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Priority Directions of Applying Innovative Management to the System of Training Personnel with a Scientific Degree in Uzbekistan

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ABSTRACT

This article uses statistical data on the number of teaching staff in Uzbekistan over the past 10 years. The number of graduates, the number of students, the number of institutions, and the level of funding for higher education are the factors selected for analysis. Descriptive statistics are also presented, calculated by the number of personnel with academic degrees, the number of academic degrees in the country and the forecast values of the factors influencing it for 2023-2027.

Also, in the Forecast period, the number of specialized academic councils in universities and ITI increases (as a result of the opening of many new specialties). In 2022, there were 275 specialized scientific councils in the republic, and by 2027 there will be 320 of them. Thus, it can be stated that about 50 new specialized scientific councils will be created in universities and ITI in the forecast period.

In addition, an econometric study of the number of faculty in Uzbekistan showed a positive trend, but it is necessary to continue work to improve the higher education system in the country. The conclusion is made about the importance of ensuring an equal distribution of teaching staff across educational institutions and regions, increasing the level of remuneration of teachers.

INTRODUCTION

Currently, the number of professors and teachers in higher educational institutions in Uzbekistan is increasing. To understand the reasons and dynamics of this process, it is necessary to conduct an econometric study.

Statistical data on the number of pedagogical personnel in Uzbekistan for the last 10 years were used as initial data. The number of graduates, number of students, number of institutions, and level of funding of higher education are the factors selected for analysis.

During the study, it was found that the increase in the number of professors and teachers is connected with the increase in the number of students and graduates of higher education institutions. It was also found that the level of funding for higher education is directly related to the number of professors and teachers.

However, despite the positive dynamics, econometric studies have shown that there are still problems in the field of higher education in Uzbekistan. For example, the composition of professors and teachers is unevenly distributed among educational institutions and regions of the republic. In addition, the low salary of teachers can lead to the departure of qualified personnel abroad.

To date, the reforms carried out in the field of science education and further education in our country are aimed at increasing the number and quality of personnel with a scientific degree. Personnel with a scientific degree have been providing great practical assistance in ensuring innovative development of the country, implementing new projects, and increasing labor productivity. Scientific centers, IT parks, innovation centers, and their scientific staff are among the first to provide innovative development in our country and are performing practical work in this field.

The President of our country Sh. Mirziyoev mentioned in a number of his speeches to carry out scientific work on important topics and apply its results in production. The President has the following thoughts: "Let's think about how the developed countries of the world achieve high development and well-being. First of all, isn't it because of the great attention to science and education?".

Therefore, in our republic, we need to organize scientific research at such a level that, as a result, we need to take direction for the development of science-intensive sectors and industries in our country, the production of innovative products, and the development of "green energy" sectors.

Despite this, conducting scientific research and increasing the efficiency of scientific research is one of the most important problems in our country today. It is necessary to carry out systematic work in the field of science in our country.

SECTION OF METHODS

The field of increasing the number of personnel with scientific degrees in our country depends on some internal, external, economic, and social factors. In this field, we have selected the following factors for our research to get effective results.

The resulting factor is the number of personnel with a scientific degree, person (Y).

Influencing factors - number of specialized scientific councils in HEIs and ITIs, unit (X^1), number of quotas for DSc and Ph.D., a person (X^2), average scholarship of Ph.D. and DSc, soum (X^3), Web of Science and number of articles in Scopus, unit (X^4).

Since the measurement units of the above factors are different, we logarithmized them. Logarithmization of the values of the factors does not bring them to the same unit of measurement, but to a certain extent aligns them.

We will conduct descriptive statistics on the number of personnel with scientific degrees in the Republic of Uzbekistan for the years 2010-2022 (Table 1).

Table 1. Descriptive statistics calculated on the number of personnel with academic degrees in the Republic of Uzbekistan

	lnY	**lnX$_1$**	**lnX$_2$**	**lnX$_3$**	**lnX$_4$**
Mean	6.386942	3.997391	6.407613	14.25712	7.381197
Median	5.808142	3.663562	6.184149	14.13963	7.110696
Maximum	8.062433	5.616771	8.188689	15.43163	8.494129
Minimum	5.288267	3.135494	5.236442	13.35921	6.843750
Std. Dev.	0.990516	0.797221	0.891581	0.727463	0.641195
Skewness	0.521686	0.813474	0.551159	0.437171	0.954086
Kurtosis	1.613510	2.317817	2.274224	1.876432	2.142163
Jarque-Bera	1.630948	1.685847	0.943506	1.097893	2.370880
Probability	0.442430	0.430450	0.623908	0.577558	0.305612
Sum	83.03025	51.96608	83.29897	185.3425	95.95556
Sum Sq. Dev.	11.77347	7.626731	9.538992	6.350423	4.933565
Observations	13	13	13	13	13

The average value (mean), median (median), maximum and minimum values (maximum, minimum) of each factor can be seen from the data in Table 1. In addition, the values of the standard deviation of each factor (std. dev. (Standard Deviation) - the coefficient of standard deviation shows how much each variable deviates from the average value) are given.

Skewness is a coefficient of asymmetry, and if it is equal to zero, it means that the distribution is normal and the distribution is symmetrical. If this coefficient is significantly different from 0, then the distribution is asymmetric (that is, not symmetrical). If the coefficient of asymmetry is greater than 0, that is, positive, then the normal distribution graph for the studied factor is shifted to the right. If it is less than 0, that is, it is negative, the normal distribution graph for the studied factor is shifted to the left. Graphs of normal distribution functions of all factors are presented in Figure 1 below.

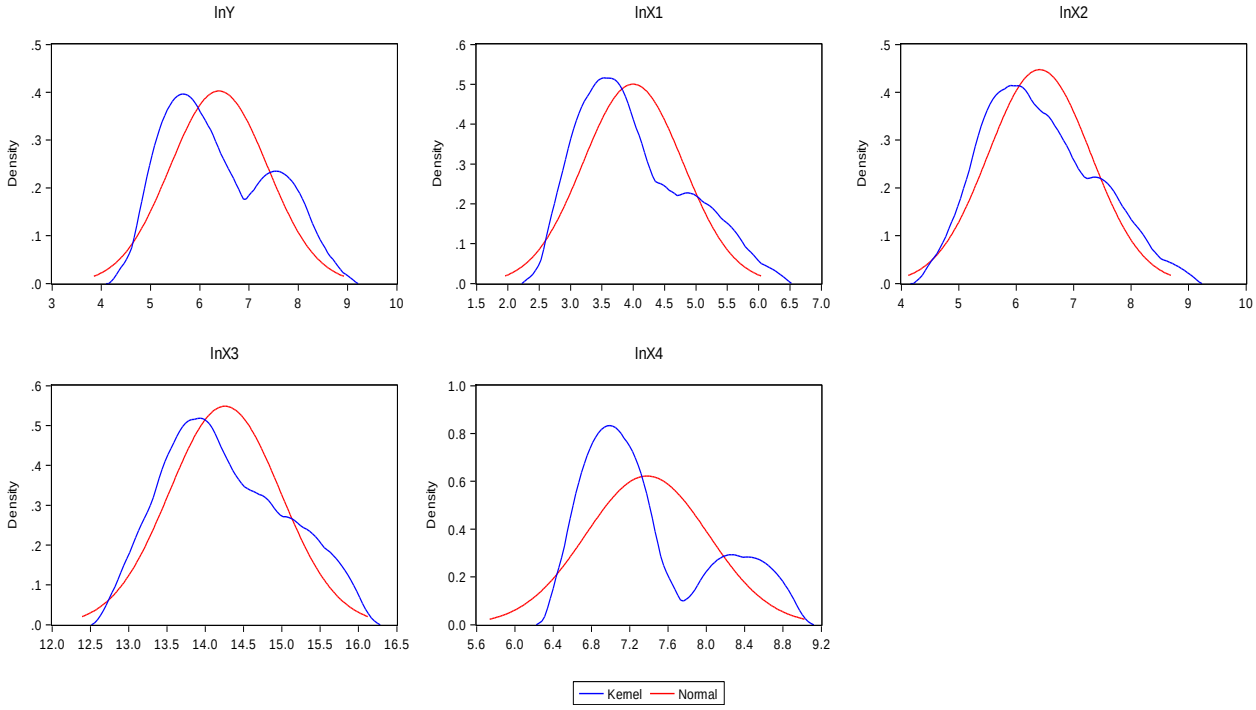


Figure 1. Graphs of normal distribution functions of factors

It can be seen from Figure 1 that all factors included in the multifactor econometric model obey the normal distribution law. Since the asymmetry coefficients of all factors have a positive value, the "right curve" in their graphs is longer than the "left curve", and it can be seen that the graph of the distribution function is shifted to the left.

These changes mainly show the changes in the number of academic staff in the Republic of Uzbekistan during the period under study. In some years, some factors had a sharp increase, while others did not change significantly. In general, all the studied factors obey the law of normal distribution.

To select factors for the multi-factor econometric model based on the factors affecting the number of academic staff in the Republic of Uzbekistan, it is necessary to conduct a correlation analysis between the factors. For this purpose, individual and pair correlation coefficients are calculated between the factors. We conducted a series of correlational and regression analysis calculations on the number of personnel with scientific degrees in the Republic of Uzbekistan mentioned above.

We conducted a series of tests based on the obtained results. It was the basis for not including the factors that do not respond to the conducted tests in the multifactor econometric model. The matrix of correlation coefficients that determines the density of connections between factors is

presented in the following table (Table 2)

Table 2. Individual and pair correlation coefficients between factors matrix*

Covariance Analysis: Ordinary

Date: 05/27/23 Time: 22:38

Sample: 2010 2022

Included observations: 13

Correlation

t-Statistic

Probability	LNY	LNX1	LNX2	LNX3	LNX4
LNY	1.000000				
LNX1	0.969484	1.000000			
	13.11584	-----			
	0.0000	-----			
LNX2	0.970108	0.684233	1.000000		
	13.25840	1.45536	-----		
	0.0000	0.07854	-----		
LNX3	0.880221	0.669008	0.681256	1.000000	
	10.11478	1.30996	1.45477	-----	
	0.0000	0.08716	0.07832	-----	
LNX4	0.830387	0.553784	0.605149	0.528950	1.000000
	8.863503	0.352723	0.422043	0.322338	-----
	0.0000	0.126342	0.102312	0.136244	-----

* Author's calculations

It can be seen from Table 2 that private correlation coefficients show the density of connections between the resulting factor (ln$Y$) and the factors affecting it. So, private correlation coefficients show that there are various connections between the resulting factor - "the number of academic staff in the Republic of Uzbekistan (ln$Y$) and influencing factors (lnX_i).

So, the density of connection between the number of personnel with academic degrees (lnY) and the number of specialized scientific councils in HEIs and ITIs (lnX_1) in the Republic of Uzbekistan is equal to 0.9695. This shows that there is a close connection between the studied factors. Also, in the Republic of Uzbekistan, there is a close relationship between the number of personnel with a scientific degree (ln$Y$) and the number of quotas for DSc and Ph.D. applicants (lnX_2), that is, the value of the private correlation coefficient between them is equal to 0.9701. In addition, there is a strong relationship between the number of academic staff (ln$Y$) and the average scholarship of Ph.D. and DSc (lnX_3) in the Republic of Uzbekistan. This is because the private correlation coefficient between these two factors is equal to 0.8802. Also, there is a strong connection between the number of academic staff in the Republic of Uzbekistan (ln$Y$) and the number of articles in the Web of Science and Scopus databases (lnX_4). The private correlation coefficient between these factors is equal to 0.8304.

In Table 2 above, there are also pairwise correlation coefficients, which show the correlation densities between the influencing factors (lnX_1, lnX_2, lnX_3, and lnX4). The most important thing here is that the influencing factors should not be closely related to each other. That is, there should be no multicollinearity between influencing factors. Multicollinearity is said to exist if the value of the pairwise correlation coefficient between two influencing factors is greater than 0.7. From the data in Table 2, it can be seen that the connection density between the influencing factors is not greater than 0.7. Judging by the pairwise correlation coefficients in the correlation

matrix, there is no multicollinearity between the influencing factors.

Also, in Table 2, coefficients for determining the reliability and probability of correlation coefficients were calculated (values in the rows located at the bottom of the calculated correlation coefficients). At the bottom of each correlation coefficient is its estimated Student's t-test value and probability. It is assumed that the calculated probability between the factors is not greater than 0.05. For example, in the Republic of Uzbekistan, the private correlation coefficient between the number of personnel with scientific degrees (lnY) and the number of specialized scientific councils in HEIs and ITIs (lnX1) is equal to, and. This shows that there is a close relationship between these two factors, the private correlation coefficient is reliable, and there is a positive relationship between the two factors with 95 percent accuracy.

Analyzing by the pair correlation coefficient, the pair correlation coefficient between the number of specialized scientific councils in HEIs and ITIs (lnX1) and the average scholarship of Ph.D. and DScs (lnX3) is equal, and This indicates that there is a weak relationship between these two factors and that the pairwise correlation coefficient is not reliable.

Another way to check the absence of multicollinearity between influencing factors is to calculate the coefficients of VIF (Variance Inflation Factors - effect of multicollinearity). The calculated VIF coefficients for each factor are presented in Table 3 below.

Table 3. Multicollinearity among influencing factors measure performance*

Variance Inflation Factors

Date: 05/27/23 Time: 22:52

Sample: 2010 2022

Included observations: 13

	Coefficient	Centered
Variable	Variance	VIF
LNX1	0.007894	1.270611
LNX2	0.003477	1.767783
LNX3	0.000582	4.453089
LNX4	0.035269	1.950199
C	9.405478	NA

* Author's calculations

If there is multicollinearity between influencing factors, then Centered VIF>10. Table 3 shows that the VIF coefficients of all influencing factors are less than 10. So, this also shows that there is no multicollinearity between the influencing factors, like the correlation analysis between the factors.

In checking the above, that is, in determining the density and form of connection between the factors, we look at their dot graphs to determine the relationship of each factor with the resulting indicator (lnY) (Fig. 2).

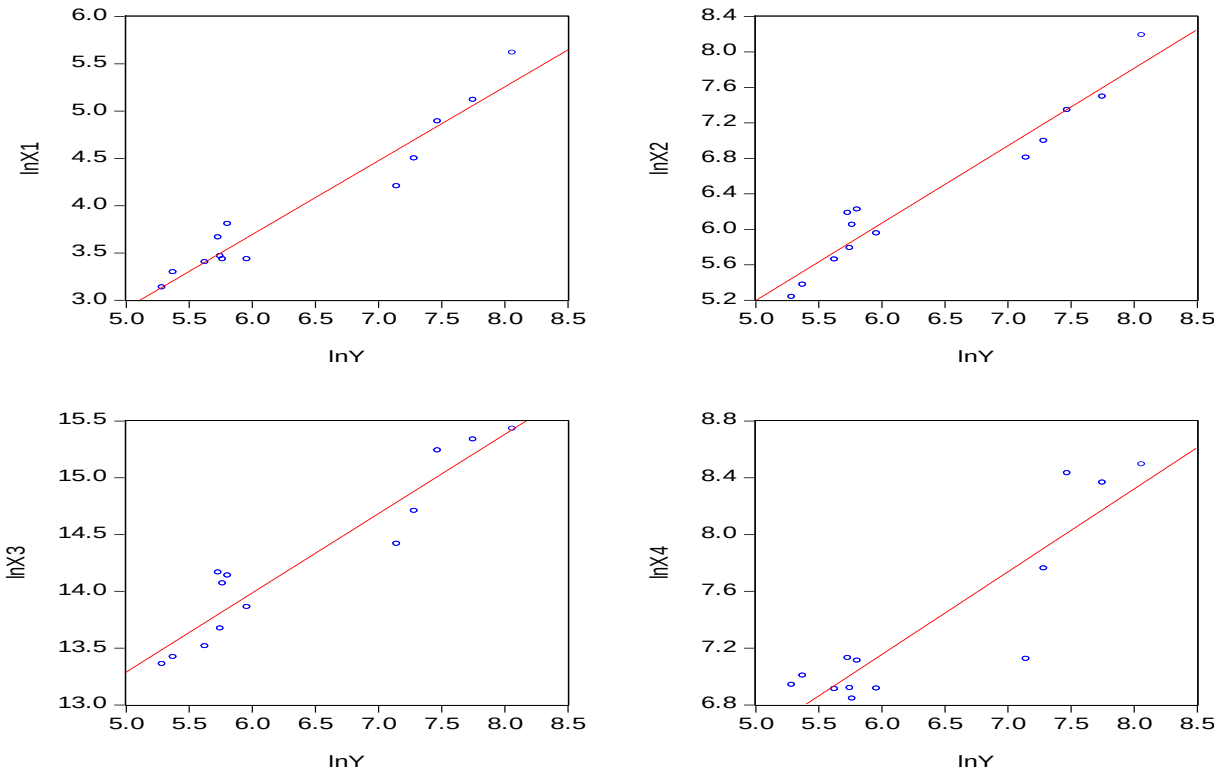


Figure 2. The appearance of the forms of connection between the number of scientific degrees in the Republic of Uzbekistan and the factors affecting it

The factors included in the multifactor econometric model are presented in the form of time series, and we use the Extended Dickey-Fuller statistic to check their stationarity (Table 4).

Table 4. Augmented Dickey-Fuller Statistics*

Null Hypothesis: LNY has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.677884	0.0028
Test critical values:	1% level	-4.121990	
	5% level	-3.144920	
	10% level	-2.713751	
*MacKinnon (1996) one-sided p-values.			

* Author's calculations

The calculated value of the t-statistic in the augmented Dickey-Fuller statistic is 2.6778, which is greater than the table value. At the same time, the probability (prob.=0.0028) is equal and it is less than 0.05, so the time series included in the multifactor econometric model is stationary.

RESULTS SECTION

Therefore, if we conclude on the factors included in the multifactor econometric model, the private correlation coefficients show the existence of reliable and tight connections and that there is no multicollinearity between the influencing factors. Also, time series are stationary (Dickie-Fuller statistics).

Thus, taking into account the absence of multicollinearity between factors and the absence of heteroscedasticity among the resulting factors, we will create a multifactor econometric model

for the number of academic degrees ($\ln Y$) and factors influencing it ($\ln X_i$). This multifactor econometric model looks like this:

$$\ln y = \ln \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + ... + \beta_n \ln x_n + \varepsilon, \quad (1)$$

where $\ln y$ – is the resulting factor, $\ln x_i$ – is the influencing factor, and ε – is a random error.

We used the "method of least squares" to determine the values of the unknown $\ln \beta_0, \ln \beta_1, \ln \beta_2, ..., \ln \beta_n$ parameters in the multifactor econometric model (1). The results are presented in Table 5 below.

Table 5. Parameters of the multifactor econometric model calculated by the number of academic degrees and factors affecting it*

Dependent Variable: LNY

Method: Least Squares

Date: 05/31/23 Time: 00:14

Sample: 2010 2022

Included observations: 13

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNX1	1,043684	0,290819	3,5887751	0.0021***
LNX2	0,252581	0,096541	2,6163081	0.0304***
LNX3	0,120907	0,051427	2,3045413	0.0545**
LNX4	-0,292091	0,135818	-2,1506061	0.0627**
C	1,028686	5,559042	0,1850474	0.8578
R-squared	0.949067	Mean dependent var		6.386942
Adjusted R-squared	0.923600	S.D. dependent var		0.990516
S.E. of regression	0.273784	Akaike info criterion		0.530768
Sum squared resid	0.599661	Schwarz criterion		0.748056
Loglikelihood	1.550010	Hannan-Quinn criter.		0.486105
F-statistic	37.26709	Durbin-Watson stat		2.026809
Prob (F-statistic)	0.000032			

* Source: author's calculations.

** - 0.1; *** - with an accuracy of 0.05 percent

Using the data of Table 5 above, we will analytically express the multi-factor econometric model calculated on the basis of the number of academic degrees ($\ln Y$) in the republic as follows:

$$\ln \hat{Y} = 1{,}0287 + 1{,}0437 \ln X_1 + 0{,}2526 \ln X_2 + 0{,}1209 \ln X_3 + 0{,}2921 \ln X_4. \quad (2)$$

The calculated multifactor econometric model shows that the number of specialized scientific councils ($\ln X_1$) in HEIs and ITIs increases by an average of one percent, while the number of academic staff ($\ln Y$) in the republic increases by an average of 1.0437 percent. While the number of quotas for DSc and Phds ($\ln X_2$) increased by an average of one percent, the number of personnel with a scientific degree ($\ln Y$) in the republic increased by an average of 0.2526 percent. An average increase in the average scholarship of Ph.D. and DSc ($\ln X_3$) by one percent leads to an average increase in the number of academic staff ($\ln Y$) by 0.1209 percent. An increase in the number of articles indexed in Web of Science and Scopus ($\ln X_4$) on average by one percent leads to a decrease in the number of academic staff in the republic ($\ln Y$) by an average of 0.2921 percent.

To check the quality of the multifactor econometric model (2) based on the number of academic

staff in the republic, we will check the coefficient of determination. The coefficient of determination shows how many percent of the resulting factor is made up of the factors included in the model. The calculated coefficient of determination (R^2 - R-squared (Table 5)) is equal to 0.9491. This shows that 94.91 percent of the number of academic staff in the republic is calculated (2) from the factors included in the multifactor econometric model. The remaining 5.09 percent (100.0-94.91) show that it is the influence of factors that have not been taken into account.

We use Fisher's *F*-criterion to check the statistical significance of the multifactor econometric model (2) based on the number of personnel with a scientific degree in the republic (2). Fisher's calculated F-criterion value is compared with its value in the table. If $F_{calculation}>F_{table}$, then the multifactor econometric model (2) is said to be statistically significant and it can be used to forecast the result indicator - the number of graduates in the republic (lnY) for future periods.

Now, to check the statistical significance of the multifactor econometric model (2) based on the number of academic degrees in the republic, we find the table value of the *F*-criterion. For this, we calculate the values according to the degrees of freedom $k_1 = m$ and $k_2 = n - m - 1$ and α the level of significance. Based on the level of significance α=0.05 and degrees of freedom $k_1 = 4$ and $k_2 = 13 - 4 - 1 = 8$ the table value of the *F*-criterion is F_{table} =3.84. Based on the fact that the calculated value of the *F*-criterion is equal to $F_{calculation}$=37,267 and the table value is equal to F_{table}=3.84 and since the condition $F_{calculation}>F_{table}$ is fulfilled, the multifactor econometric model (2) can be said to be statistically significant, and from it scientific degrees in the republic number (ln*Y*) can be used to forecast future periods.

Student's t-test is used to check the reliability of the calculated parameters of the multifactor econometric model (2) based on the number of graduates in the republic. By comparing the calculated (calculation) and table (table) values of Student's t-test, we accept or reject the N0 hypothesis. For this, we find the tabular value of the t-criterion based on the conditions of the selected reliability probability (a) and degree of freedom ($\text{d.f.} = n - m - 1$). Here n is the number of observations, m is the number of factors. When the reliability probability is *a*=0.05 and the degree of freedom $\text{d.f.} = 13 - 4 - 1 = 8$, the table value of the t-criterion is equal t_{table} =2.3060.

It can be seen from the calculations carried out to create a multifactor econometric model that the calculated values of the t-criterion for all factors included in the free extreme, multifactor econometric model are $\alpha = 0{,}05$ (lnX_1 va lnX_2) and $\alpha = 0{,}1$ (lnX_3 va lnX_4) are greater than the table value in accuracy (Table 5). This means that all factors are reliable and allows these factors to participate in the multifactor econometric model.

We use the Darbin-Watson (DW) criterion to check the presence of autocorrelation in the residuals of the outcome factor (ln*Y*) according to the multifactor econometric model (2) based on the number of academic degrees in the republic. The calculated DW value is compared with the DW_L and DW_U in the table. If $DW_{account}$ is less than DW_L, then the residuals of the resulting factor are said to have autocorrelation. If DWcount is greater than DW_U, then the residuals of the resulting factor are said to have no autocorrelation. The lower limit value of the Darbin-Watson criterion is DW_L=0.69 and the upper limit value is DW_U=1.97. DW = 2.0268. Therefore, since $DW_{account}$>DWU, there is no autocorrelation in the residuals of the resulting factor (number of graduates in the republic (lnY)).

The absence of autocorrelation in the residuals of the resulting factor also indicates that the multi-factor econometric model given above (2) can be used in forecasting.

Table 6 below presents calculations for determining autocorrelation and private autocorrelation between factors.

Table 6. Determination of autocorrelation and private autocorrelation between factors*

Date: 05/31/23 Time: 00:13
Sample: 2010 2022
Included observations: 13

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.736	0.736	8.8112	0.003
		2	0.483	-0.129	12.946	0.002
		3	0.265	-0.091	14.317	0.003
		4	0.072	-0.116	14.431	0.006
		5	-0.138	-0.219	14.892	0.011
		6	-0.191	0.133	15.908	0.014
		7	-0.265	-0.191	18.197	0.011
		8	-0.353	-0.172	23.047	0.003
		9	-0.356	0.028	29.223	0.001
		10	-0.327	-0.118	36.158	0.000
		11	-0.271	0.048	43.338	0.000
		12	-0.156	0.053	48.105	0.000

* Source: Author's calculations

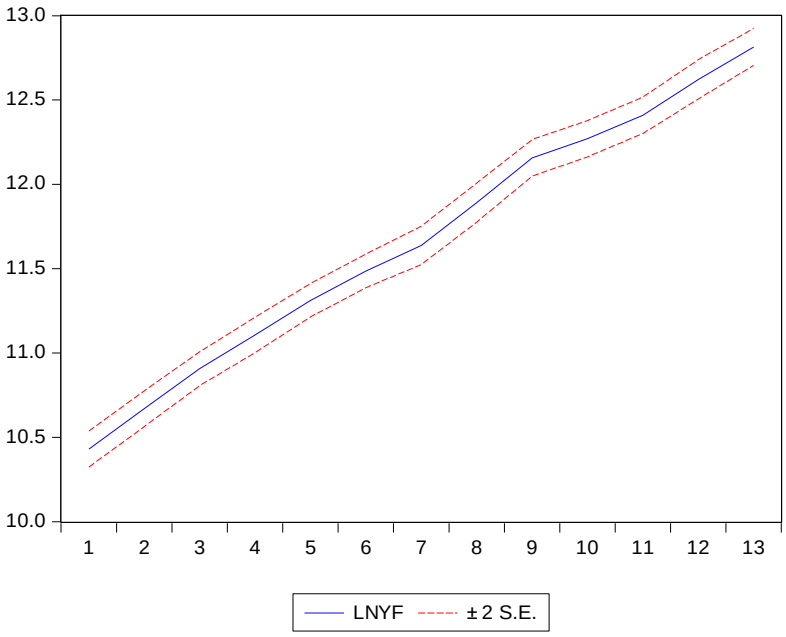
The autocorrelation and private autocorrelation test between the factors also corresponded to the obtained results. That is, there is no autocorrelation in the studied time series. Because, from all the observations, it can be seen that the probability value of all the residuals is less than 0.05. In addition, the values of autocorrelation (AS) and specific autocorrelation coefficients (RAS) have a decreasing order.

The actual (Actual), calculated (Fitted) values of the multifactor econometric model calculated by the number of graduates in the republic (2) and the differences between them (Residual) are presented in Figure 3 below.

3-rasm. Graph of the actual (Actual), calculated (Fitted) values of the number of academic degrees in the republic and the differences between them (Residual)

It can be seen from Figure 3 that the graph of the calculated values of the number of graduates in the republic according to the calculated multifactor econometric model (2) is very close to the graph of its actual values, and the differences between them are not so great. This is another proof that the calculated multifactor econometric model (2) can be used to forecast the number of people with scientific degrees in the republic for the future periods.

The coefficient of MARE (Mean absolute percent error) is used in forecasting the result indicator for future periods from the (2) multifactor econometric model calculated by the number of scientific degrees in the republic. If the value of the calculated MARE coefficient is less than 15.0 percent, the model can be used to forecast the resulting factor, otherwise it cannot be used. The value of the MARE coefficient in terms of the number of people with scientific degrees (lnY) in the republic under study is 0.2263 percent (Fig. 4).



Forecast: LNYF	
Actual: LNY	
Forecast sample: 1 13	
Included observations: 13	
Root Mean Squared Error	0.035847
Mean Absolute Error	0.025578
Mean Abs. Percent Error	0.226262
Theil Inequality Coefficient	0.001533
Bias Proportion	0.000000
Variance Proportion	0.000595
Covariance Proportion	0.999405

Figure 4. Indicators of using the calculated model in forecasting

This is less than 15.0 percent (MAPE=0.2263), that is, it is 0.22 percent. Therefore, it can be concluded that multi-factor econometric model (2) can be used to forecast the number of graduates in the republic.

Thus, the multi-factor econometric model (2) based on the number of academic degrees in the republic and the factors affecting it was checked using a number of criteria and it was found that it can be used in forecasting the factors in the future. Therefore, with the help of this (2) multi-factor econometric model, we will make forecast calculations of the number of scientific degrees in the republic for the future periods.

To do this, we first create trend models for each influencing factor. A trend model is a time-dependent function of an influencing factor, and it generally looks like this:

$$X_i = \beta_0 + \beta_1 \cdot t + \varepsilon \qquad (3)$$

First, we create a trend model for the number of specialized scientific councils ($\ln X_1$) in HEIs and ITIs. The trend model looks like this:

$$\ln \hat{X}_1 = 2{,}6523 + 0{,}1921 \cdot t \qquad (4)$$

$$R^2 = 0{,}8811\ ,\ F_{\text{хисоб}} = 81{,}499\ ,\ t_{\text{хисоб}} = 9{,}0277$$

The trend model for the number of quotas for DSc and Phd ($\ln X_2$) looks like this:

$$\ln \hat{X}_2 = 4{,}8476 + 0{,}2228 \cdot t \qquad (5)$$

$R^2 = 0{,}9476$, $F_{\text{хисоб}} = 198{,}887$, $t_{\text{хисоб}} = 14{,}1027$

The trend model for the average stipend ($\ln X_3$) of Phd and DSc is as follows:

$$\ln \hat{X}_3 = 12{,}9802 + 0{,}1824 \cdot t \qquad (6)$$

$R^2 = 0{,}9536$, $F_{\text{хисоб}} = 226{,}098$, $t_{\text{хисоб}} = 15{,}0366$

The trend model for the number of articles ($\ln X_4$) in Web of Science and Scopus looks like this:

$$\ln \hat{X}_4 = 6{,}4038 + 0{,}1396 \cdot t \qquad (7)$$

$R^2 = 0{,}7192$, $F_{\text{хисоб}} = 28{,}1669$, $t_{\text{хисоб}} = 5{,}3072$

The analysis of the trend models created between the influencing factors (lnXi) and the time factor (t) shows that the statistical significance and reliability of all calculated coefficients in the trend models (4) - (7) were determined.

Thus, we calculate the values of the trend models (4) - (7) in the forecast period and, putting their calculated values into the multifactor econometric model (2), we first calculate the forecast values of the influencing factors, and then the forecast values of the resulting factor. We exponentiate the predicted values to free them from the logarithm. As a result, we will have the values of the variables included in the multifactor econometric model based on the number of graduates in the republic during the forecast period (Table 7).

Table 7. Forecast values of the number of people with scientific degrees in the republic and factors affecting it for 2023-2027*

Years	The number of people with scientific degrees, Y	Number of specialized scientific councils at HEIs and ITIs, unit, X_1	Number of quotas DSc and PhD, place, X_2	Average stipend for PhD and DSc students, soums, X_3	Number of articles in Web of Science and Scopus, units, X_4
2022	3173	275	3600	5033517,0	4886
2023	4213	277	3986	5575764,5	4266
2024	4523	286	4236	6691509,2	4906
2025	4897	297	4507	8030521,3	5641
2026	5193	303	5632	9637477,9	6486
2027	5705	320	7038	11565996,3	7458

* Author's calculations

During the forecast period, in the new years 2023-2027, the number of people with scientific degrees in the republic may increase by 2532 people or 1.8 times in absolute terms compared to 2022 (Fig. 5).

Figure 5. Forecast values of scientific degrees in the Republic in 2023-2027

In addition, during the forecast period, the average number of people with scientific degrees in the republic is 555 per year.

During the forecast period, the number of specialized scientific councils in HEIs and ITIs is increasing (as a result of the opening of many new specialties). In 2022, there were 275 specialized scientific councils in the republic, and by 2027 there will be 320. Therefore, it is possible to observe that about 50 new specialized scientific councils will be established in HEIs and ITIs during the forecast period (Fig. 6).

Figure 6. Forecast values of the number of specialized scientific councils in HEIs and ITIs in 2023-2027

During the forecast period, the opening of specialized scientific councils in new fields (scientific councils specializing in green economy, artificial intelligence, economic security and a number of science-intensive specialties) is observed.

The government allocates a number of quotas (DSc and PhD) for young people engaged in scientific research in our republic (Fig. 7).

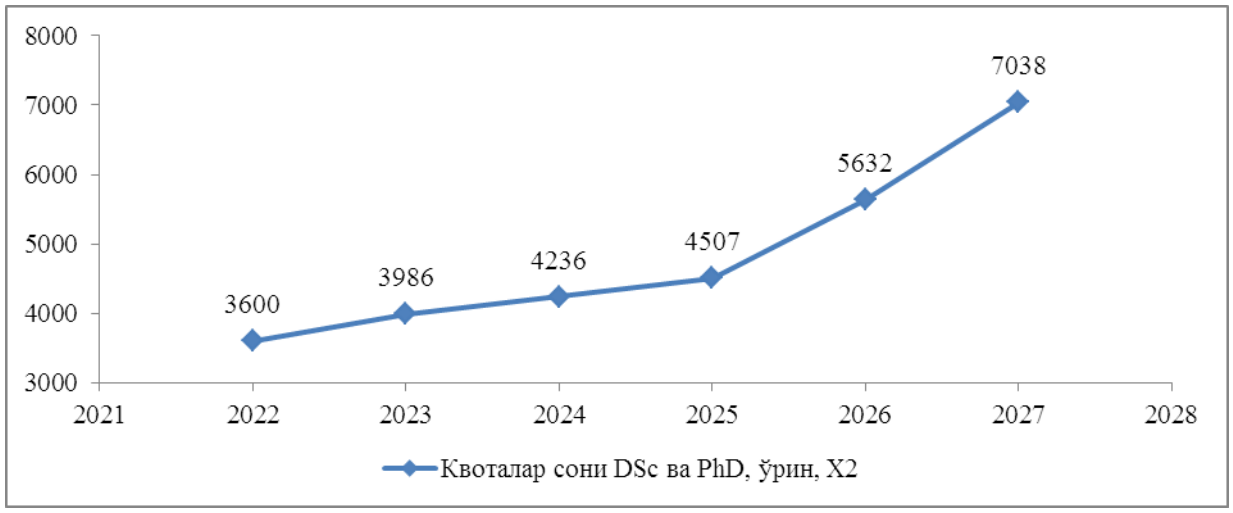


Figure 7. Forecast values of quotas for DSc and PhDs in 2023-2027, places

If in 2022 the number of quotas for DSc and PhD was 3,600, it can be seen that this figure will be 7,038 in the forecast period, that is, in 2027. In the forecast period (2023-2027), the number of quotas for DSc and PhDs is expected to increase by 3438 places or 1.96 times.

The average stipend of PhDs and DScs also tends to increase. (Figure 8)

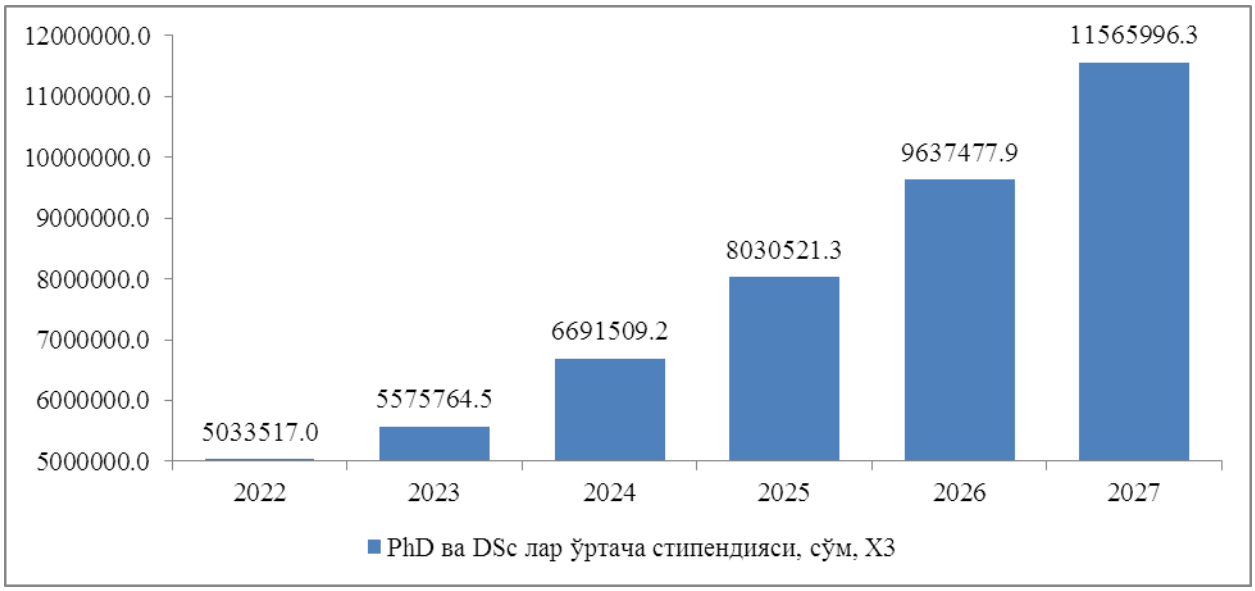


Figure 8. Forecast values of the average scholarship for DSc and PhD students in 2023-2027, soums

During the forecast period, for example, in 2027, the average amount of scholarships for DSc and PhDs is 11,565,996.3 soums. This is 2.3 times compared to 2022. Increasing the amount of scholarships for DSc and PhDs, in turn, is a financial incentive for them to quickly defend their dissertations.

DISCUSSION SECTION

Publishing scientific articles in the Web of Science and Scopus international databases is considered one of the most demanding and prestigious activities at the same time (Fig. 9). Publication of scientific articles in these prestigious international databases is mandatory for DSc and PhD. But at the same time, publishing scientific articles requires certain financial resources. On the one hand, this can be seen as an obstacle for DSc and PhDs in the path to protection. Nevertheless, DSc and PhD students play a major role in increasing the reputation of universities

by publishing the results of scientific research in these journals.

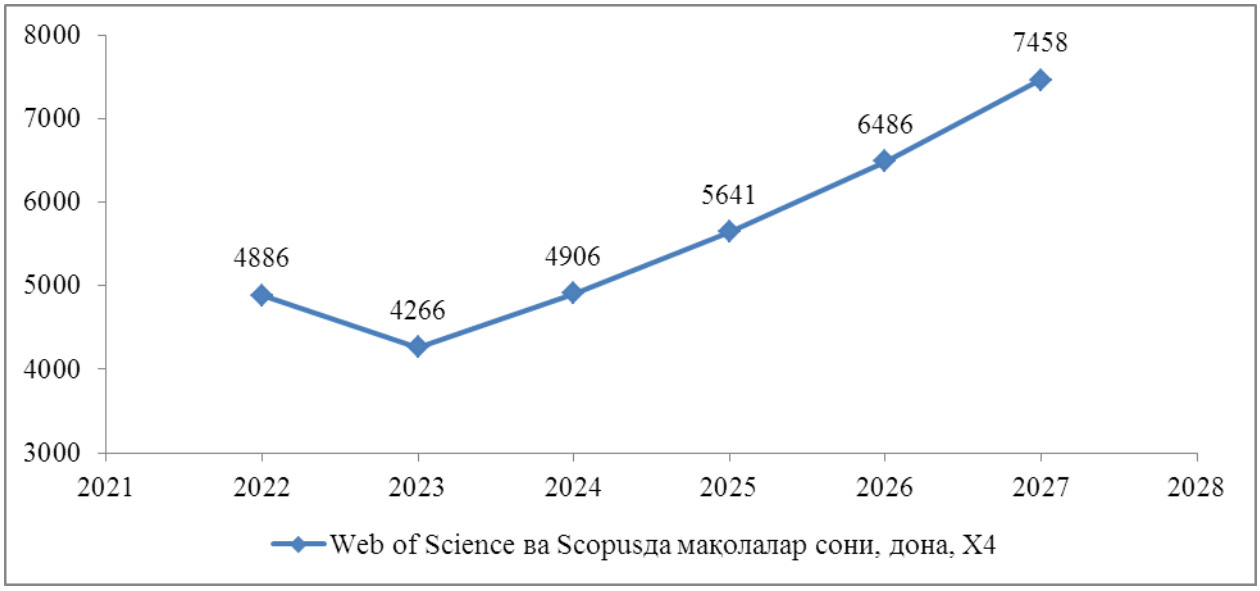


Figure 9. Publication of scientific articles in Web of Science and Scopus international databases

It can be seen from Figure 9 that in 2027, the number of scientific articles published in the Web of Science and Scopus international databases was 7,458. It can be observed that this indicator will increase by 1.5 times compared to 2022.

CONCLUSION

To sum up, to increase the number of graduates in the republic, it is necessary to solve several organizational, practical issues. Among them, the most important thing is to create a financial incentive system and provide it to the best DSc and Ph.D. students, which encourages them to defend their thesis.

Thus, the econometric study of the number of professors and teachers in Uzbekistan showed a positive trend, but it is necessary to continue to work on improving the system of higher education in the country. It is important to ensure the equal distribution of teaching staff across educational institutions and regions and to increase the level of remuneration for teachers' work.

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