



THE ROLE OF MAMUN UNIVERSITY IN THE SUSTAINABLE ECONOMIC DEVELOPMENT OF KHOREZM REGION

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Abstract

This paper discusses the scientific research related to the evaluation of the impact of the activities of Mamun University on the economy of the region is reflected. According to the results of the research, the total number of students studying at the university (both full-time and part-time courses), the total income of the university, the total number of professors, teachers, supervisors and workers who are employed at the university were found to have a positive effect on the GNP of the region. Also, in the research work, the results of forecasting the total number of university students for the next three-year period were developed. In addition future prospects of the university have been explained and strategies that will play important role in the development of both university and the region's economy have been developed and discussed.

Keywords: Economic development, education, Linear trend model, ARIMA model, GNP, Mamun.

INTRODUCTION

In an era characterized by rapid technological advancement, globalization, and dynamic economic landscapes, the role of universities in shaping regional economies has become increasingly prominent. Universities serve as multifaceted institutions not only dedicated to the pursuit of knowledge and academic excellence but also as key drivers of economic growth, innovation, and prosperity within their respective regions. This paper delves into the intricate relationship between universities and regional economies, exploring the diverse ways in which higher education institutions contribute to the socio-economic fabric of their surrounding communities (Yusupova et.al 2022). Universities are often regarded as the cradles of knowledge, fostering intellectual curiosity and academic inquiry. Beyond their traditional role as centers of learning, however, universities play a pivotal role in nurturing human capital, fostering innovation, and catalyzing economic development. Through their education and training programs, universities equip individuals with the skills, knowledge, and competencies necessary to thrive in today's increasingly competitive and knowledge-based economy. By producing a skilled workforce adept in critical thinking, problem-solving, and technical expertise, universities contribute directly to the productivity and competitiveness of regional industries. Moreover, universities serve as engines of innovation, spearheading groundbreaking research and development initiatives across a myriad of disciplines (Kuziboev et.al 2024). The research output generated by universities not only expands the frontiers of knowledge but also serves as a catalyst for technological advancement and commercialization. Through collaborations with industry partners, technology



transfer initiatives, and entrepreneurship programs, universities facilitate the translation of academic research into tangible products, services, and businesses that drive economic growth and job creation within the region.

In this paper we analysed the role of newly founded university of Mamun in the economic development of Khorezm region. This university was founded in 2021 by Nurjanov Arslon in historical city of Khiva, Khorezm region. This region is situated in Uzbekistan one of the fastest growing country of Central Asia. For the past four years the university became one of the main part of the region's economy. In 2021 only 83 students were accepted and the university began its activity. As a result of reforms carried out by the staff the university achieved the belief of the population of the region and in 2024 the total number of students reached 7067 and for the being time this organization employed around 300 staff members and it should be stated that this indicators are increasing. The university offers education services on 7 direction such as economics, accounting, English language, psychology, pedagogy, history and Russian language. The university has been expanding its main campus is situated in Khiva city and also 2 campuses in Urgench city, it means that the students can choose their studying places according to their wishes. The unique thing of the university is that it has the biggest, modern library with variety of printed and electron books and this library could be visited not only by students but also is open for locals who are interested in doing researches. Distinctive features of Mamun University are the unique career-relevant, high quality and inclusive educational programs, which are internationally recognized and accredited. That in turn allows our graduates can easily enter universities around the world. In addition, Mamun University cooperates with a number of national universities, where students can continue their studies by immediately enrolling into the 2nd year of the selected major. The strong core of Mamun University is its teaching staff. All teachers have undergone specialized trainings and some of them studied at foreign universities abroad. Our teachers are ready to provide comprehensive support in the educational process for better assimilation of knowledge and development of the potential of our students. Mamun University also supports talented students by providing scholarships for education, motivating them towards further achievements. Furthermore, the university is trying to combine the theoretical knowledge with practical activities. In order to achieve this goal the following strategies have been developed:

- **business incubator** - this center is a center that works mainly for the purpose of supporting new ideas, start-up projects;

- **business accelerator** - in this center, in order to further develop their activities, consulting services and educational courses, training and seminars in business, psychological and personnel management areas are provided to business entities in order to further develop their activities;

- **business clinic** provides various services to business entities that are on the verge of bankruptcy and helps them to resume their business activities and carry out effective activities.



2.LITERATURE REVIEW

Universities have been playing an important role in the economic development of the region for a long time. The relationship between education and the region's economic growth has been studied by several researchers so far. According to Pal (2023) the most crucial instrument for a nation's socioeconomic progress is education and it serves as a catalyst for increasing production and advancing technology. The stages of economic growth and education levels are positively correlated, as is evident. Paper by him demonstrated how education may have a transformative effect on promoting equitable and sustainable economic growth. By embracing new inputs and technology, education also plays a critical role in increasing agricultural and industrial production, which raises worker salaries. Ziberi et.al (2022) quantified how public spending on education affects North Macedonia's ability to thrive economically by using secondary data from the World Bank Indicators covering the years 1917–2020. This study indicates that North Macedonia's economic growth will be positively impacted by a one-point increase in public spending on education also the results concludes that in North Macedonia, economic growth will increase with a one-point increase in unemployment and a one-point decline in employment. Rajabov et.al (2023) examined the relationship between education and the economy, the role that education plays in economic development, and the effects that education has on the economy. The impact is more pronounced in places with a high proportion of educated individuals who can apply their knowledge to take practical steps that advance the local economy than in places with a lower proportion of educated individuals. One crucial foundation that supports society in all of its forms is education. Through this lens, the impact of public investments in elementary, secondary, and higher education on economic growth is a matter of discussion (Kuziboev et.al 2023). If public spending on education is beneficial, it is most likely done so under the guise of investing in human capital, but this has negative consequences on economic growth and merely influences the factorial equilibrium (Ibadullaev et.al 2024). Valero and Reenen (2018) created a new dataset on the locations of around 15,000 universities in roughly 1,500 regions spread over 78 nations, some of which date back to the 11th century by using UNESCO source materials. The number of universities is positively correlated with future GDP per capita growth, according to fixed effects models we estimate at the sub-national level between 1950 and 2010 (and this relationship is robust to controlling for a host of observables, as well as unobserved regional trends) (Kuziboev et al (2024). According to our projections, an area's future GDP per capita is predicted to improve by 0.4% for every 10% increase in the number of universities per capita in that region.

3.METHODOLOGY

Correlation analysis is based on determining correlation coefficients and evaluating their importance and reliability. If the links are linear, then the correlation coefficient can be used to estimate the link density:

$$r_{Y/X} = \frac{\overline{X*Y} - \overline{X}*\overline{Y}}{\sigma_X*\sigma_Y} \quad (1)$$



In this place, σ_X and σ_Y respectively X and Y the mean squared deviations of the variables, and they are calculated using the following formulas:

$$\sigma_X = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n}} = \sqrt{\overline{X^2} - \bar{X}^2} \quad (2)$$

$$\sigma_Y = \sqrt{\frac{\sum_{i=1}^n (Y_i - \bar{Y})^2}{n}} = \sqrt{\overline{Y^2} - \bar{Y}^2} \quad (3)$$

Also, the following modified formulas for calculating the correlation coefficient can be used:

$$r_{Y/X} = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{n \sigma_X \sigma_Y} = \frac{n \sum_{i=1}^n X_i Y_i - \sum_{i=1}^n X_i \sum_{i=1}^n Y_i}{\sqrt{[n \sum_{i=1}^n X_i^2 - (\sum_{i=1}^n X_i)^2][n \sum_{i=1}^n Y_i^2 - (\sum_{i=1}^n Y_i)^2]}} \quad (4)$$

The coefficient of determination is equal to the square of the correlation coefficient. The correlation coefficient $r_{Y/X}$ ranges from -1 to +1. If $r_{Y/X} = 0$, there is no relationship between the factors, if $0 < r_{Y/X} < 1$, there is a positive relationship, if $-1 < r_{Y/X} < 0$, there is a negative relationship, if $r_{Y/X} = 1$, there is a functional relationship.

Generally, correlation analysis is a statistical method that helps to define any dependency between variables and its strength using correlation coefficients. Its results can be interpreted using the Chaddock (1925) scale (Table 1)

Table 1. Chaddock scale for interpretation of correlation analysis results.

Absolute Value of Correlation, $ r_{Y/X} $	Interpretation
0.00 – 0.30	Negligible correlation
0.30 – 0.50	Weak correlation
0.50 – 0.70	Moderate correlation
0.70 – 0.90	Strong correlation
0.90 – 1.00	Very strong correlation

Regression analysis determines the effectiveness of the factors influencing the outcome. The term regression is associated with the names of the founders of correlational analysis, F. Galton (1886) and K. Pearson (1903).

Regression analysis makes it possible to assess the effectiveness of the characteristics that affect the resulting characteristic with sufficient accuracy in practice. With the help of regression analysis, it is possible to estimate the prediction values of socio-economic processes for future periods and determine their probability limits.

In regression and correlation analysis, the regression equation of the relationship is determined and it is estimated with a certain probability (confidence level), and then an economic-statistical analysis is performed. Often, several functions are suitable to represent the correlation pattern at the same time, so it is better to finally justify the choice of functions to represent the pattern of correlation on an



alternative basis. Usually, the following functions are used in the study of connections between socio-economic processes (Dougerti 2009):

The linear form of regression is the simplest form in terms of understanding, interpretation and calculation techniques. A linear pair regression equation generally looks like this:

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 * X_i \text{ or } \hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 * X_i + \hat{u}_i \quad (5)$$

here, $\hat{\beta}_1, \hat{\beta}_2$ – model parameters, \hat{u}_i – error term.

Estimation of model parameters $\hat{\beta}_1$ and $\hat{\beta}_2$ is carried out by the method of ordinary least squares (OLS). The essence of (OLS) is that, Y_i is calculated according to the regression equation of the actual (true) values of the resulting character. It is found that the sum of the squared deviations from the (theoretical) values of \hat{Y}_i will be the smallest, i.e.:

$$F = \sum_{i=1}^n (Y_i - \hat{Y}_i)^2 = \sum_{i=1}^n \hat{u}_i^2 \rightarrow \min \quad (6)$$

It can be seen in thus graph:

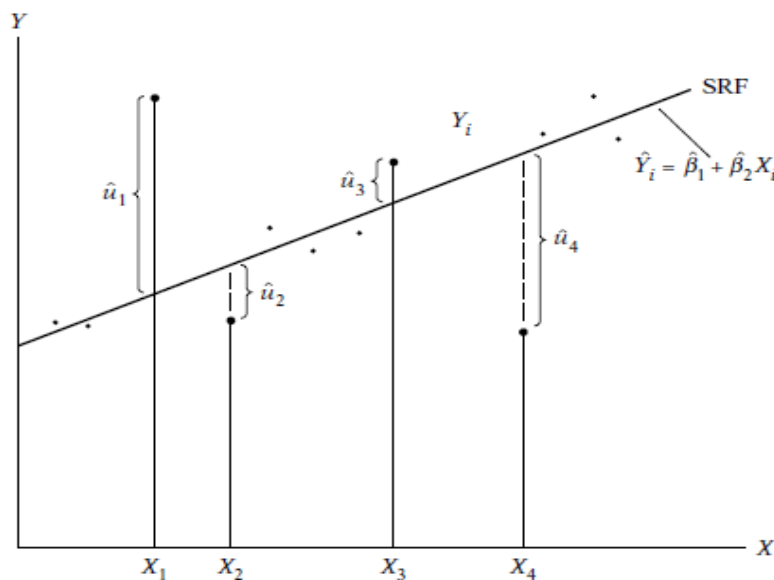


Fig. 2. Ordinary Least-squares criterion.

(5) in order to find the parameters $\hat{\beta}_1, \hat{\beta}_2$ in the linear regression equation, it is equal to 0 by taking the 1st derivative (first differentiation) of these parameters from the function (6). Then the following formulas for finding the parameters $\hat{\beta}_1, \hat{\beta}_2$ in the regression equation are created:

$$\hat{\beta}_2 = \frac{n * \sum_{i=1}^n X_i * Y_i - \sum_{i=1}^n X_i * \sum_{i=1}^n Y_i}{n * \sum_{i=1}^n X_i^2 - (\sum_{i=1}^n X_i)^2} = \frac{\sum_{i=1}^n (X_i - \bar{X}) * (Y_i - \bar{Y})}{\sum_{i=1}^n (X_i - \bar{X})^2} \quad (7)$$

$$\hat{\beta}_1 = \frac{\sum_{i=1}^n X_i^2 * \sum_{i=1}^n Y_i - \sum_{i=1}^n X_i * \sum_{i=1}^n X_i * Y_i}{n * \sum_{i=1}^n X_i^2 - (\sum_{i=1}^n X_i)^2} = \bar{Y} - \hat{\beta}_2 * \bar{X} \quad (8)$$



Forecasting is considered based on the ARIMA (Autoregressive integrated moving average) model. In order to understand the ARIMA model in detail, it is necessary to first consider the "Autoregressive Process" and "Moving Average Process" processes.

Autoregressive Process: Let Y_t be the volume of GDP per capita at time t . We can express Y_t as follows:

$$(Y_t - \delta) = \alpha_1(Y_{t-1} - \delta) + u_t \quad (9)$$

where δ – is the average value of Y_t , u_t – is related to σ^2 with zero mean and constant variance the concept of non-random error. The value of Y at time t depends on its value at the previous time and random error; Values of Y are expressed as deviations from their mean.

Now we can express the appearance of the model (9) in a different form, that is

$$(Y_t - \delta) = \alpha_1(Y_{t-1} - \delta) + \alpha_2(Y_{t-2} - \delta) + u_t \quad (10)$$

Based on (10), Y_t is called a second-order autoregressive or $AR(2)$ process. Values of Y are plotted around their mean values δ .

And in general

$$(Y_t - \delta) = \alpha_1(Y_{t-1} - \delta) + \alpha_2(Y_{t-2} - \delta) + \dots + \alpha_p(Y_{t-p} - \delta) + u_t \quad (11)$$

(3.3.3) is a p -order autoregressive or $AR(p)$ process.

Moving Average Process: Autoregressive Process is not the only mechanism that generates Y . That is, we can express Y in a different way

$$Y_t = \mu + \beta_0 u_t + \beta_1 u_{t-1} \quad (12)$$

where μ is constant and u is the white noise stochastic error term as before. Y is the moving average of the constant and past error terms at time t . Thus, in the present case, Y is said to obey a first-order moving average or $MA(1)$ process.

(12) we change the appearance of the model to a different form, i.e

$$Y_t = \mu + \beta_0 u_t + \beta_1 u_{t-1} + \beta_2 u_{t-2} \quad (13)$$

Based on (13), Y_t is called a second-order moving average or $MA(2)$ process.

In general

$$Y_t = \mu + \beta_0 u_t + \beta_1 u_{t-1} + \beta_2 u_{t-2} + \dots + \beta_q u_{t-q} \quad (14)$$

(14) is a q –order moving average or $MA(q)$ process.

Based on the above, the ARIMA model has the order (p,d,q) , where p represents the autoregression parameter, d represents the integration part, and q represents the moving average parameter. An overview of the ARIMA model will look like this:

$$Y_t = \mu + \alpha_1 Y_{t-1} + \dots + \alpha_p Y_{t-p} + u_t + \beta_1 u_{t-1} + \dots + \beta_q u_{t-q} \quad (15)$$

It is known that the meaning of d -integration is to monitor the difference between the values of variables in the current period and their values in the past period.

4.RESULTS AND DISCUSSION.

The method of correlation-regression analysis was used in this research conducted in order to determine the impact of Mamun University's activities on the economic development of the region. In our opinion, the total number of students studying at the university (both full-time and part-time), the



total income of the university, the total number of professors, teachers, managers and employees working in the university and a number of other factors affect the GNP of the region.

Based on the above ideas, in order to create a multi-factor econometric model representing the impact of the activities of Mamun University on the economic development of the region, the following indicators covering the period 2021Q1 - 2024Q1 were selected as the resulting and influencing factors: the resulting factor - the volume of regional GNP (billion soums) - (Y), the total number of students studying at the university (person) – (X₁), the total income of the university (million soums) – (X₂), the total number of professors, teachers, supervisors and workers working at the university (person). Since the units of measurement of the variables are different and to better explain the interpretation of the multifactor econometric model, we will logarithmize the values of all factors. Before creating a multi-factor econometric model, let's consider the statistical description of the factors (Table 1).

The average value (mean), bisector value (median), maximum and minimum values (Maximum, minimum) for each factor, as well as how much each factor differs from the average value (Std. Dev (Standard Deviation)) are given in the table. In addition, in the table, the asymmetry coefficient (Skewness – S), which indicates that the theoretical distribution curve of each factor is located on the right side ($S > 0$) or on the left side ($S < 0$) compared to the normal distribution curve, and the theoretical distribution curve of each factor is a normal distribution curve The kurtosis coefficient (Kurtosis - K), which means that it is located higher ($K > 0$) or lower ($K < 0$) compared to the line, and the Jarque-Bera criterion test, which is conducted to confirm the compatibility of each factor with the normal distribution, are mentioned.

Table 1 Statistical description of factors

	LN _Y	LN _{X₁}	LN _{X₂}	LN _{X₃}
Mean	10.33266	6.308823	9.631225	4.405371
Median	10.34595	6.973543	10.04481	4.564348
Maximum	10.59443	8.863191	11.25234	5.616771
Minimum	10.08110	2.564949	7.193032	2.995732
Std. Dev.	0.162270	2.132877	1.421243	0.864933
Skewness	0.059506	0.570203	0.470473	0.281333
Kurtosis	1.817789	1.891000	1.770989	1.760144
Jarque-Bera	0.764718	1.370637	1.297752	1.004161
Probability	0.682250	0.503930	0.522633	0.605270
Sum	134.3246	82.01469	125.2059	57.26983
Sum Sq. Dev.	0.315980	54.58996	24.23919	8.977314
Observations	13	13	13	13

Source: Authors' estimations

Whether the factors are stretched to a normal distribution is considered using the coefficient of asymmetry, the coefficient of kurtosis and the Jarka-Bera criterion. If we pay attention to the numerical values in the table, the coefficient of asymmetry, the coefficient of kurtosis and the indicators of the



Jarka-Bera criterion have small values, in this case, it can be estimated that the known factors are close to the normal distribution. On the contrary, large values of asymmetry, kurtosis, and Jarka-Bera criterion indicate that the factors deviate significantly from the normal distribution.

A correlational analysis is necessary to select factors for a multifactor econometric model. For this, pairwise correlation coefficients are calculated between the factors. According to the results of the correlation analysis, it is shown that there is a close relationship between the resulting factor ($\ln Y$) and the influencing factors ($\ln X_1, \ln X_2$), that is, the value of the pair correlation coefficients is greater than 0.8.

The results of the analysis of the matrix of pair correlation coefficients $\ln(x_i)$ ($i = \overline{1, 3}$) and $\ln(x_i)$ ($i = \overline{1, 3}$) factors cannot be recognized as collinear. Because, if $r_{\ln(x_i), \ln(x_j)} < 0.8$ and the determinant of matrix $X'X$ is not close to zero, then this indicates the absence of multicollinearity. Therefore, the pairwise correlation coefficients between the factors took numerical values smaller than 0.8. Therefore, the correlation coefficients between the factors included in the multifactor econometric model meet the requirements for the calculated value and probability of the t-Student criterion. Based on these factors, it will be possible to create a multi-factor econometric model of the total volume of products produced in the regional industrial network and the factors affecting it.

The results of the calculation of the unknown parameters of the multifactor econometric model are presented in Table 2 below.

Table 2 Calculation results of multifactor econometric model parameters

Dependent variable: LNY				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln X_1$	0.029222	0.003774	7.742663	0.0000
$\ln X_2$	0.011072	0.001463	7.567057	0.0000
$\ln X_3$	0.273710	0.008035	34.06512	0.0000
C	9.417863	0.020977	448.9544	0.0000
R-squared	0.899782	Mean dependent var		10.33266
Adjusted R-squared	0.879709	S.D. dependent var		0.162270
S.E. of regression	0.002766	Akaike info criterion		-8.694888
Sum squared resid	6.89E-05	Schwarz criterion		-8.521057
Log likelihood	60.51677	Hannan-Quinn criter.		-8.730618
F-statistic	13759.98	Durbin-Watson stat		1.962346
Prob(F-statistic)	0.000000			

Source: Authors' estimations

The calculated multifactor econometric model shows that a 1% increase in the total number of students studying at the university leads to an increase in the region's GDP by 0.02%. Also, a 1% increase in the total income of the university and the total number of professors, managers and employees working in the university can lead to an increase in the regional GNP by 0.01% and 0.27%, respectively.



The coefficient of determination, standard errors, F-Fisher, t-Student, Akaike, Schwartz criteria in Table 2 show the statistical significance and adequacy of the multifactor econometric model.

In addition, in our research work, the forecast values of the total number of students at Ma'mun University for future periods were developed. Forecast values were formed using "Linear trend model" and "ARIMA" models.

The calculation results of the "Linear Trend" model are presented in Table 3 below.

Table 3 Calculation results of the "Linear trend" model

Dependent variable: Total_number_of_students					
Variable	Coefficient	Std. Error	t-ratio	p-value	
Const	-1694.85	547.567	-3.095	0.0102	**
time	509.363	68.9870	7.383	<0.0001	***
Mean dependent var	1870.692		S.D. dependent var	2174.624	
Sum squared resid	9527935		S.E. of regression	930.6857	
R-squared	0.832101		Adjusted R-squared	0.816837	
F(1, 11)	54.51543		P-value(F)	0.000014	
Log-likelihood	-106.2273		Akaike criterion	216.4547	
Schwarz criterion	217.5846		Hannan-Quinn	216.2224	
rho	0.794324		Durbin-Watson	0.543568	

Source: Authors' estimations

The calculation results of "ARIMA" are presented in Table 4 below.

Table 4 Calculation results of the "ARIMA (0; 1; 1)" model

Dependent variable: (1-L) Total_number_of_students					
Variable	Coefficient	Std. Error	z	p-value	
Const	647.503	255.773	2.532	0.0114	**
theta_1	0.518221	0.303703	1.706	0.0879	*
Mean dependent var	587.8333		S.D. dependent var	681.2546	
Mean of innovations	15.28233		S.D. of innovations	594.3855	
R-squared	0.968998		Adjusted R-squared	0.968998	
Log-likelihood	-93.83396		Akaike criterion	193.6679	
Schwarz criterion	195.1226		Hannan-Quinn	193.1293	

Source: Authors' estimations

The coefficient of determination, standard errors, F-Fisher, t-Student, Akaike, Schwartz, Hannan-Quinn criteria in tables 3, 4 show the statistical significance and adequacy of the "Linear trend" and "ARIMA" models.



Based on the calculation results of the above "Linear trend" and "ARIMA" models, the comparative forecast values of the total number of students at Ma'mun University for future periods were developed (Table 5).

Table 5 Comparative results of econometric models based on forecasting the total number of students at Mamun University

Years	Predictive value	Standard error	95% interval
According to the linear model			
2024	7474	1228,28	(4770,3; 10177,1)
2025	8492	1317,99	(5591,5; 11393,3)
2026	10530	1519,28	(7185,9; 13873,8)
According to the ARIMA model			
2024	9959	1407,83	(7199,5; 12718,1)
2025	12549	2288,96	(8062,5; 17035,1)
2026	15139	2914,91	(9425,7; 20851,9)

Source: Authors' estimations

According to the comparative results, the total number of students according to the "Linear trend" is expected to increase by 1.5 times compared to the current period by the end of 2026, and by the end of 2026 according to the "ARIMA" model, it is expected to increase by 2.1 times compared to the current period. So, based on our forecast results based on the two models developed in our research work, it can be seen that the total number of students at Mamun University NTM has a possibility to increase by 1.5-2.1 times from the current period to 2026.

5.CONCLUSION

In general, in recent years, special attention has been paid to raising the higher education system to a new level of quality, further developing the system of higher educational institutions, eliminating existing problems in the field, and ultimately turning them into large centers of science. The level of coverage of the population with higher education is constantly increasing. In this regard, new non-state higher education institutions are being established in our country.

These non-state educational institutions make a significant contribution to the socio-economic development of not only the country, but also the regions.

According to the results of the research carried out by Mamun University as part of the object, the total number of students studying at the university increased by 1%, the regional GNP increased by 0.02%, the total income of the university and the total number of professors, teachers, managers and employees working at the university increased by 1%. and it was found that the increase of 0.01% and 0.27% can lead to the growth of regional GNP, respectively.



Also, in the future according to the results of "Linear trend" and "ARIMA" models by expanding the number of existing educational courses at the university and opening two new educational buildings in the center of the region, it is possible to increase the total number of university students by 1.5-2.1 times from the current period to 2026. Overall, the university plays a vital role in the economic development of the region, serving as catalysts for innovation, entrepreneurship, and talent development. By leveraging its academic expertise, research capabilities, and institutional resources, Mamun university can make significant contributions to building resilient, inclusive, and sustainable economies that benefit society as a whole.

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