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Analysis of Development of Production Infrastructure in Navoi Region

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A B S T R A C T

Today, a significant restructuring is required, namely the improvement of the production infrastructure, technology, methods of organizing production management. This article analyzes the industrial infrastructure of the Navoi region. When analyzing the industrial infrastructure of the Navoi region, data collected during a scientific study from enterprises related to industrial infrastructure facilities were used. The author used a regression model, while building regression models of processes, the author used the least squares method.

A R T I C L E I N F O

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To determine whether the development of Navoi region under the influence of production infrastructure on the volume of gross regional product can be more positive, we need to know in advance the negative impact of these factors, scientifically substantiate the impact of these factors and draw appropriate conclusions. Therefore, in the analysis of production infrastructure of Navoi region, using the data collected during the regional engineering and communication organizations, statistical organizations and scientific research, we determine the regression equations of output in key areas of production infrastructure in the region.

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The main indicators of the gross regional product (GRP) and production infrastructure in Navoi region are as follows:

Gross regional product (billion soums) - Y;

Industrial product - Y1

Electricity, mln. kWh, soum - X1;

Natural gas supply, thousand cubic meters - X2;

Water volume, thousand cubic meters - X3;

Freight turnover, mln. ton-km - X4.

Table 1. Dynamics of key indicators representing the production infrastructure in the region

Years	Gross regional product, billion soums	Industrial production, billion soums	Electricity, mln. kWh	Natural gas, thousand cubic meters	Water supply, thousand cubic meters	Freight turnover, mln. ton-km
	Y	Y_1	X_1	X_2	X_3	X_4
2010	4325,6	4038,5	7242,300	4256,890	1028,000	1223,075
2011	5285,4	4865,7	7326,900	4402,293	1028,000	1262,979
2012	6528,8	5761,1	7308,100	4556,266	816,500	1227,430
2013	7708,5	7087,3	7269,100	4538,471	695,500	1280,691
2014	9181,7	8238,9	7342,700	4630,802	701,000	1264,690
2015	10545,2	9286,9	7402,000	4753,874	632,300	1386,432
2016	11959,3	10657,9	7213,900	4662,185	632,300	1481,406
2017	14681,5	13072,9	7287,600	4897,730	631,100	1517,180
2018	22677,2	22892,4	7463,300	4440,956	633,100	1589,459
2019	36661,9	44438,1	7808,800	4687,413	632,100	1642,181
2020	50605,8	65116,7	8325,000	4994,711	632,900	1653,890
2021	59357,7	73631,1	8596,600	5093,334	632,900	1674,067

Source: Prepared by the author on the basis of data from the Navoi regional department of statistics

We found it necessary to use a regression model in assessing the development of the gross regional product. In doing so, we created regression models in n-exponent and linear view. To do this, we used the least squares method in generating process regression models to create regression model $Y_x = a_0 + a_1x + a_2x^2 + \cdots + a_kx^k$, you need to do the following:

$F = \sum(Y - Y_x)^2 \rightarrow min$ or $F = \sum(Y - a_0 - a_1x - a_2x^2 - \cdots - a_kx^k)^2 \rightarrow min$ if we derive a special product from this, a system of equations in the following view is formed.

$$\begin{cases} \sum Y = a_0 n + a_1 \sum x + a_2 \sum x^2 + \cdots + a_k \sum x^k \\ \sum Yx = a_0 \sum x + a_1 \sum x^2 + a_2 \sum x^3 + \cdots + a_k \sum x^{k+1} \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ \sum Yx^k = a_0 \sum x^k + a_1 \sum x^{k+1} + a_2 \sum x^{k+2} + \cdots + a_k \sum x^{2k} \end{cases} \quad (1)$$

Fisher's F-criterion is used to assess the "significance" of the regression equation. The amount of Fisher's F-criterion is related to the determination coefficient as follows:

$$F_{real} = \frac{r_{xy}^2}{1-r_{xy}^2} \cdot (n-2), \quad \text{n} \geq 3. \qquad (2)$$

If $\alpha = 0{,}05$ (five percent meaning level) and the degree of freedom $k_1 = 1$ and $k_2 = n-2$ then the random values are found in the tables given by Fisher's distribution, -F_{tabl} of the F-sign. If this $F_{\text{real}} > F_{tabl}$ inequality is reasonable, the regression equation is statistically significant.

Errors in the regression equation "a" and "b" parameters and r_{xy}- random errors in the calculation of the correlation coefficient are also affected. Therefore "a" and "b" standard errors in calculating these parameters determined by m_a, m_b.

The random error of the regression coefficient was determined by the following formula:

$$m_b = \sqrt{\frac{\sum (y-y_x)^2 /(n-2)}{\sum (x-\bar{x})^2}}. \qquad (3)$$

The random error of "a" parameter of the regression equation was determined by the following formula:

$$m_a = \sqrt{\frac{\sum (y-y_x)^2}{n-2} \cdot \frac{\sum x^2}{n \cdot \sum (x-\bar{x})^2}}. \qquad (4)$$

The random error of the linear correlation coefficient was determined on the basis of the following formula:

$$m_r = \sqrt{\frac{1-r^2}{n-2}} \qquad (5)$$

Assessment of the statistical significance of the parameters of the regression equation can also be done using the Student-t criterion (When the number of degrees of freedom is n-2 and $\alpha = 0{,}05$, the table values of the symbol t are found in the Student Distribution Table). It includes the following:[1]

$$t_a = \frac{a}{m_a}, \quad t_b = \frac{b}{m_b}, \quad t_r = \frac{r_{xy}}{m_r}. \qquad (6)$$

If the found original values of the sign t are greater than its table value (i.e $t_a > t_{tabl}$, $t_b > t_{tabl}$, $t_{rxy} > t_{tabl}$), the parameters "a" and "b" are statistically significant.

The volume of industrial production in Navoi region (together with the closed system) was defined as Y1, the values obtained as a result of observations were formed trend models by relating the time factor t.

In Navoi region, changes in the volume of industrial production were taken as factors influencing the production infrastructure: the volume of electricity, natural gas, water and freight traffic supplied to consumers. It makes sense to construct a multivariate regression model using these factors.

[1]Econometrics: Textbook./Edited by I.I.Eliseeva. -M.: Finance and statistics, 2003-p. 344.

One of the basic rules of multivariate regression modeling is to determine the bond densities between the factors selected for the model, that is to investigate the problem of multicollenearity of the relationship between the selected factors.

A correlation matrix was calculated between the influencing factors for the outcome factor. We conduct a correlation analysis to determine if there is no multicollenity between these factors (Table 2).

Table 2. The correlation matrix between the volume of industrial output and factors of production infrastructure of Navoi region

	Y_1	X_1	X_2	X_3	X_4
Y_1	1,000				
X_1	0,954	1,000			
X_2	0,838	0,733	1,000		
X_3	-0,566	-0,372	-0,704	1,000	
X_4	0,806	0,735	0,697	-0,701	1,000

Source: Created by the author using MS Excel

In order to create a multifactorial empirical model of the basic supply of production infrastructure for the volume of industrial output in Navoi region, all the above factors are taken and how they behave in the model is examined.

As a result of our analysis, when performing a correlation analysis between industrial output volume and production infrastructure indicators, it was found that there is no multicorrelation between factors, and there is a correlation between each factor and the outcome factor, and a factor 3 inverse relationship.

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