ECONOMY

MATHEMATICAL-STATISTICAL ANALYSIS OF PRODUCTS SOLD IN ENTERPRISES

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Abstract. *The demand for some oil mining equipment in the country is met by the activities of open joint-stock companies with an oil mechanical engineering profile. Such enterprises include: Baku Steel Ropes OJSC, Baku Oil Mining Equipment OJSC, Neftgazmash OJSC.*
For the successful solution of many economic and social problems in the country, it is important to increase labor productivity, the production of quality products, in short, improve the efficiency of all social production.
In modern times, the increase in production efficiency in the country's economy is due to a number of reasons. First, a very wide economic and scientific-technical potential has been created in the country. A slight deviation from this potential means a large loss. Improving the use of individual resources allows for greater economic gains. Second, the extensive factors of economic development have exhausted themselves to some extent.
Keywords: *efficiency, oil mechanical engineering, joint stock company, realized product, factors, mathematical-statistical model, regression, criteria, interpretation.*

Introduction. In market relations, the rational use of past labor (fixed assets, raw materials, materials) in the conditions of high technical support of production is important.

With the development of scientific and technical progress, against the background of a general decrease in labor costs per unit of output, the share of materialized (past) labor is constantly increasing, and this is the essence of progress. In modern times, like other industries, the share of live labor in total production costs in oil engineering is up to 10%. The use of fixed assets is important in increasing production efficiency, as well as increasing production. Rising economic growth increases the demand for raw materials. That is why the issue of rational use of material and energy resources to reduce the material capacity of the product is urgent.

Saving on material resources means saving on capital investment. Reducing the material capacity of the product is associated with improving its quality. Improving product quality provides great economic benefits by reducing the demand for resources, capital investment and operating costs.

Production of products in oil engineering enterprises is important for its realization and increase of economic efficiency. It is from this point that it is noted that economic growth in market relations is associated with the intensification of production, increasing the efficiency of rational use of labor, material and financial resources. There are many ways to increase production efficiency, the basics of which can be grouped as follows.

- Acceleration of scientific and technical progress and their application in oil engineering enterprises;

- Implementation of economic intensification with the application of the latest technology in production;

- Improving the management system, their methods and organizational structure;

- Application of new equipment and technology, digital technology in production;

- Improving the system and methodology of planning at the enterprise level, improving the system of technical and economic indicators and improving access to world experience for this purpose;

- Technical progress, the best direction of development, improvement of pricing policy aimed at improving product quality;

- Creation of conditions for the produced product to meet the world standards and introduction of the high quality product to the world market;

- Improving the interaction of other technical and economic indicators of the enterprise with the realized product;

- Realization of constant intensification of production process in oil engineering enterprises.

Research methodology. Oil mechanical engineering enterprises have a special role in the economy of the Republic of Azerbaijan, where the study of production and sales is important. In addition to the methods known in statistics, such as grouping, comparison, systematization, dynamic series, probability theory, mathematical-statistical (correlation and regression modeling) methods were used to study the products sold in oil companies. The obtained models were tested by statistical criteria, its economic interpretation was carried out and analyzed by a number of statistical indicators.

Research results. The production program of each enterprise is of great importance in its production and economic activity. The volume, range and quality of the products produced are an integral part of the overall plan of the oil engineering enterprise. A very large amount of material resources and various equipment are used in the production process. That is why the maximum use of raw materials and production capacity in the planning work of oil refineries is reflected as an economic issue.

The production program has a comprehensive impact on the production and economic activities of the oil engineering enterprise. The production program determines costs, profits, profitability, labor productivity and other indicators, which imposes special requirements on the control of its design and implementation, and decisions are made to obtain its optimal version. The production program includes the following reports: volume and nomenclature of products produced in kind and value, volume and nomenclature of realized products, production capacity and use of fixed capital.

In market relations, each enterprise calculates these indicators for a long time in order to achieve strategic goals, and these reports are also made over the years. Current reports on production and sales are made on a monthly and quarterly basis. This is due to the fact that the consumption of individual products is not equal, there is a need to repair technological equipment, work is being done to increase production capacity, organizational and technical measures are being taken.

Quality and reliability of equipment in oil enterprises, assessment of the service life of this equipment in the oil industry, their maintenance, factors affecting production capacity, the relationship between oil and oil companies, the potential and value of the company, their analysis in the economic literature [1-5,7- 10] has been extensively studied. However, it is important to study the products sold at oil companies and the factors that affect its level. This is also closely related to the issue of financial sustainability in these enterprises, and there is a need to use mathematical and statistical methods to address this issue. Based on the Aprior analysis, two indicators affecting the realized product (RM) were taken: the number of employees (IS) and labor productivity (LP), and a mathematical-statistical model was built between them.

Linear dependence was used to construct the regression model and is generally formulated as follows:

$$y = a_0 + a_1 x_1 + a_2 x_2 + \cdots + a_n x_{n_1}, \qquad i = \overline{1,n} \qquad (1)$$

Criteria and indicators known in mathematical statistics were used for the analysis of the obtained model [6].

Using the "Statistics" program, the input data of individual OJSCs were entered into the computer and the following regression model was obtained for BSR OJSC.

$$RM_1 = -331{,}8491 + 13{,}9546 \, \dot{I}S_1 + 24{,}2246 \Theta M_1 \qquad (2)$$

Here　　$RM_1 -$ Volume of products sold in BSR OJSC, thousand man

　　　　$\dot{I}S_1 -$ Number of employees in BSR OJSC, people

　　　　$\Theta M_1 -$ Labor productivity in BSR OJSC, man / person

The statistics of the obtained model are shown in the table below (Table 1).

It can be seen from Table 1 that the total correlation coefficient is R = 0.9923 and is very high. The critical (table) value of the F-Fisher coefficient characterizing the obtained model is 3.62 with a probability of 95%, and its reported value is 64.7265, i.e. the condition $F > F_{krit}$ is satisfied and the model is adequate. However, the P-significance indicator does not confirm the adequacy of the model, as the condition $F_{əh} > 0.05$ is not satisfied, ie 0.01521 < 0.05. The analysis of t-Student coefficients characterizing the individual coefficients of the regression model shows that the critical (table) value of this indicator is higher than some coefficients, ie $t > t_{krit}$ is not paid for these coefficients. Only in the labor productivity indicator $t > t_{krit}$, i.e. $t_{əh_1} > t_{krit}$ (4.9618 > 2.57) is satisfied.

Table 1. Statistical indicators of the model

Indicators	The sign	The Formula	Price
1	2	3	4
total correlation coefficient	R	$\sqrt{\dfrac{\sum_{i=1}^{n}(\tilde{y}_i - \bar{y})^2}{\sum_{i=1}^{n}(y_1 - \bar{y})^2}}$	0,992363563
determination coefficient	R^2	$\dfrac{\sum_{i=1}^{n}(\tilde{y}_i - \bar{y})^2}{\sum_{i=1}^{n}(y_1 - \bar{y})^2}$	0,984785441
Standard error	S_i	$\sqrt{\dfrac{\sum_{i=1}^{n} E_i^{\,2}}{n-2}}$	40,10640809
sum of squares regression residue total	SS SS_{req} SS_{resid} $SS_{req}+SS_{resid}$	$\sum_{i=1}^{n}(\tilde{y}_i - \bar{y})^2$	208228,3178 3217,0479 211445,3657
to a degree of freedom dispersion regression residue	MS S_i^2 S_{ao}^2	SS_{req}/K_1 SS_{req}/K_2	104114,1589 1608,52397
F-Fisher	F	S_i^2/S_{ao}^2	64,72651998
95% probability	$F\text{-}kritik$	$F_{hes} > F_{krit}$	3,62
F-importance	$F_{əh}$	if: $F_{əh} > 0.05$ the model is adequate if: $F_{əh} < 0.05$ the model is not adequate	0,015214559 < 0,05
Student coefficient-t	t_{RM_1} $t_{İS_1}$ $t_{ƏM_1}$	$t_{hes} > t_{krit}$	-0,673101028 1,10114175 4,961826027
95% probability	t_{krit}		2,57
P-importance	P_{RM_1} $P_{İS_1}$ $R_{ƏM_1}$	if: $P < 0.05$ With a 95% probability, the model coefficient is significant	0,570188209 0,385643055 0,03829956 (significant)
Standard error	RM_1 $İS_1$ $ƏM_1$		492,4420644 12,67281485 4,882202085
95% probability reliability coefficients	RM_1 $İS_1$ $ƏM_1$		$-2452,807023 \le RM_1 \le 1789,109414$ $-40,57215558 \le İS_1 \le 68,4812691$ $3,218217245 \le ƏM_1 \le 45,2310575$

If the P-significance values also meet the condition P <0.05, i.e. with 95% probability, this coefficient of the model is considered significant. In the model (2) purchased for the product sold in BSR OJSC, only $R_{\partial M_1}$ pays for this condition, i.e. 0.03830 <0.05 condition is paid and this factor is important. The table shows that with a probability of 95%, the reliability coefficients $RM_1(\dot{I}S_1, \partial M_1)$ are paid for all factors, i.e.

$$min \leq RM_1(\dot{I}S_1, \partial M_1) \leq max$$

It should be noted that such models were also purchased for Neftgazmash OJSC and BOME, OJSC. The regression model obtained for Neftgazmash OJSC sold product (RM_2) is as follows.

$$RM_2 = -3102,952567 + 23,18966263\dot{I}S_2 + 133,5048875\partial M_2 \qquad (3)$$

The criteria and indicators that characterize the model are as follows.

The total correlation coefficient is R = 0.999944. The standard error is 39.12708061. The reported value of the F-Fisher coefficient, which characterizes the adequacy of the model, is several times higher than its critical (table) value with a probability of 95%, i.e. the condition F$_{hes}$> F$_{krit}$ is satisfied, (756,40> 3,62). The value of the F-importance indicator does not satisfy the condition F$_{\partial h}$> 0.05. Reporting values of t-Student coefficients, which characterize the individual coefficients of the model, must satisfy the condition t$_{hes}$> t$_{krit}$. However, in our model $t_{RM_2} < t_{krit}$ ($-13,8903 < 2,57$), $t_{\dot{I}S_2} > t_{krit}$ ($14,5934 > 2,57$), $t_{\partial M_2} > t_{krit}$ ($34,8127 > 2,57$) terms are paid. In the P-importance index, the condition P <0.05 is satisfied for all coefficients, ie 0.0051 <0.05 for P_{RM_2}; 0.0047 <0.05 for $P_{\dot{I}S_2}$; for $P_{\partial M_2}$ is 0.00082<0.05. If we look at the reliability coefficients with a probability of 95%, we see that for all indicators, ie $RM_2(\dot{I}S_2, \partial M_2)$

$min \leq RM_2(\dot{I}S_2, \partial M_2) \leq max$ condition is satisfied.

The relationship between the product sold for Baku Oil Mining Equipment OJSC RM_3, the number of employees $\dot{I}S_3$ and labor productivity ∂M_3 is characterized by the following regression equation.

$$RM_3 = -1014,061158 + 21,78525457\dot{I}S_2 + 49,0145782\partial M_3 \qquad (4)$$

To give an economic interpretation of the obtained statistical model, let's look at its criteria and indicators. The total correlation coefficient of the model is R = 0.99492. The F-Fisher coefficient is used to characterize the model obtained for the realized product, where in any case (for example, 95%) the reported value of this ratio must be greater than its critical (table) value, i.e. $F_{hes} > F_{krit}$. It is known that the critical value of the F-Fisher coefficient with a probability of 95% F$_{krit}$ = 3.62, and the reported value of this coefficient is

F$_{hes}$ = 97.75916006, i.e. the condition $F_{hes} > F_{krit}$ is satisfied.

As for the statistical evaluation of the individual factors of the obtained model, they are performed by the t-Student criterion. Thus, a critical table value of this coefficient with a probability of 95% t$_{krit}$ = 2.57. The results show that this condition is satisfied for both $\dot{I}S_3$ and f∂M_3 factors, i.e. $t_{\dot{I}S_{3hes}}$ = 3,760937715, $t_{\partial M_{3hes}}$ = 6,181754041. Then the condition $t_{hes} > t_{krit}$ is satisfied for both factors, which indicates the importance of the factors included in the model.

The condition P <0.05 must be satisfied for the individual factors in the P-importance index that characterizes the model. However, this condition is not satisfied for factor $\dot{I}S_3$, so $P_{\dot{I}S_3}$ = 0,063987193. Hence, $P_{\dot{I}S_3}$=0,063987193> 0,05, which is unacceptable. For P_{RM_3} and $P_{\partial M_3}$ the condition P <0,05 is satisfied.

If we look at the reliability coefficients with a probability of 95%, for all factors, i.e. $RM_3(\dot{I}S_3, \partial M_3)$

$min \leq RM_3(\dot{I}S_3 \ \partial M_3) \leq max$ condition is satisfied.

The results. Summarizing all this, we note that the monitoring of the financial sustainability of these companies is important for the adaptation of production and economic activities in the OJSC under study to the laws of the market. The assessment of financial sustainability depends on the volume of products sold directly in the enterprise. The article provides two-factor regression models of the realized product for all three OJSCs and provides their mathematical-statistical analysis. The use of these models in the practical life of the OJSC is important for making operational decisions.

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