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PROFITABILITY MODELING OF THE ENTERPRISE

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Abstract

The article presents a modeling process used for optimal planning of enterprise profitable activities. Models that represent approximations and assumptions and allow describing the properties of the object in a wide range are used in the article. The significant role of profit in the enterprise development and ensuring the interests of its owners and employees is determined by the need for effective and sound management.

Keywords: correlation, determination, Fisher's criterion, modeling, regression equation.

Modeling is a scientific theory of construction and implementation of models, which are used to study phenomena and processes in nature and social life. Investigating any phenomenon (process, object), we build in the minds of their models. That is why essentially every scientific work is in the main part of modeling: creation of models in laboratory installations, creation of graphic models in the form of schemes and drawings, construction of mathematical models.

A model is a conditional image of an object that reflects its most important characteristics that are necessary for the study. Any model performs primarily a predictive function, without which its construction would be impractical for theory and even more so for practical use.

The most important requirement for the model is its ability to adequately reflect the processes. However, the excessive desire to increase the adequacy of the model leads to its complexity, which sometimes does not allow implementing it with modern software and hardware. Therefore, a compromise is needed between the complexity of the model and the possibility of its implementation for practical application. The model significance in the study of the surrounding world is that it should be an intermediate link between theory and reality, schematically simplifying the latter.

Mathematical model has cognitive and practical value if it meets certain requirements:

- relies on the basic provisions of economic theory;
- adequately reflects the real economic reality;
- takes into account the most important factors that determine the level researched indicators;
- meets the established criteria;
- allows you to get knowledge that was unknown before its implementation;
- be abstract enough to allow for large variations number of variables, but not so much that there are doubts about its reliability and practical usefulness of the obtained results;
- meet the conditions that limit the time to solve the problem;
- allows you to implement it by existing means.

Formation of correlations between the studied factors

Correlation analysis is a method of studying the features interdependence in the general population, which are random variables with a normal distribution. The main requirements for the application of correlation analysis are a sufficient number of observations, a set of factor and performance indicators, as well as their quantitative measurement and reflection in information sources.

The establishment of causal relationships in the studied phenomenon precedes the actual correlation analysis. Therefore, the application of correlation methods should be preceded by an in-depth theoretical analysis that characterizes the main process taking place in the phenomenon under study, will determine the significant links between its individual parties and the nature of their interaction.

Preliminary analysis of the data creates a basis for formulating a specific task of studying relationships, selecting the most important factors, establishing a possible form of relationship of features and thus leads to mathematical formalization - the choice of mathematical equation that most fully reproduces existing relationships.

One of the most important issues of correlation analysis is the selection of productive and factor (factor) features. Factor and performance traits selected for correlation analysis should be significant; the former should directly affect the latter. The selection of factors for their inclusion in the correlation model should be based primarily on the theoretical foundations and practical analysis experience of the studied socio-economic phenomenon. Such statistical techniques and methods as comparison of parallel series, construction of distribution numbers tables on two signs (correlation tables), construction of statistical groupings both on an effective sign with the analysis of interrelated factors, and on a factor basis (or a combination of factor features) with an analysis of their impact on the performance feature.

The factors selection for paired correlation models is not difficult: from the set of factors influencing the resultant trait, one of the most important factors is selected, which mainly determines the variation of the resultant trait or the factor whose significance on the resultant trait is to be studied or verified. The factors selection for multiple correlation models has a number of features and limitations.

One of the main problems in constructing a correlation model is to determine the form of communication and on this basis to establish the type of analytical function that reflects the communication mechanism of the resultant feature with the factor. Under the form of correlation understand the type of analytical equation that expresses the relationship between the studied features.

The choice of an equation to study the relationships between features is the most difficult and responsible task on which the results of correlation analysis depend. All subsequent most careful calculations may be impaired if the form of communication is chosen incorrectly. The importance of this stage is that the correctly established form of communication allows you to select and build the most adequate model and on the basis of its solution to obtain statistically reliable and reliable characteristics.

Establishing a form of connection between the signs in most cases is based on the theory or practical experience of previous research. If the form of connection is unknown, then in pair correlation the mathematical equation can be established by compiling correlation tables, constructing statistical groupings and choosing the equation that gives the smallest sum of squares of deviations of actual data from aligned (theoretical) values and so on.

Depending on the initial data, the theoretical regression line can be different types of curves or a straight line. Thus, if the change in the resultant feature under the influence of the factor is characterized by constant increments, it indicates the linear nature of the relationship, if the change in the resultant feature under the influence of the factor is characterized by constant growth rates, and then there is reason to assume a curvilinear relationship.

A special place in the substantiation of the communication form in the correlation analysis belongs to the graphs constructed in the system of rectangular coordinates on the basis of empirical data. Graphic representation of the actual data gives a clear idea of the presence and form of the relationship between the studied features.

According to the rules of mathematics, when constructing a graph, the values of the factor feature are plotted on the abscissa axis, and the values of the resultant feature are plotted on the ordinate axis. Deferring at the intersection of the corresponding values of the two signs of the point, we obtain a point graph, which is called the correlation field. By the nature of the point's location on the correlation field make a conclusion about the direction and form of communication. It is enough to look at the graph to come to the conclusion about the presence and form of connection between the signs. If the points are concentrated around the imaginary axis directed to the left, bottom, right, up, the connection is straight, if the opposite is left, top, right, down - the connection is inverted. If the points are scattered throughout the field, it indicates that the relationship between the signs is absent or very weak. The nature of the location of points on the correlation field also indicates the presence of a rectilinear or curvilinear relationship between the studied features.

Using the graph, select the appropriate mathematical equation to quantify the relationship between performance and factor characteristics. An equation that reflects the relationship between features is called a regression equation or correlation equation. If the regression equation connects only two features, it is called the pairwise regression equation. If the points are scattered throughout the field, it indicates that the relationship between the signs is absent or very weak. The nature of the point's location on the correlation field also indicates the presence of a rectilinear or curvilinear relationship between the studied features.

If the relationship equation reflects the dependence of the resultant feature on two or more factor features, it is called a multiple regression equation. Curves based on regression equations are called regression curves or regression lines.

There are empirical and theoretical regression lines. If we connect the points on the correlation field with segments of a straight line, we obtain a broken line with some tendency, which is called the empirical regression line. The theoretical regression line is the line around which the points of the correlation field are concentrated and which indicates the main direction, the main tendency of the connection. The theoretical regression line should reflect the change in the average values of the resultant trait as the values of the factor trait change, provided that all other - random in relation to the factor causes are completely offset. Therefore, this line should be drawn so that the sum of the point's deviations of the correlation field from the corresponding points of the theoretical line is zero, and the sum of the deviations squares would be the minimum value. Search, construction, analysis and practical application of the theoretical regression line are called regression analysis.

The empirical line of regression is not always possible to establish the connection form and get the regression equation. In such cases, various regression equations are constructed and solved. Then evaluate their adequacy and select the equation that provides the best approximation (approximation) of the actual data to the theoretical and sufficient statistical probability and reliability.

Strictly speaking, regression-correlation analysis should be divided into regression and correlation. Regression analysis solves the problem of constructing, solving and estimating regression equations, and in correlation analysis these issues are joined by a range of issues related to determining the closeness of the relationship between performance and factor (factor) features.

In order for the results of correlation analysis to find practical application and give scientifically substantiated results, certain requirements regarding the object of research and the quality of the original statistical information must be met. The main of these requirements are:

• qualitative homogeneity of the studied population, which implies the proximity of the effective and factorial features formation. The need to fulfill this condition follows from the content of the communication equation parameters. It is known from mathematical statistics that the parameters are averages. In a qualitatively homogeneous set, they will be typical characteristics, in a qualitatively heterogeneous - distorted, distorting the nature of communication. Quantitative homogeneity of the population is the absence of observation units, which in their numerical characteristics differ significantly from the bulk of the data;

• a fairly large number of observations, because the connections between the signs are revealed only due to the law of large numbers. The number of observation units should be 6-8 times higher than the number of factors included in the model;

• randomness and independence of individual units from each other;

• stability and independence of individual factors;

• constancy of the effective feature variance when changing factor features;

• normal distribution of symptoms.

Consider the activities of an entity over 10 periods. The main indicators are shown in table 1.

Table 1

Business performance

Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
N - the number of exported goods (thousand units)	100	90	80	80	40	40	30	30	30	20
P – unit price (thousand monetary units)	20	50	60	60	70	80	80	90	100	110
C – production cost (million monetary units)	122	127	147	158	164	155	153	151	136	112

Find the type of correlation of the function $\widehat{P}=P(N)$. We approximate the data of this dependence on the Cartesian coordinate system (Fig. 1):

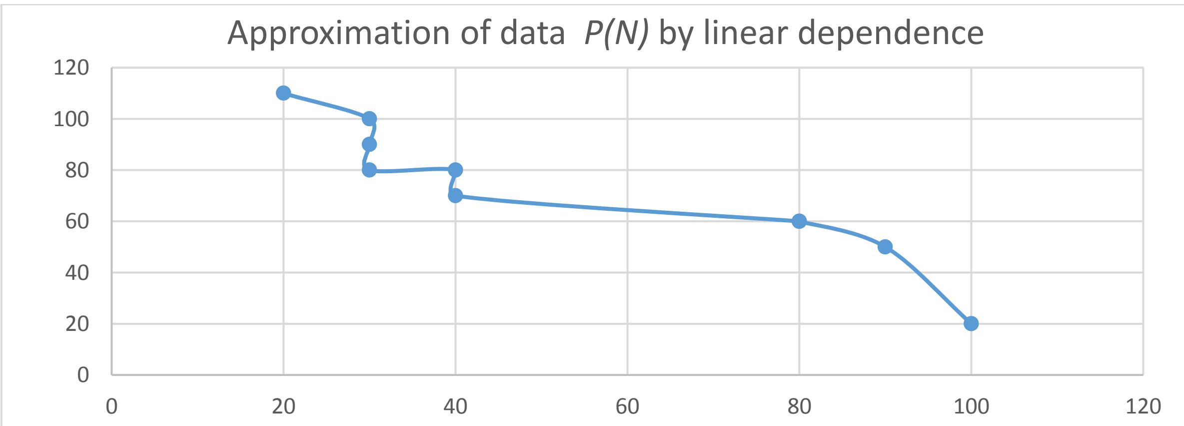

Fig. 1. Approximation of the dependence $\widehat{P}=P(N)$

Based on the graph of Fig. 1, the dependence $\widehat{P}=P(N)$ – is linear. The form of the linear one-factor model is as follows: $\widehat{P}=b_0 + b_1 \cdot N$.

In order to calculate the unknown parameters b_0 and b_1 we use the method of least squares.

$$b_1 = \frac{\sum_{i=1}^{n} N_i P_i - n \cdot \overline{N} \cdot \overline{P}}{\sum_{i=1}^{n} N_i^2 - n \cdot \overline{N}^2}; \quad (1)$$

$$b_1 = \overline{P} - b_1 \overline{N}. \quad (2)$$

Let's make the correlation table (tab. 2) for calculation of unknown sums.

Table 2

Table for determining the parameters of the dependence $\widehat{P}$=P(N)

№	N_i	P_i	N_i^2	$N_i P_i$	$\widehat{P}_i$
1	100	20	10000	2000	34,92537313
2	90	50	8100	4500	42,98507463
3	80	60	6400	4800	51,04477612
4	80	60	6400	4800	51,04477612
5	40	70	1600	2800	83,28358209
6	40	80	1600	3200	83,28358209
7	30	80	900	2400	91,34328358
8	30	90	900	2700	91,34328358
9	30	100	900	3000	91,34328358
10	20	110	400	2200	99,40298507
$\sum$	540	720	37200	32400	720
$\sum/n$	54	72			

Substitute the obtained amounts in formulas (1), (2) and calculate the parameters of the model:

$$b_1 = \frac{32400 - 10 \times 54 \times 72}{37200 - 10 * 54 * 54} = -0{,}8.$$

$b_0 = 72 + 0{,}8 \times 54 = 115{,}52.$

Therefore, the estimated equation for the dependence $\widehat{P}$=*P(N)* has the form:

$\widehat{P}$ = 115,52 – 0,8**N*.

Based on the obtained data, we can conclude that the increase in the number of manufactured products per unit leads to a decrease in price by 5.51 thousand monetary units.

Determine the type of correlation of the function $\widehat{C}$=*C(N)*. We approximate the data of this dependence on the Cartesian coordinate system (Fig. 2):

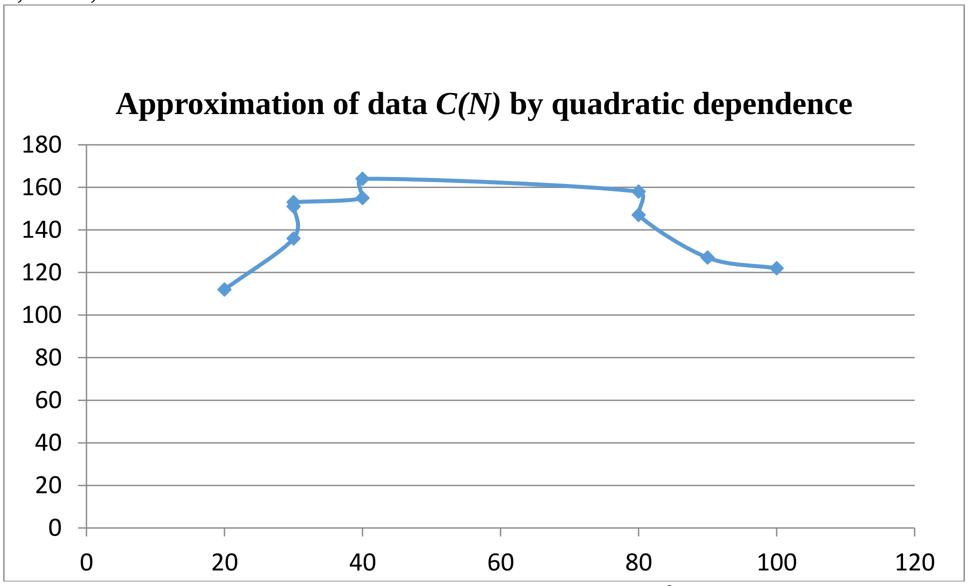

Fig. 2. Approximation of the dependence $\widehat{C}$=C(N)

Based on the graph, the dependence $\widehat{C}$=*C(N)* – is linear quadratic. The form of a quadratic one-factor model is as follows: $\widehat{C} = b_0 + b_1 \cdot C + b_2 \cdot C^2$. To find the parameters of the quadratic dependence, we solve the following system of normal equations:

$$\widehat{C} = b_0 + b_1 \times C + b_2 \times C^2 \rightarrow \begin{cases} nb_0 + b_1 \sum N_i + \sum N_i^2 = \sum C_i \\ b_0 \sum N_i + b_1 \sum N_i^2 + \sum N_i^3 = \sum N_i C_i \\ b_0 \sum N_i^2 + b_1 \sum N_i^3 + \sum N_i^4 = \sum N_i^2 C_i \end{cases} \quad (3)$$

Let's make the correlation table (table 3) for calculation of unknown sums.

Table 3

Correlation table for determining the dependence $\widehat{C}$=*C(N)*

№	N_i	P_i	N_i^2	N_i^3	N_i^4	N_iC_i	$N_i^2C_i$	$\widehat{C}_i$
1	100	122	10000	1000000	100000000	12200	1220000	113,05348
2	90	127	8100	729000	65610000	11430	1028700	136,80636
3	80	147	6400	512000	40960000	11760	940800	154,07008
4	80	158	6400	512000	40960000	12640	1011200	154,07008
5	40	164	1600	64000	2560000	6560	262400	158,23329
6	40	155	1600	64000	2560000	6200	248000	158,23329
7	30	153	900	27000	810000	4590	137700	143,05118
8	30	151	900	27000	810000	4530	135900	143,05118
9	30	136	900	27000	810000	4080	122400	143,05118
10	20	112	400	8000	160000	2240	44800	121,3799
Σ	540	1425	37200	2970000	255240000	76230	5151900	1425
Σ/*n*	54	142,5						

Substitute the obtained amounts in formula (3) and calculate the parameters of the model:

$$\begin{cases} 10b_0 + 540b_1 + 37200b_2 = 1425 \\ 540b_0 + 37200b_1 + 2970000b_2 = 76230 \\ 37200b_0 + 2970000b_1 + 255240000b_2 = 5151900 \end{cases}$$

In order to solve this system of equations, we compose a matrix A of coefficients for the unknowns, a matrix column B of free terms and a matrix-column X of unknowns:

$$A= \begin{vmatrix} 10 & 540 & 37200 \\ 540 & 37200 & 2970000 \\ 37200 & 2970000 & 255240000 \end{vmatrix}$$

$$B= \begin{vmatrix} 1425 \\ 76230 \\ 5151900 \end{vmatrix}$$

$$x = \begin{pmatrix} b0 \\ b1 \\ b2 \end{pmatrix}$$

Solve this system of linear equations by the Cramer method:

$$\Delta= \begin{vmatrix} 10 & 540 & 37200 \\ 540 & 37200 & 2970000 \\ 37200 & 2970000 & 255240000 \end{vmatrix} = 156168000000$$

$$\Delta_1= \begin{vmatrix} 1425 & 540 & 37200 \\ 76230 & 37200 & 2970000 \\ 5151900 & 2970000 & 255240000 \end{vmatrix} =9146736000000,37$$

$$\Delta_2= \begin{vmatrix} 10 & 1425 & 37200 \\ 540 & 76230 & 2970000 \\ 37200 & 5151900 & 255240000 \end{vmatrix} = 591785999999,99$$

$$\Delta_3= \begin{vmatrix} 10 & 540 & 1425 \\ 540 & 37200 & 76230 \\ 37200 & 2970000 & 5151900 \end{vmatrix} =-5067000000$$

$$b0 = \frac{\Delta 1}{\Delta} = \frac{9146736000000,37}{156168000000} = 58,57.$$

$$b1 = \frac{\Delta 2}{\Delta} = \frac{591785999999,99}{156168000000} = 3,79.$$

$$b2 = \frac{\Delta 3}{\Delta} = \frac{-5067000000}{156168000000} = -0,03.$$

Therefore, the estimated equation for the dependence $\widehat{B} = B(K)$ has the form:

$$\widehat{C} = 58,57 + 3,79N - 0,03N^2.$$

The obtained function is quadratic; with its help it is possible to predict the value of production costs at full cost in the presence of the quantity values of manufactured products.

Estimate the density of the relationship depending on the price of the products number and check the model for adequacy

The correlation coefficient (denoted by "*r*") is an indicator of the linear relationship between two variables X and Y, which takes values from −1 to +1 inclusive. It is widely used in science to measure the degree of linear dependence between two variables. The correlation coefficient takes values from −1 to 1. A value of +1 means that the relationship between X and Y is linear, and all points of the function lie on a line that reflects the growth of Y with increasing X. A value of −1 means that all points lie on a line that reflects the decrease in Y as X increases. If the correlation coefficient is 0, then there is no linear correlation between the variables.

Different authors offer different approaches to interpreting the value of the correlation coefficient. At the same time, all criteria are to some extent conditional, and should not be interpreted too meticulously. The interpretation of the correlation depends on the context and purpose. For example, a correlation index of 0.9 may be very low in the case of studying the physics laws using high-quality equipment, but can be interpreted as very high in the humanities, where there are many other factors.

Table 4

Correlation levels

Correlation	Negative	Positive
Missing	−0.09 to 0.0	0.0 to 0.09
Low	−0.3 to −0.1	0.1 to 0.3
Average	−0.5 to −0.3	0.3 to 0.5
High	−1.0 to −0.5	0.5 to 1.0

The correlation coefficient is calculated by the formula:

$$r = \pm\sqrt{\frac{\sum(\hat{y}_i-\bar{y})2}{\sum(y_i-\bar{y})2}} \quad (4)$$

where $\hat{y}_i$ - are the estimated values of the dependent parameters y_i, $\bar{y}$ - is the average value of the dependent parameters y_i.

The correlation coefficient can be calculated using MS Excel, namely the CORREL function.

In addition to checking the statistical significance of the parameters estimates of pairwise linear regression, it is also important to determine the quality of the model as a whole. One of the most effective estimates of the regression model adequacy, a measure of the regression equation quality, a characteristic of its predictive power is the determination coefficient (D). This coefficient shows the part of the variance explained by the regression equation:

$$\boldsymbol{D} = \frac{\sum(\hat{y}_i-\bar{y})2}{\sum(y_i-\bar{y})2}. \quad (5)$$

In the case of an even linear regression model, the determination coefficient is equal to the square of the correlation coefficient:

$$\boldsymbol{D} = \boldsymbol{r}^2 \quad (6)$$

The closer *D* is to unity, the better the regression approximates the empirical data, the closer the observation points are to the regression line. If *D* = 1, then the empirical points characterizing the independent X and dependent Y variable lie on the regression line and there is a linear functional dependence between the variables. If *D* = 0, then the variation of the dependent variable is entirely due to the action of variables not taken into account in the model, and the regression line is parallel to the abscissa.

The determination coefficient can be calculated using MS Excel, namely the KVPIRSON function.

If the determination coefficient is known, then the criterion of its statistical significance (Fisher's F-test) for pairwise linear regression can be written as:

$$\mathbf{F}_{(1,n-2)} = \frac{\sum(\hat{y}_i-\bar{y})2/1}{(\sum(y_i-\bar{y})2-\sum(\hat{y}_i-\bar{y})2)/(n-2)}, \quad \mathbf{(7)}$$

For a given significance level α of freedom degrees k_1 and k_2 is the tabular value of the Fisher criterion (in some sources it is called the Fisher-Snedekor criterion). Moreover, k_1 = m-1, where *m* is the number of variables in the model (for pairwise regression k1 = 1), k_2 = n-2, where *n* is the number of experiments in the model. The critical value of the Fisher test can be determined using the statistical function FRASPOBR Microsoft Excel, in the line "Probability" of the dialog box which must specify the significance level α. If F> Fcr, then for the probability α the coefficient of determination is statistically significant.

After constructing and studying the quality of the pairwise linear regression model, we can proceed to forecasting the development of an economic phenomenon or process that describes this model.

Let us determine the correlation and determination coefficients for the dependence $\hat{P}=P(N)$. The necessary calculations are performed in table 5.

Table 5

Calculation of the required amounts to determine *r* and *D*

№	P_i	$\widehat{P}_i$	$(\widehat{P}_i-\overline{P})^2$	$(P_i-\overline{P})^2$
1	20	34,93	1374,53	2704
2	50	42,99	841,87	484
3	60	51,04	439,12	144
4	60	51,04	439,12	144
5	70	83,28	127,32	4
6	80	83,28	127,32	64
7	80	91,34	374,16	64
8	90	91,34	374,16	324
9	100	91,34	374,16	784
10	110	99,40	750,92	1444
∑	720	720	5222,69	6160
∑ /n	72			

Based on the obtained calculations, the correlation coefficient according to formula 4 is equal to:

$$r = \pm\sqrt{\frac{5222,69}{6160}} = -0,92.$$

The correlation index is close to -1, which indicates a tight and inverse relationship between the indicators *N* and *P*, with increasing the number of manufactured products, the price will decrease.

The calculation of the correlation coefficient can be performed using the CORREL function of MS Excel.

The determination coefficient according to table 5 and formula 5 is equal to:

$$D = \frac{5222,69}{6160} = 0,84.$$

$$D = r^2 = (-0,92)^2 = 0,84.$$

Based on the value of the determination coefficient (D = 0.84), the model is adequate and the change in the performance trait is 84% due to changes in the factor trait and 16% - due to factors not taken into account in the model.

The coefficient of determination can be calculated using the Pearson criterion function MS Excel.

Let's check the adequacy of the considered model also by Fisher's test, using the data of table 5 and formula 7:

$$F_{(1.8)} = \frac{5222,69/1}{(6160-5222,69)/8} = 44,58.$$

Set the significance level to 0.05 (5%). This means that you can make a mistake in no more than 5% of cases, and in 95% - (100 (1-α))% conclusions will be correct.

Using the Pearson criterion function MS Excel with (1, n-2) degrees of freedom and the level of significance (100 (1-α))% calculate the critical value F_{cr}.

Since the calculated value of $F > F_{cr}$ (44,58> 5,31), the constructed regression model is adequate.

Estimate the density of the relationship depending on the cost of production and check the model for adequacy

Determine the correlation and determination coefficients for the dependence $\widehat{C}=C(N)$. The necessary calculations are performed in table 6.

Table 6

Calculation of the required amounts to determine *r* and *D*

№	C	$\widehat{C}_i$	$(\widehat{C}_i-\overline{C})^2$	$(C_i-\overline{C})^2$
1	122	113,05	867,10	420,25
2	127	136,81	32,42	240,25
3	147	154,07	133,87	20,25
4	158	154,07	133,87	240,25
5	164	158,23	247,54	462,25
6	155	158,23	247,54	156,25
7	153	143,05	0,30	110,25
8	151	143,05	0,30	72,25
9	136	143,05	0,30	42,25
10	112	121,38	446,06	930,25
∑	1425	1425,00	2109,29	2694,5
∑ /n	142,5			

Based on the obtained calculations, the correlation coefficient according to formula 4 is equal to:

$$r = \pm\sqrt{\frac{2109,29}{2694,5}} = 0,88.$$

Since the correlation index is close to 1, it indicates a fairly close relationship between indicators *N* and *C*. A positive value indicates a direct relationship between the indicators, with increasing the number of manufactured products, its costs also increase.

The determination coefficient according to table 6 and formula 5 is equal to:

$$D = \frac{2109,29}{2694,5} = 0,78.$$

$$D = r^2 = (0,88)^2 = 0,78.$$

Based on the value of the determination coefficient (D = 0.78), the model is adequate and the change in the effective feature is 78% due to changes in the factor feature and 22% - due to factors not taken into account in the model.

Let's check the adequacy of the considered model also by Fisher's test, using the data of table 6 and formula 7:

$$F_{(1.8)} = \frac{2109,29/1}{(2694,5-2109,29)/8} = 28,83.$$

The critical value of the Fisher test is is similar to that calculated above and is Fcr = 5.31. Since the calculated value of $F > F_{cr}$ (28.83> 5.31), the constructed regression model *C(N)* is adequate.

Analysis of the optimal profit of the studied enterprise

The criterion of the management decision optimality is the indicator characterizing the decision of the administrative task which value allows to estimate optimality of the chosen decision (the maximum of satisfaction of the set requirements).

One problem can have several optimality criteria.

Optimization is the process of finding the optimal (best) solution to a management problem with given constraints.

For some objects the criteria of optimality are obvious, for others - their choice is difficult. It is necessary, on the one hand, to ensure the coverage of the full requirements of interested users, and on the other - not to complicate the task excessively by assigning a large number of criteria. Therefore, different tasks involve the different numbers of criteria use: single-criteria optimization tasks use one optimization criterion, multi-criteria optimization tasks use several criteria.

Most management tasks can be reduced to two-criteria optimization, the criteria of which are: price (economic requirements), quality (production and technical requirements).

To reduce such a problem to a single-criteria one, we have to make significant assumptions, but this facilitates the final choice. Optimization tasks are found in many areas of human activity that require high efficiency, for example: technology, economics, computer science. To choose a really optimal solution, it is impossible to do without the right choice of criteria.

Decision theory as a science does not provide a clear generally accepted algorithm for selecting optimization criteria. Managers rely on their own experience or expert advice. Most often based on the following traditional approaches: in financial and economic problems the key criterion is to maximize efficiency - profit, profitability, or minimize payback period, etc., in technical tasks rarely manage to do without one criterion (eg, minimize resource consumption, maximize security, etc.), because this leads to absurd, unacceptable decisions. Therefore, they are supplemented by economic criteria, such as maximizing profitability or minimizing costs.

Mathematical methods of optimization are quite well developed and in most cases make it possible to obtain a solution unambiguously. In multi-criteria optimization, it is often impossible to choose the best solution, because the improvement of values on one criterion leads to deterioration on another. Such criteria are called contradictory. Any decision will be a compromise.

To find the optimal profit (*OP*) of the researched enterprise, we use the formula:

$$\boldsymbol{OP = P*N - C.} \qquad (8)$$

Substitute into this formula the equations obtained above $\widehat{P}_n$ та $\widehat{C_n}$:

$$OP = \widehat{Pn} * N - \widehat{Cn} = (115,52 - 0,8N)N - (58,57 + 3,79N - 0,03N^2) = = 115,52N - 0,8N^2 - 58,57 - 3,79N + 0,03N^2 = = 111,73N - 0,77N^2 - 58,57$$

Since $b_2 < 0$, the branches of the parabola are directed downwards, which indicates the presence of the maximum of this function. In order to find the maximum it is necessary to obtain the derivative of this function and equal it to zero:

$$OP' = 111,73 – 1,54*N=0$$

$$111,73 = 1,54*N$$

$$N=73$$

Let's check the function for the maximum. To do this, take the derivative at points (N-1) and (N+1):

$$OP_{n(72)} = 0,85>0$$

$$OP_{n(74)} = -2,23<0$$

Therefore, N = 73 is really the maximum of the function.

To compare the performance of the enterprise for the 10th period with the calculated optimal values, we compile the following table:

Table 7

Comparative characteristics of enterprise performance indicators

№	N_i	P_i	C_i	OP_i
10th period	20	110	112	2088
Optimal	73	56,69	162,29	3975,83
Deviation	-53	53,31	-50,29	-1887,83

When comparing the data of the enterprise for the last period with the proposed optimal data, it was determined that: in order for the profit to increase by 1887.83 thousand monetary units, it is necessary to increase production by 53 thousand units, due to this you can reduce the price units of production by 53.31 thousand monetary units, and costs - to increase by 50.29 thousand monetary units.

Conclusions

Modeling is one of the most promising modern methods of systems research. It involves the creation of a conceptual model of the study object, its formalization and transformation into a mathematical or computer model, adequacy verification and further study of the resulting model using analytical or numerical methods and modern computer technology.

As a result of the model analysis, it was concluded that the relationship between the variables is quite dense and the model is quite adequate. Also, the obtained optimal profit exceeds the current activity of the enterprise by 1887.83 thousand monetary units. The linear dependence $\widehat{P}=P(N)$ and parabolic $\widehat{C}=C(N)$ were formed in the work, which are good approximations for the initial data. This is evidenced by the obtained correlations values, which allows you to predict the unit price or cost value of this production volume having the planned optimal products number.

As a result of the model analysis, it was concluded that the relationship between the variables is quite dense and the model is quite adequate.

On the basis of the conducted researches it is possible to draw a conclusion that the profit of the enterprise is completely exposed to the administrative actions based on certain principles and scientific approaches. This proves once again that to manage the enterprise profits as an economic object it is necessary to apply effective management tools.

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