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Analysis of the Input of Education and Innovation on Economic Growth in Kazakhstan

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Abstract

Purpose: this study is aimed at assessing the contribution of education and innovation to the economic growth of Kazakhstan, the correlation between them is checked based on two levels on a national scale and a regional scale. Based on the literature review, it was revealed that in the vastness of the scientific community, there are many views concerning the influence of educational and innovative factors on economic growth. **Research design, data and methodology:** the research methodology is divided into two levels, at the first level, a correlation analysis is carried out between key factors and the economic growth of the country (GDP), at the second level, the same factors are analyzed, but the impact on the economic growth of the region (GRP) is estimated. Statistical data on educational and innovation potential is taken from the Bureau of National Statistics for the period 2003-2021. **Results**: in this study, it was revealed that the economic development of regions could be influenced by such indicators that cannot affect the entire state in aggregate and vice versa. In addition, the correlation analysis results showed that investments in innovations affect economic growth at the country and the regional level. **Conclusions:** based on the results of the assessment of educational and innovative potential, policy recommendations and further research in this area were proposed.

Keywords: Education, Innovation, Economic Growth, Distribution, Correlation Analysis, Kazakhstan

JEL Classification Code: I25, I28, O43

1. Introduction

For a long time, the study of the relationship between innovation and economic growth has been a constant topic in many scientific papers, often during the discussion of which new ideas, theories, and concepts arise. The economic growth of a country depends mainly on the development of capital, the level of distribution of knowledge, the growth of human capital, and technological progress. Many studies have noted that higher education is a crucial way to increase

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human capital (Mincer, 1974; Lucas, 1988; Pegkas & Tsamadias, 2014).

The educational and innovative potential is considered one of the main elements for building an economically developed state. In developed countries, the most important direction of economic development is the development of the state's educational system, as it is the basis of education, science, and innovation. Consequently, developing countries are building quality reforms to obtain quality education and are paying more attention to improving educational potential, which entails increased innovation potential.

In the modern knowledge economy, the educational potential of a country is its main competitive advantage. The educated population makes it possible to innovate, adapt to the conditions of the changing world economy, and achieve high competitiveness. In addition, the country's high educational potential will be able to become an engine of economic development. The dynamics of the development of factors of the country's educational system can significantly affect economic growth (Mankiw et al., 1992; Syed & Shaikh, 2013; Amirat & Zaiti, 2020; Haryanto et al., 2021).

The importance of government intervention in the form of a well-thought-out reform in higher education can positively affect economic growth (Kimenyi, 2011; Miller, 2013; Cloete, 2012; Marquez-Ramos & Mourelle, 2019). In addition, unjustified and heavy attention to secondary and preschool education and underestimation of higher education can have a negative effect on economic growth. Since higher education in the production of science and innovation is a critical factor of economic development (Blute, 1972; Stephan et al., 2004; Zhou & Luo, 2018; Popović et al., 2019).

An even distribution of state funding by regions, considering the region's peculiarity in the educational and innovative potential, will not only eliminate inequalities in regional development but also contribute to the emergence of new approaches and directions of economic growth. Such a policy will give a new impetus to the development of the educational and innovative potential of the country. Therefore, the importance and necessity of this study are to overcome the inequality in educational and innovative potential in the regions.

The primary attention in this article is paid to the analysis of the spread of educational and innovative potential based on the impact of indicators on GDP and GRP. Therefore, the assessment will be carried out at two levels. The scorecard consists of (1) the number of higher education institutions (Universities); (2) the number of students of higher education organizations; (3) the number of undergraduates; (4) the number of doctoral students; (5) the number of organizations (enterprises) performing R&D; (6) the number of employees performing research and development by regions; (7) Innovation costs.

This research work consists of a literary review summarising scientific views on educational and innovative potential. Next, a measurement scheme and a description of the research methodology and data are described. The analytical part consists of two parts. The conclusion presents conclusions, policy recommendations, and future research.

2. Literature Review

The most valuable asset among developed and developing countries is human capital. The development of human capital requires high-quality education. Education promotes self-understanding, improves the quality of life, and increases people's productivity and creativity, thereby contributing to innovative growth. At the same time, innovation is the driving force of economic development. In turn, education is a crucial way to disseminate knowledge that affects economic growth. There are many scientific studies, but there still needs to be a clear position on how education affects the economy.

Earlier studies examined the issues of financing human capital for economic development (Mincer, 1974; Lucas, 1988). Mincer (1974) showed that education plays an important role in human development. Lucas (1988) developed a model of endogenous growth that illustrates the mechanism of the impact of education on economic growth. Education can give competitive advantages to human capital since this process includes training and disseminating knowledge to acquire skills (Pegkas & Tsamadias, 2014). Consequently, due to the uneven distribution of factors such as education in different countries, there is a differentiation in the development of the economy (European Commission, 2010).

Mankiw et al. (1992) noted that the combination of human capital with education as a standard could make a significant contribution of human capital to economic growth. Further, other researchers describe in empirical studies how education and its key factors affect a country's economic growth (Syed & Shaikh, 2013; Amirat & Zaiti, 2020; Haryanto et al., 2021).

Blankenau and Simpson (2004) created an endogenous economic growth model and showed that the impact of public spending on education on economic growth is variable within certain limits. In other words, long-term investments in education positively impact economic growth, while in the short term, the return on education financing is negligible (Ifa & Guetat, 2018). Ogunleye et al. (2017) applied the least squares method to identify the importance of education spending on Nigeria's economic growth using annual GDP time series dating from 1981 to

2015. Chankseliani and McCowan (2021) analyzed spending on higher education and regional GDP. They concluded that the education costs of ordinary colleges and universities positively impact regional GDP. Namely, the return on education funding is higher in the rural regions than in the central cities.

The importance of the educational system in economic growth is essential, especially in the development of higher education. According to the research of some authors, higher education has a better impact on the country's economic growth, and colleges and universities are the most important components of national and regional strategies of innovation systems (Miller, 2013). As for secondary education, it has little effect on economic growth. Therefore the return on financing secondary education or school education to economic growth is negligible. Thus, higher education is crucial for innovative development, although primary and secondary education is necessary for economic growth (Kimenyi, 2011). At the same time, in some countries, higher education is considered expensive and equated with luxury (Cloete, 2012).

Understanding the contribution of science and innovation to economic growth is extremely important. Thus, there are many works in which the significant role of science in economics has been shown, but the dependence of these areas of human activity (Blute, 1972; Popović et al., 2019). Regarding the training of scientific personnel, their crucial importance for universities in promoting economic development and forming an innovation strategy is shown (Stephan et al., 2004). Moreover, the role of innovation and economic growth needs to be clarified and depends on specific data samples. Zhou and Luo (2018) found that higher education and innovation are two important factors influencing economic growth. Further, other studies on this issue have used different methods to assess the impact of higher education on economic growth.

In some scientific studies, the correlation between various variables and economic growth was used to analyze the level of human capital distribution (Anyanwu, 2014; Amoah et al., 2022; Török, 2022). Ziberi et al. (2020) used the Pearson correlation to identify the relationship between government spending on higher and secondary education and GDP. This method was also used in the analysis of the impact of college indicators on GDP (Pegkas & Tsamadias, 2014) and the study of the impact of qualitative and quantitative indicators of education on GDP (Deme & Mahmoud, 2020). Kazakh studies also used index and comparative analysis methods (Kangalakova & Sabden, 2017; Korzhegulova et al., 2018: Orynbet et at al., 2020). Thus, it is possible to summarise the main content of previous studies or the theoretical basis in the table (see Table 1).

Table 1: The main essence of previous studies

Authors	Contribution of the study
Mincer (1974)	The importance of human capital on staff turnover and the impact of technological changes on the formation of human capital.
Lucas (1988)	An explanation of the impact of human capital on economic growth as a contribution to the research and development sector.
Blankenau and Simpson (2004)	Human capital plays a central role in innovative growth, and there is a potential link between public spending on education and economic development.
Kimenyi (2011)	The importance of the quality of education for development is explained, and it is concluded that higher education is crucial for the development of modern societies.
Cloete (2012)	The study analyzed most educational development projects and concluded that higher education was considered a non-target sector or even a luxury auxiliary tool.
Zhou and Luo (2018)	The theoretical analysis of the relationship revealed that higher education is an important source and driving force, and technological innovations will contribute to further economic growth.
Popović et al. (2019)	Education and innovation in stimulating economic development are essential for understanding endogenous growth theory.
Deme and Mahmoud (2020)	The results show that the amount of primary and secondary education has a positive and statistically significant impact on real GDP growth per capita.

Summing up, the impact of the contribution of education and innovation on economic growth still needs to be fully understood. Although there are empirical studies on the relationship between these three factors, to clarify the relationship between them, many studies rely on the basic development of the economy of each country. Similar studies on the evaluation of panel data of Kazakhstan have not been conducted before.

The article focuses on the relationship between education and economic growth, innovation and economic growth, to identify their causal relationship. Therefore, the purpose of this document is to assess the contribution of education and innovation to the economic development of Kazakhstan, the correlation between them is checked based on two levels on a national scale and a regional scale.

3. Research Methods and Materials

The driving force of economic development is education, an important way of spreading knowledge in innovation. From the above literary analysis, it can be understood that there is a link between education, innovation, and economic growth. In addition, economic development through the

accumulation of human capital creates a process of influencing innovation and thus contributing to economic growth., i.e., dynamic circulation. Therefore, the relationship between education, innovation, and economic growth is relatively multifaceted. Therefore, in this study, we decided to conduct the following experiment: the same data type will be studied on a national and regional scale.

The methodological basis of this study was the developments of foreign and domestic scientists (Blankenau & Simpson, 2004; Kimenyi, 2011; Kireyeva et al., 2022). Regardless of the direction of scientific activity, the following principles will be taken into account in the implementation of the project: (1) objectivity - in the study, do not allow subjective ideas to affect the final result; (2) systematic - the process will be logical and consistent; (3) reproducibility - in the course of the study, additional calculations can be performed with the same results. Otherwise, the results of the study will be distorted. Based on the proposed aim of the study, the planned project will follow the sequence of stages of the implementation of scientific research (Figure 1).

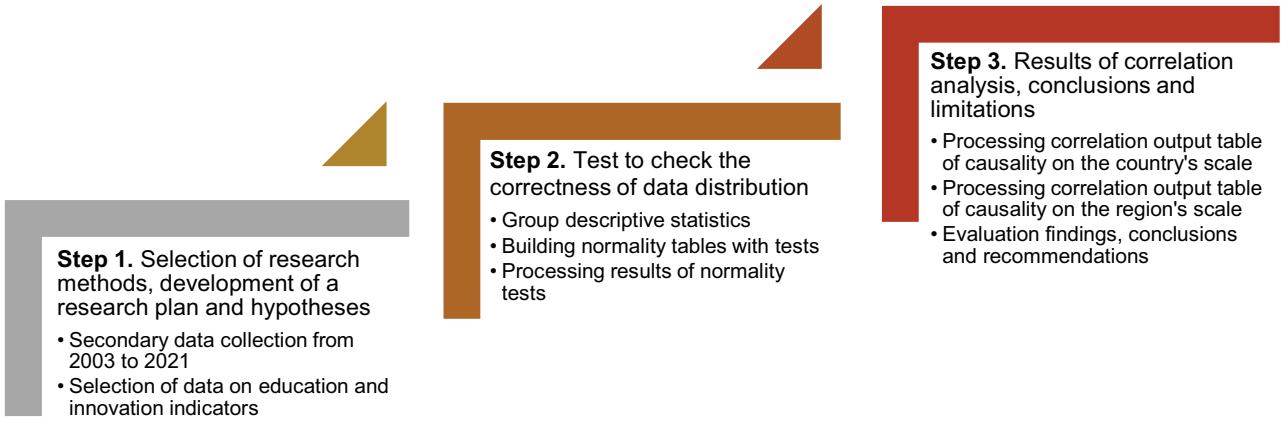

Figure 1: The main stages of the implementation of scientific research

The data sample was made based on the transformation and analysis of information from the annual statistical collections of the Bureau of National Statistics of the Republic of Kazakhstan. Data from 2003 to 2021 were used for the analysis. The advantage of using panel data is that it is possible to analyze economic processes dynamics and make future forecasts.

Table 2 shows the summary indicators used.

Table 2: Variables and their measurements

Code	Variable	Type of indicator	Unit
GDP p/c	Gross domestic product per capita	Economic indicators	Million, KZT
GRP p/c	Gross regional product per capita		Million, KZT
Univers	Number of higher education institutions (Universities)	Education indicators	number
Stud	Number of students in higher education organizations		people
Mag	Number of undergraduates		people
PhD Stud	Number of doctoral students		people
Org R&D	Number of organizations (enterprises) performing R&D	R&D indicators	number
Res/emp	Number of employees performing research and development by regions		people
Inn/costs	Innovation costs, total		million kzt

Source: Organized by authors

As noted earlier, it was decided to use two data types for empirical research, so there will also be two dependent variables. Based on carefull consideration of the above variables, the interaction between educational contribution, innovation, and economic growth can be analyzed at the following two levels.

The first level is the Gross domestic product per capita (GDP per capita) will be used as a dependent variable to assess the level of distribution across the country. This indicator is considered the primary determinant used to measure a country's economy's overall state and size. The data coverage period is from 2003 to 2021. At both levels, two-dimensional data is required for correlation analysis.

Two-dimensionality lies in the fact that each value of one variable is paired with another value. At the first level, two-dimensionality consists of compliance with each year (from the data coverage range from 2003 to 2021) and the determinants under consideration (7 indicators).

The second level to assess the distribution level across regions, the Gross regional product per capita (GRP per capita), will be used as a dependent variable. This indicator is the leading indicator used to measure the region's development. The sample will cover 14 regions: Akmola, Aktobe, Almaty, Atyrau, West Kazakhstan, Zhambyl, Karaganda, Kostanay, Kyzylorda, Mangystau, Pavlodar, North Kazakhstan, Turkestan, East Kazakhstan and three cities (Almaty, Astana, and Shymkent). Data by region will cover 2021. At the second level, two-dimensionality lies in the correspondence of the 14 areas presented and the determinants under consideration (seven indicators). Therefore, data by region can be shown in one year. It was decided to take the most up-to-date data for 2021.

Based on the research aim, the following hypotheses of our research can be proposed.

H1: All education indicators positively impact the Gross domestic product per capita.
H2: All R&D indicators positively impact the Gross domestic product per capita.
H3: All education indicators positively impact the Gross regional product per capita.
H4: All R&D indicators positively impact the Gross regional product per capita.

Thus, the research model and hypotheses are presented in Figure 2.

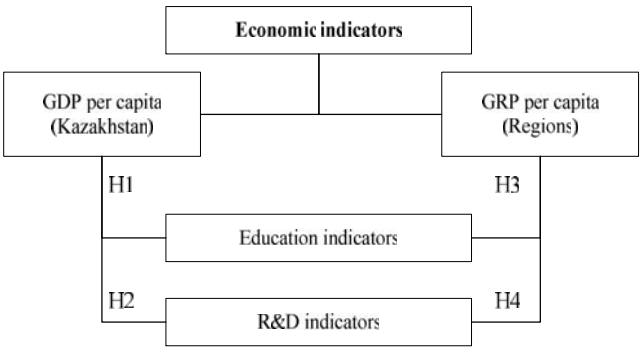

Figure 2: The scheme of the research process

There are many studies to explain the influence of variables on economic growth, in which the dependent variable is GDP as an indicator of economic growth or economic development (Amoah et al., 2022; Török, 2022). However, selecting the input and output data to identify the links in this study will apply GDP per capita and GRP per capita. Further, in various scientific studies, it is customary to use the formula for calculating Spearman's correlation coefficient, which is calculated using the formula below (1):

$$r_{xy} = 1 - \frac{6\Sigma d^2}{n\,(n^2-1)} \quad (1)$$

where x – independent variable;
y – dependent variable;
d2 – the sum of squared differences between ranks;
n – number of features in the ranking.

Additional calculations will be carried out to check the correctness of the matrix compilation based on the checksum calculation. If the sum over the columns of the matrix is equal to each other and the checksum, then the matrix is composed correctly (2):

$$\sum x_{ij} = \frac{(1+n)n}{2} \quad (2)$$

where i – the value of the first parameter;
j – the value of the j parameter;
n – number of features in the ranking.

Compared to conventional simultaneous equations, the correlation coefficient considers all variables and gives a complete picture of the current situation, reducing uncertainty in the model. In addition, the correlation relation shows its superiority in the following aspects: (1) it shows the level of data distribution; (2) it is relatively easy to estimate parameters; (3) the model has a wide range of applications; (4) the advantages of event forecasting.

4. Analysis and Results

4.1. Test to Check the Correctness of Data Distribution

The primary database was used for the empirical test of the article to check the distribution between variables. This test must be carried out before the results are obtained. Therefore, testing the data for normality is the first stage of the analysis. If the sequence is stable and shows the distribution of the initial data, then the subsequent analysis of the influence of variables begins. In this article, we used the Kolmogorov-Smirnov test to check for normality. This test allows you to determine the available data's main statistical characteristics: average, standard deviation, probability of error, etc.

Table 3 shows a data check for the country as a whole and the regions of Kazakhstan for testing time series using SPSS software.

Table 3: Data validation results Kolmogorov-Smirnov Test

Verification Parameter		Economic indicators	Univers	Stud	Mag	PhD Stud	Org R&D	Res/emp	Inn/costs
First level: GDP (N = 19), Kazakhstan									
Normal Parameters[a,b]	Mean	1,967625	143,89	603595,8	20334,58	2330,316	14313,105	20256,63	51943,925
	Std. Deviation	1,265366	22,33	97623,1	15545,25	2253,8218	3403,626	3106,73	27182,679
Test Statistic		,133	,235	,115	,220	,204	,267	,143	,123
Asymp. Sig. (2-tailed)		,200[c,d]	,007[c]	,200[c,d]	,016[c]	,037[c]	,001[c]	,200[c,d]	,200[c,d]
Second level: GRP (N = 17), Regions									
Normal Parameters[a,b]	Mean	4,938,328.0	7,18	33853,59	2146,06	348,47	174,12	25,76	47064,08
	Std. Deviation	3,583,702.6	9,59	41096,53	3113,61	756,19	183,93	35,71	44447,69
Test Statistic		,263	,307	,281	,312	,376	,289	,383	,221
Asymp. Sig. (2-tailed)		,003[c]	,000[c]	,001[c]	,000[c]	,000[c]	,001[c]	,000[c]	,027[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance

Source: Organized by authors

Of all the presented statistical parameters, Azymp. Sig. (2-tailed) is the most important. This indicator shows the normality of the data distribution. If the Azymp. Sig. (2-tailed) is more significant than 0.200, then the data has an abnormal distribution, or a deviation from the normal distribution is considered significant.

All indicators have a value less than 0.200, meaning the data have a normal distribution. In this case, the Pearson or Spearman correlation coefficient is used. Next, to decide which method is suitable, it is necessary to determine N – the number of parameters under consideration. This paper covers 17 regions. If N is less than 50, the Spearman coefficient is used. In both parts of the study, N <50, so Spearman's rank correlation coefficient will be applied.

4.2. Results of Correlation Analysis

To study the relationship between education and economic growth, innovation and economic growth, and further determine the level of influence of various factors, we used two dependent variables. So, in this paper, correlation tables of output data were built on two levels (on a national scale and a regional scale).

Thus, the results obtained nationwide are presented in Table 4.

Table 4: Correlation output table of causality on the country's scale

Variable	C	GDP p/c	Univers	Stud	Mag	PhD Sud	Org R&D	Res/emp	Inn/costs
GDP p/c	Correlation Coefficient	1,000	-,956**	-,747**	,967**	,979**	,051	,698**	,989**
	Sig. (2-tailed)	,836	,967	,279	,642	,819		,355	,816
Univers	Correlation Coefficient	-,956**	1,000	,800**	-,937**	-,933**	,010	-,670**	-,946**
	Sig. (2-tailed)	,000		,000	,000	,000	,967	,002	,000
Stud	Correlation Coefficient	-,747**	,800**	1,000	-,755**	-,756**	,262	-,782**	-,753**
	Sig. (2-tailed)	,000	,000		,000	,000	,279	,000	,000
Mag	Correlation Coefficient	,967**	-,937**	-,755**	1,000	,961**	-,114	,709**	,944**
	Sig. (2-tailed)	,000	,000	,000		,000	,642	,001	,000
PhD Sud	Correlation Coefficient	,979**	-,933**	-,756**	,961**	1,000	-,056	,679**	,967**
	Sig. (2-tailed)		,000	,000	,000	,000	,836	,001	,000
Org R&D	Correlation Coefficient	,051	,010	,262	-,114	-,056	1,000	-,225	,057
	Sig. (2-tailed)	,000	,000	,000	,000		,819	,001	,000
Res/emp	Correlation Coefficient	,698**	-,670**	-,782**	,709**	,679**	-,225	1,000	,698**
	Sig. (2-tailed)	,001	,002	,000	,001	,001	,355		,001
Inn/costs	Correlation Coefficient	,989**	-,946**	-,753**	,944**	,967**	,057	,698**	1,000
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,816	,001	

Note: *. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Source: Organized by authors

According to the presented data in the correlation analysis results table, negative and positive degrees of correlation were identified to determine the cause-effect relationship across the country. Thus, the number of universities is negatively correlated (-,956**) with economic growth, as is the number of students studying at universities (-,747**). On the contrary, the number of undergraduates and doctors of Philosophy positively correlates with GDP (above ,900**). Surprisingly, the number of organizations (enterprises) performing R&D has no interdependence with any of the factors in the matrix. The number of employees performing research and development by regions has a relatively weak relationship with GDP (less than 0,800). The Innovation costs indicator and GDP have a positive relationship (,989**). All indicators are statistically significant and average 0.01% for the coefficients obtained. Next, the second level will be presented.

Further, the results obtained on a regional scale are presented in Table 5.

Table 5: Correlation Output Table of Causality on the Region's Scale

Variable	C	GDP p/c	Univers	Stud	Mag	PhD Sud	Org R&D	Res/emp	Inn/costs
GDP p/c	Correlation Coefficient	1,000	,527*	,311	,218	,131	,402	,480	,659**
	Sig. (2-tailed)	,109	,000	,001	,001	,000		,005	,004
Univers	Correlation Coefficient	,527*	1,000	,873**	,751**	,726**	,862**	,621**	,614**
	Sig. (2-tailed)	,030		,000	,001	,001	,000	,008	,009
Stud	Correlation Coefficient	,311	,873**	1,000	,875**	,717**	,731**	,466	,431
	Sig. (2-tailed)	,224	,000		,000	,001	,001	,060	,084
Mag	Correlation Coefficient	,218	,751**	,875**	1,000	,857**	,711**	,576*	,458
	Sig. (2-tailed)	,400	,001	,000		,000	,001	,016	,064
PhD Sud	Correlation Coefficient	,131	,726**	,717**	,857**	1,000	,770**	,650**	,414
	Sig. (2-tailed)		,030	,224	,400	,616	,109	,051	,004
Org R&D	Correlation Coefficient	,402	,862**	,731**	,711**	,770**	1,000	,643**	,665**
	Sig. (2-tailed)	,616	,001	,001	,000		,000	,005	,098
Res/emp	Correlation Coefficient	,480	,621**	,466	,576*	,650**	,643**	1,000	,466
	Sig. (2-tailed)	,051	,008	,060	,016	,005	,005		,060
Inn/costs	Correlation Coefficient	,659**	,614**	,431	,458	,414	,665**	,466	1,000
	Sig. (2-tailed)	,004	,009	,084	,064	,098	,004	,060	

Note: *. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
Source: Organized by authors

According to the presented data, the tables of the results of correlation analysis to determine the cause-and-effect relationships across the regions showed ambiguous results and indicated the absence of positive relationships. Only the number of investments in the environment has a positive effect on the development of the economy of the regions (,659**). The indicator is statistically significant. It should be noted that in the regional context, it is clear that the number of universities has a positive relationship with the number of students at the bachelor's, master's, and doctoral levels. Several organizations (enterprises) performing R&D have weak links with all but two indicators: there is a significant positive relationship with the indicator Number of higher education institutions (Universities) (,862**), however, there is a lack of relationships with the Gross regional product per capita. These results will allow us to decide on hypotheses in the future.

After statistical data processing, some hypotheses were confirmed, some partially and some wholly rejected. The result of the hypotheses is presented in more detail in Figure 3.

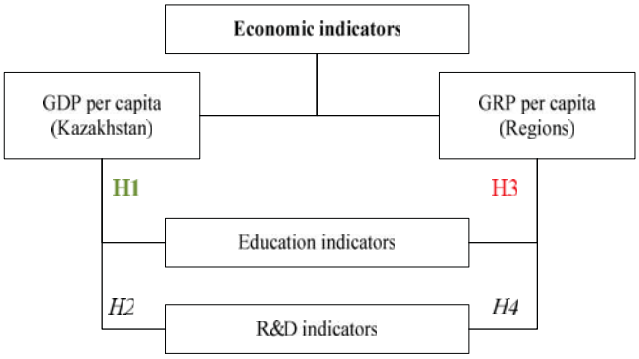

Figure 3: Testing results

The results according to the hypotheses:

H1: All education indicators positively affect gross domestic product per capita – fully confirmed and accepted.

H2: All R&D indicators positively impact Gross domestic product per capita – partially confirmed.

H3: All education indicators positively impact the Gross regional product per capita –rejected.
H4: All R&D indicators positively impact Gross regional product per capita – partially confirmed.

5. Conclusions

This paper mainly examines the relationship between education, innovation and economic growth in Kazakhstan and checks the correlation between them based on two national and regional levels. First, it contains a theoretical overview of the relationship between innovation and economic growth in the past, its study and the generalization of research experience and shortcomings. From a quantitative point of view, many researchers calculate the level of education's contribution to economic growth and also explain the important role of education. Nevertheless, we decided to go into this study by comparing two correlation matrices with each other: the same data were studied on a national scale and by region. The experiment covered data from 2003 to 2021. Gross domestic product per capita and Gross regional product per capita were taken as dependent variables.

Thus, the analysis results show that the economic development of regions can be influenced by indicators that cannot affect the entire state in aggregate and vice versa. Also, in some cases, the indicators have an inverse relationship. Interestingly, in both parts of the test, the factor that has consistently positively influenced the development of Gross domestic product per capita and Gross regional product per capita is an investment in innovation. Economic innovations and updating the resource base of educational organizations, universities and enterprises engaged in R&D lead to the creation a modern digital educational and scientific environment. Some time ago, universities faced difficulties with technical equipment. However, during the Covid-19 pandemic, all universities in Kazakhstan were forced to switch to an online education format. Organizations engaged in scientific research and R&D were forced to switch to a remote work format.

Also interesting was the indicator number of organizations (enterprises) performing R&D, which on a country scale had no relationship with the elements. Still, if we consider the regions, it increases almost all indicators. This suggests that in Kazakhstan, it is necessary to develop scientific institutes in the regions, especially since some are development institutions. Of course, the most significant effect will be from the spread of the education-state-business-science interaction system. Such integration will allow the Government to influence regional development trends more effectively.

This study has limitations, which will be described below, but it should be noted that nine indicators were analyzed for different periods. It will be possible for future researchers to take as indicators not only data on students and teaching staff.

6. Limitations and Future Research

There are some limitations in this study. Firstly, this study examines the same factors in assessing the impact of educational and innovative potentials on the region's economic growth (GRP) and the country (GDP). Secondly, the data for the first part of the experiment included the period 2003-2021 for many indicators. Official statistics on the number of students have been given since 2003, but the data on the number of undergraduates covers the period from 2009 to 2021. This is because Kazakhstan has adopted the Bologna Education System since 2009.

This study focuses on the transfer of knowledge in a new way, as the impact of some indicators on the country's GDP and GRP is assessed. In addition, the paper uses several factors that describe the educational and innovative potential of the country, but other factors can be used in other countries. And we would like to encourage other scientists from other countries to investigate different factors at the level of the country and region for the completeness of the study and confirmation of our scientific results. However, our findings may show different results when using data from other countries. Therefore, the results obtained can become the basis of new research.

The most important thing is that we considered only clearly defined parameters of the potential of education and innovation; reference to other parameters could lead to different results. The extent to which our findings can be generalized certainly requires further study.

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