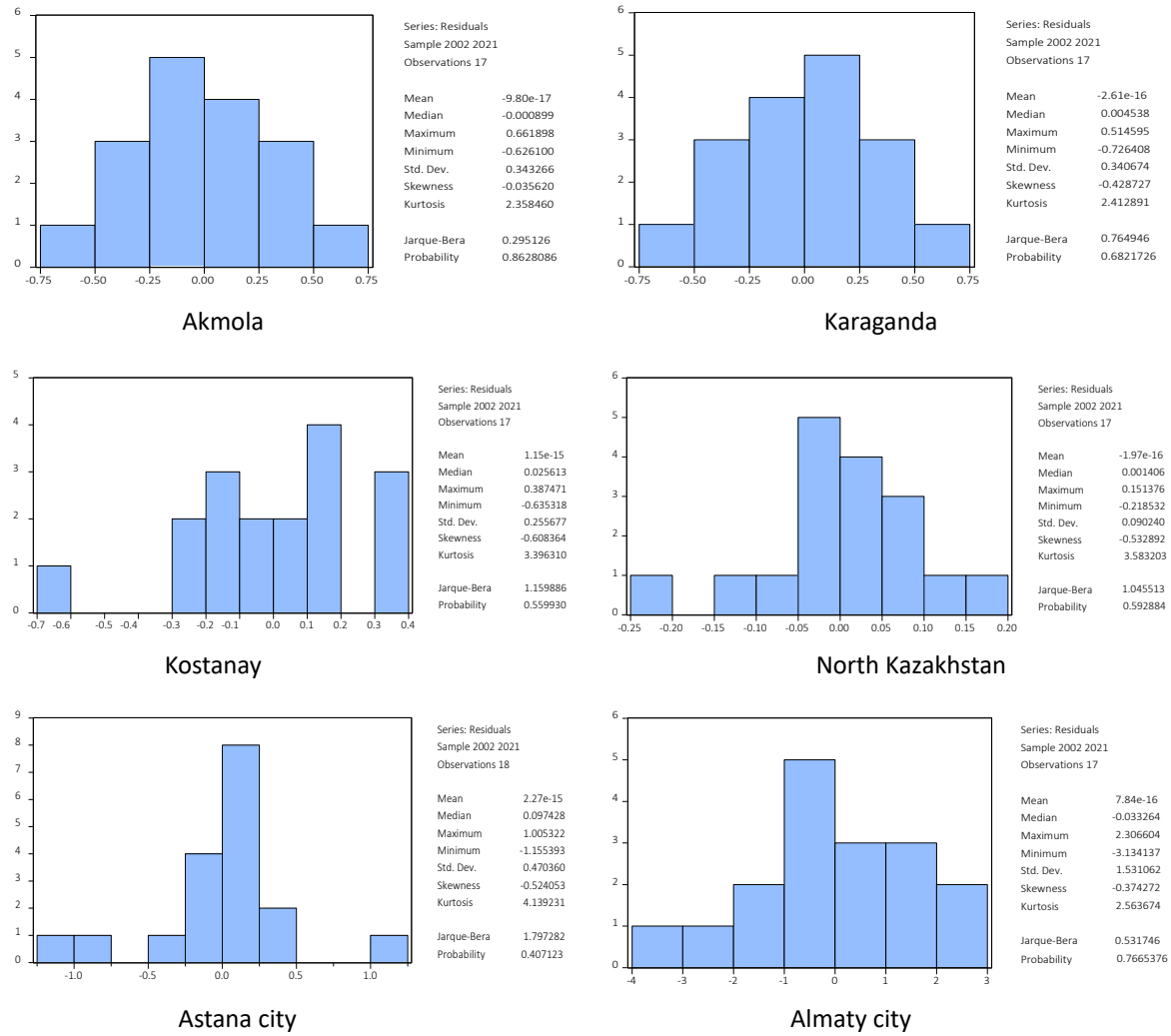

Figure 2. Estimated indicators of normal distribution calculated by regions of Kazakhstan for 2002–2021

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der lags. The probability coefficients are below 0.05, confirming the absence of autocorrelation of random deviations.

Next, the study checks the models for the normal distribution of the sample. Figure 2 shows the residuals for the normal distribution for each model.

Jarque-Bera statistics are calculated in the constructed histograms, and P is the probability of accepting the null hypothesis. Jarque-Bera statistics show whether the residuals (obtained/known dependent variables minus predicted/expected values) are normally distributed. In models for all regions, the p-probability is more significant than 0.05, which means that the null hypothesis is accepted. Based on the Akmola, Karaganda, Kostanay, North Kazakhstan, and the Astana and Almaty models, the variables have a normal distribution since the p-value is more significant than 0.05, i.e., the null hypothesis about the normal distribution of these variables is accepted (Table 5).

Table 5. Estimated indicators of the normal distribution of balances by regions of Kazakhstan for 2002–2021

Source: Authors' compilations.

Region	Probability	Hypothesis 1
Akmola	0.862808>0.05	Accepted
Karaganda	0.682178>0.05	Accepted
Kostanay	0.559930>0.05	Accepted
North Kazakhstan	0.592884>0.05	Accepted
Astana city	0.407123>0.05	Accepted
Almaty city	0.766537>0.05	Accepted

According to the results obtained, in all six models, the selected factors somehow affect the number of functioning higher education institutions in the above regions of Kazakhstan. Regression equations for six regions of Kazakhstan has higher coefficients of determination, F-statistics, and all other regression coefficients turned out to be statistically significant. The coefficients of determination and adjusted coefficients of determination are high in all the models obtained. This confirms the high quality of the sample and that the selected criteria corresponded well to the regression sample. Thus, it can be stated that all the models obtained are of high quality and reliable. As a result, these models can be used for experimental purposes.

5. DISCUSSION

This paper describes the educational potential of Kazakhstan in terms of the region's functioning of higher education institutions. The findings found that the selected factors affect each region differently, which was not shown in previous studies. For example, Barnett (1992), Magnuson et al. (2004), and Zigler et al. (2006) considered the educational potential of the country by preschool, school, secondary, higher, and postgraduate education. Nevertheless, they missed that at each level of the educational stage, an evaluation system could negatively affect the student's motivation, especially at the initial levels of education. Furthermore, this in the future will necessarily be negatively reflected in the indicators of educational potential as a whole. For example, because of an underestimated assessment or humiliation of the teacher in front of other children, children may withdraw and transfer to study.

Collier (1995), Prauzner (2017), Gil-Flores et al. (2017), and Ibrokhimovich et al. (2022) described the educational potential through the importance of increasing competence by presenting the importance of particular school subjects. However, they did not consider that students may have inclinations to certain subjects rather than to all priority subjects for the school. For example, there are students with a penchant for the humanities rather than for natural sciences, or there are musical abilities, or there are none. In this case, it is necessary to divide the students into groups according to their desires and inclinations, which will give a more significant result.

Aron and Loprest (2012) and Michielsen and Brockschmidt (2021) considered students with disabilities and the need for their education as one factor in increasing the country's educational potential. These studies describe inclusive children and students who, just like ordinary people, have equal rights and desire to get an education. In addition, according to statistical data of Kazakhstan, from year to year, the number of students who want to get an education among special students is increasing.

Barnett (1990), Meyer et al. (2007), and Pinto et al. (2015) contributed to solving theoretical and

methodological issues of the development of educational potential. They studied cultural contribution, the impact on social values, and the development of competitiveness of higher education institutions. These findings are incomparably valuable contribution of universities to the development of human and social capital. Furthermore, they present human capital as the basis of educational potential. Education and vocational training are likely to have a much more significant impact on the educational potential through the socialization of individuals.

Some universities resorted to such measures as increasing the cost of tuition in order to increase their incomes. Moreover, others supported the need to search for external investment in higher education through various funds and private production structures (Mughan et al., 2022; Monk, 2012; Thanassoulis et al., 2011). Nevertheless, there is an increase in the number of those wishing to receive a decent education, not only from the younger generation but also from the elderly, despite the annual price increase. Therefore, the functioning of higher education institutions in all regions should be accessible to everyone and remain of good quality. In this regard, supporters of regional development adhere to the opinion about the global role of universities in its development (Lendel, 2010; Schiuma & Lerro, 2010; Harrison & Turok, 2017; Faggian et al., 2019; Mellander & Florida, 2021; Fonseca & Nieth, 2021). There are enough examples in the world where a region or a city is supported by the functioning of higher education institutions alone, not only by the presence of production facilities. From this point of view, it is possible to agree with many predecessors on this issue with a particular point of contact.

Based on these studies, higher education institutions significantly impact the formation of the socio-cultural capital of the region. Therefore, the development of educational potential should be at the head of the government's state policy. For further management of the number of functioning higher education institutions, the state policy in education should consider that an individual approach is required for each region since the same tool in different regions can produce completely different results. Therefore, it is essential not to harm the functioning of higher education institutions in the regions by untested tools (factors).

CONCLUSION

The purpose of the study is to analyze the development level of higher education institutions in the regions of Kazakhstan based on a multivariate regression model. The results revealed that not all model equations significantly depend on the integral indicator Y (the number of functioning higher education institutions in the regions). That is, the number of teaching staff of higher education organizations (X_2), the total coverage of higher education in the region (X_5), and the unemployment rate among young people (15-28 years old) (X_8) were not influential factors for the functioning of higher education institutions in the regions.

The most significant impact was on X_1, X_3, X_4, X_6, and X_7. These are: the number of students at all levels of higher education at the beginning of the academic year; current income and expenses of universities; the number of accepted students at all levels of higher education at the beginning of the academic year; the number of graduates at all levels of higher education at the end of the academic year. That is, the directions of state policy in education should be based on these five indicators. The last two indicators cause demand for educational services, and the previous ones affect the supply and quality of higher education institutions in the regions.

As a result, the study developed six working models. Of these, there are contradictory indicators such as an increase or decrease in current income or current expenses of higher education institutions in the regions. For example, the growth or reduction of current expenses and income of universities reduces the number of universities in the region. This is due to changes in expenses or income due to the consolidation of higher education institutions in the aftermath of a merger.

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Based on the conducted analysis, several problems of public administration of the educational sphere are identified, such as insufficient funding, increasing competition, insufficient number of teaching staff among scientists, constantly changing requirements of the mandatory state standard of education, brain drain, different levels of quality of education, especially in the regions, etc.

It is necessary not to reduce the number of higher education institutions but to increase their quality and demand. This study has shown that there are grounds to assert that there is a weak state policy to increase educational potential concerning some regions. At the same time, it is equally important to note that the education system has developed and is being purposefully reformed in Kazakhstan. Nevertheless, the analysis concludes that the educational system's functioning is problematic, which can become the basis for further research. For example, other research could involve the first heads of higher education institutions in an interview to study the significance of higher education institutions in these regions and the possibility of turning them into a brand of their region.

AUTHOR CONTRIBUTIONS

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