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CORRELATION AND REGRESSION ASSESSMENT OF THE MAIN FACTORS INFLUENCE ON THE CHANGE IN THE LEVEL OF THE NET PROFITABILITY OF SALES

Dumitru TRACI, Assoc. Prof., PhD
Shevchenko State University, Rybnitsa branch
E-mail: dtrach.72@mail.ru

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Abstract

Ensuring the positive dynamics of the agricultural organizations development taking into account their specifics is an extremely difficult process. It is due to the seasonal nature of the activity and significant dependence on external factors. In this regard, it requires high efficiency of management personnel, which is expressed in the quality of the development strategy being designed, the ability to analyze the current results achieved in their correlation, based on the results of the analysis, to make adjustments to the development strategy and current activities. To solve these problems, a system of indicators is important, which will make it possible to draw objective conclusions on the analysis of the relevant subject of research.

In the proposed article, the author uses the correlation method to analyze and study the impact on the profitability of sales of such indicators as labor productivity, return on capital of production assets, turnover of working capital, labor capital ratio, current liquidity ratio, investments per 1 hectare of agricultural land.

For the first time, the object of the study was twenty peasant farms in the region.

As a result of the analysis, a forecast of the level of management efficiency dependence of on selected factors was made, calculated on the database of the studied enterprises in the region.

The use of the systematic analysis of correlations will make it possible to make adjustments to current activities and thus ensure its positive dynamics and achieve the ultimate goal of ensuring financial stability.

Keywords*: capital-labour ratio, capital return, current liquidity ratio, growth rate of production and sales, gross profit, net profit, labour productivity, net profitability, turnover of working capital, investments*

1. Introduction

A prerequisite for high indicators of agricultural business dynamics is a steady growth rate, determined by such indicators as asset turnover, net sales, gross profit, net profit, profitability indicators, etc [1].

The sustainable growth of an agricultural enterprise can be considered effective if the increase in the value of assets leads to a greater increase in sales revenue, and the increase in sales revenue leads to a greater increase in sales profits. This ratio is the indicator of the increase in the efficiency and/or financial activity of an agricultural enterprise [2, 3, 4]. This means that the company has a sound policy of investing in the assets of the enterprise and a well-established policy of managing current assets, indicators of which are the indicators of turnover and return on assets. However, in agriculture an important role is assigned to labour resources. Therefore, the sustainability of the growth of agricultural enterprises also depends on the return of these resources, expressed by the labour productivity indicator [5, 6].

2. The current level of investigation of the issue

The works of famous foreign scientists are devoted to the development of the correlation theory and its application in economic analysis. The well-known scientists of the development of correlation theory are Chuprov A. A. "The main problems of correlation theory"; Boyarsky A. Ya. "Theoretical studies in statistics"; Druzhinin N. K. "Mathematical statistics in economics"; Ryauzov N.N. "General theory of statistics" [9, 10, 11, 12].

The following works are devoted to its application in the analysis of economic indicators and the development of forecasts: Sheremet A. D., Bakanov M. I., Kovalev V. V., Volkova O. N., Markin Yu. P., Blank I. A., Gametsky A. F., Akulai E., Shkiopu I., Timofti E., Perchun R. [13, 14, 15, 16, 17, 18, 19, 20, 21].

The purpose of the study is to use the correlation method to analyze and study the influence of the main specific factors on the profitability of sales of twenty peasant farms in the region in order to predict the level of dependence of management efficiency on selected factors.

3. Methods and applied materials

Based on the statistical observations of 20 agricultural enterprises of the Rybnitsa district, a sample was created for 2017-2020, however, in 5 enterprises, part of the indicators, including net profitability, turned out to be negative, making it impossible to be included in the correlation model [7, 8].

One of the limitations of the study is the limited amount of data studied in time and space. The limited amount of data studied for 15 enterprises over a four-year period may affect the representativeness of the simulation results.

In order to study the influence of the main factors on the change in the net profitability of sales when using the correlation and regression analysis, a panel data analysis model was used:

(15 enterprises x 4 years) = 60 observations

Another limitation of the study is a large number of indicators used in the scientific literature to measure the main factors and the effective feature included in the model. Thus, it remained with the author to choose those indicators which he considers representative for the purposes of this study.

4. Results and discussions

According to the methodology of financial analysis proposed by the well-known scientists Sheremet A. D. and Bakanov M. I., one of their most important indicators for assessing the effectiveness of management is the profitability of sales, calculated as the ratio of the net profit to the sales income (the net profitability of sales, %), which also reflects the impact of the price factor and the sales volume indicator. In this regard, this indicator is a dependent variable (Y – effective). For the correlation and regression analysis and studying the impact on the profitability of sales, the following indicators (factors) were considered at the first stage:

$X1$ – Employees' labour productivity, thousand lei.

X2 – Capital return on 1 leu of fixed production assets, lei.
X3 – Turnover of working capital, turnovers.
X4 – Capital-labour ratio, thousand lei.
X5 – Current liquidity ratio.
X6 – Investments per 1 ha of the agricultural land, lei.

The degree of influence of these factors was determined on the basis of the correlation and regression analysis by the step-by-step inclusion-exclusion method.

To assess the cumulative effect of these factors on the dependent variable, we used the data presented in Table 1.

Table 1. Initial data for the regression and correlation analysis

Enterprise code	Year	Net profitability of sales, %	Employees' labour productivity, thousand lei	Capital-labour ratio, thousand lei	Current liquidity ratio, ratio	Investments per 1 ha of the agricultural land, lei
001	2017	2.4	193.4	250.2	1.02	165.3
	2018	8.8	290.5	320.5	1.57	185
	2019	14.3	150.4	190.1	1.05	158.2
	2020	11.3	164	193.1	0.97	101
002	2017	7.5	240	301.4	1.2	120.2
	2018	11.3	293.4	395.2	1.4	174.7
	2019	24.3	295.2	382.1	1.47	230.2
	2020	12.5	201	292	1.01	150.2
...	...	...	...	...	...	...
015	2017	13.4	270.4	375.4	2.33	221.4
	2018	15.4	266.7	356.1	2.87	293.4
	2019	35.9	250.8	325	2.51	281.4
	2020	10.3	210.5	313	2.01	260.2

Source: author's calculations based on the data of the enterprises of the town of Rybnitsa and the Rybnitsa district

As a result of the fourth step-by-step inclusion and exclusion of the factors, we decided not to include in the proposed regression model the following two indicators: the capital return per 1 leu of fixed assets and the turnover of working capital, since the relationship with the effective feature is insignificant.

The resulting matrix of the paired correlation coefficients (r) indicates the following (Table 2).

The number of observations $n = 60$. The number of independent variables in the model is 4, and the number of regression coefficients taking into account the unit vector is equal to the number of unknown coefficients. Taking into account the attribute Y, the dimension of the matrix becomes equal to 6. The matrix of independent variables x_i has a dimension (60 x 6).
The analysis was carried out using the MS Excel program – the Data Analysis package.

Table 2. Matrix of the paired correlation coefficients

-	*Y*	x_1	x_2	x_3	x_4
y	**1**	0.640623	0.544383	0.660685	0.551953
x_1	0.640623	**1**	0.61986687	0.6903034	0.58998083
x_2	0.544383	0.6198668	**1**	0.5990069	0.39451029
x_3	0.660685	0.6903034	0.5990069	**1**	0.6436347
x_4	0.551953	0.58998083	0.39451029	0.6436347	**1**

To confirm the statistical significance of the calculated coefficients of the paired correlation the following formulas were applied:

The values of t-statistics for r_{yx1} were calculated using the formulas:

- $$t_{observ} = r_{yx_1} \cdot \frac{\sqrt{n-m-1}}{\sqrt{1-r_{yx_1}^2}} = 0.64 \cdot \frac{\sqrt{60-1-1}}{1-0.64^2} = 6.35, \quad (1)$$

where $m = 1$ – the number of factors in the regression equation.

According to the Student's table the value of t_{table} was determined:

$$t_{crit}\ (n\text{-}m\text{-}1;\ \alpha/2) = (58;0.025) = 2.299$$

Since $t_{observ} > t_{crit}$ we reject the hypothesis that the correlation coefficient is equal to *0* respectively, the correlation coefficient is statistically significant.

According to the same principle, the values of t-statistics were calculated for the other factors:

- for r_{yx2}: $$t_{observ} = r_{yx_2} \cdot \frac{\sqrt{n-m-1}}{\sqrt{1-r_{yx_2}^2}} = 0.54 \cdot \frac{\sqrt{60-1-1}}{1-0.54^2} = 4.94, \quad (2)$$
- for r_{yx3} : $$t_{obsev} = r_{yx_3} \cdot \frac{\sqrt{n-m-1}}{\sqrt{1-r_{yx_3}^2}} = 0.66 \cdot \frac{\sqrt{60-1-1}}{1-0.66^2} = 6.7, \quad (3)$$
- for r_{yx4}: $$t_{observ} = r_{yx_4} \cdot \frac{\sqrt{n-m-1}}{\sqrt{1-r_{yx_4}^2}} = 0.55 \cdot \frac{\sqrt{60-1-1}}{1-0.55^2} = 5.04, \quad (4)$$

Since $t_{observ} > t_{crit}$ in all the above cases, the hypothesis that the correlation coefficient is equal to *0* is rejected respectively, all calculated correlation coefficients are considered statistically significant.

The analysis of the matrix of the paired correlation coefficients shows that there is no strong correlation between the influencing variables ($r < 0.7$), therefore, we can use them in the regression analysis. The data reflected in the first column of Table 2 show the tightness of the relationship between the dependent variable and the factors. Thus, there are four factors that have a moderate relationship with the indicator of assessing the effectiveness of enterprise management (the profitability of sales): labour productivity ($r_{yx1} = 0.64$). capital ratio ($r_{yx2} = 0.544$); current liquidity ratio ($r_{yx3} = 0.66$) and investments per 1 ha of agricultural land ($r_{yx4} = 0.55$). Thus, the third factor has the highest relationship with the net profitability of sales: $r_{yx3}=0.66$.

The closeness of the combined influence of factors on the result is assessed by the multiple correlation index. The multiple correlation coefficient is 0.724, which indicates a close

relationship between the net profitability of sales and the factors included in the regression model.

$$R = \sqrt{1 - \frac{3025,404}{6359,3}} = 0,7241 \; R = \sqrt{1 - \frac{3025,404}{6359,3}} = 0,7241 \; R = \sqrt{1 - \frac{3025,404}{6359,3}} = 0,7241$$

When the *R* value is close to *1*, the regression equation describes the actual data better. and the relationship of the factors with the results is considered strong. If the value of the correlation coefficient *R* approaches *0*, it is assumed that the regression equation slightly describes the actual data, respectively, the relationship of the factors with the result is weak. The correlation coefficient is calculated using the values of linear coefficients of the paired correlation (*r*) and *β*-coefficients.

$$R = \sqrt{\sum r_{yxi} \bullet \beta_{yxi}}, \tag{5}$$

$$R = \sqrt{0.641 * 0.252 + 0.544 * 0.149 + 0.661 * 0.3 + 0.552 * 0.151} = \sqrt{0.524} = 0.723$$

The coefficient of determination: $R^2 = 0.7241^2 = 0.5243$

The value of the multiple coefficient of determination ($R^2 = 0.7241^2 = 0.5243$) shows that about 52.4% of the variation in the net profitability of sales of the studied subjects is due to the influence of the factors included in the model.

A more objective assessment is the adjusted coefficient of determination.

$$\overline{R}^2 = 1 - (1 - R^2) * \frac{n-1}{n-m-1} \quad \overline{R}^2 = 1 - (1 - 0.5243) * \frac{60-1}{60-4-1} = 0.49, \tag{6}$$

The closer this coefficient is to *1*, the more the regression equation explains the behavior of *Y*. The addition of new explanatory variables to the model is carried out as long as the adjusted coefficient of determination increases.

The share of each factor in the total variation of the resultant feature is determined by the coefficients of paired determination:

$$d^2_i = r_{yxi}\beta_i.$$

$$d^2_1 = 0.64 \cdot 0.252 = 0.161$$

$$d^2_2 = 0.54 \cdot 0.149 = 0.081$$

$$d^2_3 = 0.66 \cdot 0.30 = 0.198$$

$$d^2_4 = 0.55 \cdot 0.151 = 0.0836$$

When checking the equality is performed:

$$\sum d_i^2 = R^2 \times 100\% = 0.524 \cdot 100\% = 52.4\%$$

The results demonstrate that out of 52.4% of the total variation, the highest level in the formation of the net profitability of sales has the liquidity ratio, the share of which in the total variation is 19.8%. The next factor is the level of the employees' labour productivity, the share of which is 16.1%, and the impact of the armament of the employees with fixed assets and investments per 1 ha of the agricultural land is 8% for each factor.

At the next stage, based on the calculations, the quality of the multiple regression equation, the assessment of the factors included in the model and checking for the presence of the

autocorrelation are confirmed. The verification of the overall quality of the multiple regression equation was carried out using the Fisher criterion *F*-statistics:

$$R^2 = 1 - \frac{s_e^2}{\sum\left(y_i - \bar{y}\right)^2} \quad ; \qquad R^2 = 1 - \frac{3025.404}{6359.3} = 0.5243, \tag{7}$$

We also tested the hypothesis of general significance, i.e. the hypothesis that all regression coefficients are equal to zero at the same time with explanatory variables using *F*-statistics of the Fisher distribution (right-hand check):

$$H_0: R^2 = 0; \beta_1 = \beta_2 = ... = \beta_m = 0.$$
$$H_1: R^2 \neq 0.$$

The results of the calculations show that there are no grounds for rejecting the H_0 hypothesis. since $F < F_{cr} = F_{\alpha\ ;\ n-m-1}$:

$$F = \frac{R^2}{1-R^2} * \frac{n-m-1}{m} = \frac{0.5243}{1-0.5243} * \frac{60-4-1}{4} = 15.152, \tag{8}$$

The tabular value of $F_{cr\ (4;55)} = 2.53$ at degrees of freedom $k_1 = 4$ and $k_2 = n\text{-}m\text{-}1 = 60 - 4 - 1 = 55$.

Since the actual value of $F > F_{cr}$. the coefficient of determination is **statistically significant. and the regression equation is statistically reliable (i.e. the coefficients b_i are jointly significant).**

The need to assess the significance of the additional inclusion of a factor (a particular *F*-criterion) is due to the fact that not every factor included in the model can significantly increase the proportion of the explained variation of the effective feature. This may be due to the sequence of factors introduced (as there is a correlation between the factors themselves).

The measure of assessing the significance of improving the quality of the model, after the factor x_j is included in it is a particular *F*-criterion – F_{xj}:

$$F_{xj} = \frac{R^2 - R^2(x_1, x_n)}{1-R^2}(n-m-1), \tag{9}$$

where *m* – the number of estimated parameters.

In the numerator there is an increase in the proportion of the variation *y* due to the factor x_j additionally included in the model. If the observed value of F_{xj} is greater than F_{cr}. then the additional introduction of the factor x_j into the model is statistically justified. The particular *F*-criterion evaluates the significance of the coefficients of the "pure" regression(b_j).

There is a relationship between the particular *F*-criterion – F_{xj} and the *t*-criterion used to assess the significance of the regression coefficient for the *j*th factor:

$$t(b_j = 0) = \sqrt{F_{xj}}, \tag{10}$$

When comparing the observed values of the particular *F*-criterion with the critical ones, the following conclusions were made:

a) $F_{x1} > 2.76$. therefore. it is advisable to include the factor x_1 in the model after the introduction of the factors x_j

$$F_{x1} = \frac{0.5243 - 0.363}{1 - 0.5243} * (60 - 4 - 1) = 18.649$$

$$R^2(x_4.x_n) = \sum \beta_j r_j = 0.1486 \times 0.5444 + 0.3004 \times 0.6607 + 0.1514 \times 0.552 = 0.363$$

$$F_{kp}(k_1=3;\ k_2=55) = 2.76$$

b) $F_{x2} > 2.76$, therefore, it is advisable to include the factor x_2 in the model after the introduction of the factors x_j.

c)

$$F_{x2} = \frac{0.5243 - 0.443}{1 - 0.5243} * (60 - 4 - 1) = 9.355$$

$$R^2(x_4.x_n) = \sum \beta_j r_j = 0.2518 \times 0.6406 + 0.3004 \times 0.6607 + 0.1514 \times 0.552 = 0.443$$

d) $F_{x3} > 2.76$, therefore, it is advisable to include the factor x_3 in the model after the introduction of the factors x_j.

$$F_{x3} = \frac{0.5243 - 0.326}{1 - 0.5243} * (60 - 4 - 1) = 22.942$$

$$R^2(x_4.x_n) = \sum \beta_j r_j = 0.2518 \times 0.6406 + 0.1486 \times 0.5444 + 0.1514 \times 0.552 = 0.326$$

e) $F_{x4} > 2.76$, therefore, it is advisable to include the factor x_4 in the model after the introduction of the factors x_j.

$$F_{x4} = \frac{0.5243 - 0.441}{1 - 0.5243} * (60 - 4 - 1) = 9.663$$

$$R^2(x_4.x_n) = \sum \beta_j r_j = 0.2518 \times 0.6406 + 0.1486 \times 0.5444 + 0.3004 \times 0.6607 = 0.441$$

As a result of the calculations, the multiple regression equation was obtained:

$$\overline{Y} = -7.3601 + 0.03366x_1 + 0.01288x_2 + 4.1212x_3 + 0.01331x_4$$

The regression coefficients demonstrate that the net profitability of sales with a fixed position of other factors of the model can grow under the following conditions:

- the increase in the productivity of one employee per 1000 lei – 3.36 p.p.;
- the increase in the stock ratio of employees per 1000 lei – 1.128 p.p.;
- the increase in the current liquidity ratio by 1% – 4.12 p.p.;
- the increase in investments per 1 ha of the agricultural land per 1000 lei – 1.33 p.p.

The analysis shows that the selected factors affect the change in the net profitability to increase, but the main factor that has the greatest impact is the level of the liquidity ratio and productivity labour. The stock ratio of the employees and investments per 1 ha of the agricultural land has been and remains at the lowest level and therefore the impact on the effective indicator is insignificant.

The factor features are different in their essence and (or) have different units of measurement, then the regression coefficients b_j for different factors are not comparable. Therefore, the regression equation is supplemented with commensurate indicators of the closeness of the relationship between the factor and the result, which allow ranking factors by the strength of their influence on the result.

The indicators of the tightness of the connection. in addition to the correlation coefficient and β-coefficients. include partial elasticity coefficients, β-coefficients, and partial correlation coefficients (Table 3).

In order to expand the possibilities of the meaningful analysis of the regression model, partial elasticity coefficients are used. which are determined by the formula:

$$E_i = b_i \cdot \frac{\bar{x}_i}{\bar{y}}, \quad (11)$$

The partial elasticity coefficient shows by how many percent on average the attribute-result *y* changes with an increase in the attribute-factor x_j by 1% from its average level with a fixed position of the other factors of the model.

The elasticity coefficient E_1 shows that with the increase in the labour productivity by 1%. the net profitability of sales will increase by 0.588%.

$$E_1 = 0.0337 \cdot \frac{199.987}{11.45} = 0.588$$

The elasticity coefficient E_2 demonstrates that with the increase in the capital-labour of the employees by 1% the net profitability of sales will increase by 0.295%:

$$E_2 = 0.0129 \cdot \frac{262.527}{11.45} = 0.295$$

The value of the partial elasticity coefficient E_3 indicates that with the increase in the current liquidity ratio by 1% the profitability of sales will increase by 0.542%.

$$E_3 = 4{,}121 \cdot \frac{1.505}{11.45} = 0.542$$

The particular coefficient of elasticity E_4 shows that with the increase in the amount of investments per 1 ha of the agricultural land by 1% the net profitability of sales will increase by 0.218%.

$$E_4 = 0{,}0133 \cdot \frac{1187.89}{11.45} = 0.218$$

Thus, it was found that the two factors have the greatest impact on the change in the net profitability of sales: the level of labour productivity and the liquidity ratio.

Table 3 shows the final results of the correlation and regression analysis of the influence of the main factors on the change in the net profitability of sales of the agricultural enterprises of the Rybnitsa district. on average for 2017-2020.

To check the model for the presence of heteroscedasticity the corresponding calculations were carried out:

At S_3 = 2257.55 and the number of degrees of freedom $v1 = v2 = (n - c - 2m)/2 = (60 - 16 - 2\times1)/2 = 21$

$F_{cr}(21.21) = 4.35$; *F*-statistics: $F = 2257.55/537.76 = 4.2$

Since $F < F_{cr} = 4.35$, *the hypothesis of the absence of heteroscedasticity is accepted.*

An important prerequisite for constructing a qualitative regression model based on LSM is the independence of the values of random deviations from the values of deviations in all other observations. This ensures that there is no correlation between any deviations and, in particular, between neighboring deviations.

Table 3. The final results of the correlation and regression analysis of the influence of the main factors on the change in the net profitability of sales of the agricultural enterprises of the Rybnitsa district, on average for 2017-2020

Factors	Symbols	Paired correlation coefficient	Regression coefficient	Standardized partial regression coefficients	Elasticity coefficient	Paired coefficients of determination
		ry_{x_i}	b_i	$\beta_i = b_i \frac{\delta x_i}{\delta y}$	$E_i = b_i * \frac{\bar{x}_i}{\bar{y}}$	$d_i^2 = ry_{x_i} \times \beta_i$
Employees' labour productivity, thousand lei	x_1	0.64	0.034	0.252	0.588	0.161
Capital-labour ratio, thousand lei	x_2	0.54	0.013	0.149	0.295	0.081
Current liquidity ratio	x_3	0.66	4.121	0.3	0.542	0.198
Investments per 1 ha of the agricultural land, lei	x_4	0.55	0.218	0.151	0.218	0.0836

Source: author's calculations using the MS Excel program – the Data Analysis package

If the autocorrelation coefficient is r_{ei} <0.7, then there is a reason to assert that there is no autocorrelation. To determine the degree of autocorrelation, we calculate the autocorrelation coefficient and check its significance using the standard error criterion. The standard error of the correlation coefficient is calculated by the formula:

$$S_e y = \frac{1}{\sqrt{n}}, \quad (12)$$

The autocorrelation coefficients of random data should have a sample distribution approaching normal with zero mathematical expectation and a mean square deviation equal to

$$S_e y = \frac{1}{\sqrt{60}} = 0.129$$

If the first-order autocorrelation coefficient r_1 is in the range of -2.299×0.129 < r_1 < 2.299×0.129, then it can be assumed that the data do not show the presence of the first-order autocorrelation.

$$r_1 \approx \frac{\sum \varepsilon_i * \varepsilon_{i-1}}{\sum \varepsilon_i^2} = \frac{302.941}{3025.404} = 0.1, \quad (13)$$

Using the calculation table. we get:

Since -0.297 < ×= 0.1 < 0.297, *the property of independence of the residuals is satisfied.*

There is no autocorrelation.

To analyze the correlation of deviations, especially to detect the autocorrelation. *Darbin-Watson statistics* is used:

$$DW = \frac{\sum(\varepsilon_i - \varepsilon_{i-1})^2}{\sum \varepsilon_i^2} \quad DW = \frac{5377.21}{3025.4} = 1.78, \tag{14}$$

The critical values of d_1 and d_2 are determined on the basis of special tables for the required significance level α. the number of observations n = 60 and the number of explanatory variables m = 4. There is no autocorrelation if the following condition is met:

$$d_1 < DW \; u \; d_2 < DW < 4 - d_2.$$

Without referring to the tables. one can use an approximate rule and assume that there is no residues autocorrelation if 1.5 < *DW* < 2.5. Since 1.5 < 1.78 < 2.5 there is **no** residues autocorrelation.

For a more reliable conclusion it is advisable to refer to table values. According to the Darbin-Watson table for n = 60 and k = 4 (significance level is 5%) we find: d_1 = 1.44; d_2 = 1.73. Since 1.44 < 1.78 and 1.73 < 1.78 < 4 – 1.73 there is **no** residues autocorrelation. Thus, the proposed model is adequate and can be used to predict the net profitability of sales for the future as a result of the improvement of the included main factors.

To do this, in the developed regression model, we insert the average data of the factor features included in the model and calculate the equalized level of the effective feature – the net profitability of sales.

$$\overline{Y}x_1, x_2, x_3, x_4 = -7.3601 + 0.0336X_1 + 0.0129X_2 + 4.121X_3 + 0.0133X_4$$

$$11.45 = -7.3601 + 0.0336 \bullet 199.897 + 0.0129 \bullet 252.527 + 4.121 \bullet 1.505 + 0.0133 \bullet 187.89$$

$$\overline{Y}x_1, x_2, x_3, x_4 = 11.45\%.$$

The result obtained does not differ from the actual level, which allows you to use the model to predict the net profitability of sales, taking into account the improved levels of factors in order to develop a strategy for sustainable growth.

Table 4 provides data on the forecast of the level of management efficiency dependence on the selected factors, calculated as a result of the correlation and regression analysis on the database of the agricultural enterprises of the Rybnitsa district.

Including the levels of the planned factors in the correlation and regression equation. we obtain the following forecast of the level of the net profitability of sales by year:

$$\overline{Y}_{2021} = -7.3601 + 0.0336 \bullet 220.5 + 0.0129 \bullet 268.5 + 4.121 \bullet 1.71 + 0.0133 \bullet 220$$

$$\overline{Y}_{2021} = 13.47\%;$$

...

$$\overline{Y}_{2024} = -7.3601 + 0.0336 \bullet 360.5 + 0.0129 \bullet 450 + 4.121 \bullet 2.3 + 0.0133 \bullet 410$$

$$\overline{Y}_{2021} = 25.48\%.$$

The results obtained (Table 4) demonstrate that the net profitability of sales is growing annually by 2.02-4.9% and by 2024 may reach 25.48%. provided that the factor signs are gradually improving in dynamics as follows:

x_1 – employees' labour productivity will increase from 199.89 thousand lei to 360.5 thousand lei;
x_2 – the capital-labour ratio of the employees will increase from 268.5 thousand lei per employee to 450 thousand lei;
x_3 – the current liquidity ratio increased from 1.71 to 2.3. i.e. by 0.59;
x_4 – investments per 1 ha of the agricultural land will increase from 220 lei to 410 lei.

Table 4. The forecast of the level of management efficiency dependence on the selected factors. calculated as a result of the correlation and regression analysis on the database of the agricultural enterprises of the Rybnitsa district

Factors	Symbols	On average for 2017-2020	Year			
			2021	2022	2023	2024
Factors: Employees' labour productivity, thousand lei	x_1	199.89	220.5	260.7	290	360.5
Capital-labour ratio, thousand lei	x_2	262.52	268.5	300.0	370	450
Current liquidity ratio, ratio	x_3	1.505	1.71	1.90	2.15	2.30
Investments per 1 ha of the agricultural land, lei	x_4	187.89	220.0	270	340	410
The effective factor: The level of the net profitability of sales, %	y	11.45	13.47	16.69	20.58	25.48
Growth (decrease) by the chain method, p.p.	y	-	+2.02	+3.22	+3.89	+4.90

Source: calculated by the author

5. Conclusions

The conducted research demonstrates that the greatest impact on the growth of the net profitability of sales from 11.45% to 25.48% in 2024 has the increase in the current liquidity ratio to 2.3, which is an indicator of the solvency of the enterprise provided that all available stocks are sold and accounts receivable are returned.

Another important factor influencing the growth of the net profitability of sales is the increase in the labour productivity to 360.5 thousand lei by 2024 in such a way as to comply with the conditions of advancing labour productivity growth over wage growth.

Regarding the capital-labour ratio of the employees, the study proves that by 2024, reaching the level of 450 thousand lei is possible only if the enterprise is equipped with high-performance technologies and equipment, as well as highly qualified labour resources.

The growth of investments per 1 ha of the agricultural land to 410 lei/ha is possible on condition of the increase in public, private capital investments and foreign investments within the framework of various financing programs.

The joint rational and effective use of the studied factors in the proposed model will increase the volume of production, improve the quality of products and services, increase the turnover, profit, which will entail the increase in the net profitability of sales and further sustainable development of the enterprise.

REFERENCES

1. BRIGHAM, Y., GAPENSKI, L. Financial management. St. Petersburg: Economic School, Vol. 1, 1998. 357 p. ISBN 978-5-482-01505-6.
2. TRACH, D. Management of the organization's finances in conditions of uncertainty. In: Scientific Papers. Series "Management, Economic Engineering in Agriculture and Rural Development". Bucharest, Romania. 2019, Vol. 19, issue 1, pp. 587-593. PRINT ISSN 2284-7995, E-ISSN 2285-3952.
3. TRACH, D., LITVIN, A., RAKUL, A. The impact of financial management performance on the sustainable development of agricultural enterprises in the Republic of Moldova. International Conference "Agriculture for Life, Life for Agriculture", June 6-8, 2019, Bucharest, Romania. In: Scientific Papers. Series "Management, Economic Engineering in Agriculture and Rural Development". Bucharest, Romania. 2019, Vol. 19 issue 2, pp. 449-457. PRINT ISSN 2284-7995, E-ISSN 2285-3952.
4. TRACH, D. Scientific foundations of management. Rybnitsa: OJSC "Rybnitsa Printing House", 2019. – 300 p. ISBN 978-9975-3218-4-6.
5. TRACH, D. Activities of farms on the left bank of the Republic of Moldova. In: Monthly theoretical and scientific-practical magazine "Agribusiness: Economics and Management". August 2019. – Moscow. 2019, pp. 92-96. ISSN 0235-2443.
6. TRACH, D. Managing the financial development of an organization based on a new income structure for operating personnel. Financial management. – M.: Finpress LLC. 2019, No. 5, pp. 25-33. ISSN 1607-968X.
7. Website of Ministry of Economic Development. Available: http: //mer.gospmr.org /
8. www.statistica.md
9. CHUPROV, A. A. Main problems of correlation theory. M: Gosstatizdat, TsSU USSR, 1960.
10. BOYARSKY, A. Ya. Theoretical studies in statistica. M: Statistics, 1974, times II.
11. DRUZHININ, N. K. Mathematical statistics in economics. M: Statistics, 1971, chapter. 6-9.
12. RYAUZOV, N. N. General theory of statistics. M: Finance and Statistics, 1984.
13. SHEREMET, A. D. BAKANOV, M. I. Theory of economic analysis. Textbook. M: Infra-M. 2002. 333 p. ISBN 5-279-02042-7.
14. KOVALEV, V. V., VOLKOVA, O. N. Analysis of the economic activity of the enterprise. M.: PBOYUL Grizhenko E. M. 2000. 424 p. ISBN 5-94032-005-8.
15. MARKIN, Y. P. Economic analysis: a textbook for university students. M.: Omega-L Publishing House, 2nd ed. 2010. 450 p. ISBN 978-5-370-01299-0.
16. BLANK, I. A. Fundamentals of financial management. M.: Perspective. 2001. 358 p. ISBN 978-5-370-00922-8.
17. GAMETSKII, A. F., KUSHNIR, I. L. Mathematical modeling of raw material flows in oduct subcomplexes of the agro-industrial complex. Chisinau: Shtiintsa, 1990. 123 c.
18. AKULAY, E. Improving the policy of supporting small and medium-sized enterprises in the Republic of Moldova / E. Akulay; scientific ed. A. Stratan; National Institute of Economics research. Chisinau: NIEI. 2015. 178 p. ISBN 978-9975-4422-3-7.
19. ȘCHIOPU, I. Obiectivele financiare ale întreprinderii și corelarea lor cu managementul financiar. În: Revista Științifico-Didactică „Economica". Chișinău: Editura ASEM. Iunie 2018, an. XXV, nr. 2 (104). 2018, pp. 95-104. ISSN 1810-9136.
20. TIMOFTI, E. Statistica: Teorie si Aplicatii. Chisinau: State Agricultural University of Moldova. 2010. 283 p. ISBN 978-9975-64-198-2.
21. PERCIUN, R., ȚÎRLEA M. R. Alternative de finanțare a microîntreprinderilor. În: Creșterea economică în condițiile globalizării. 2018, Ed. a 13-a, Vol. 2, pp. 15-27. ISBN 978-9975-3202-9-01.

Rezumat

Asigurarea dinamicii pozitive a dezvoltării organizațiilor agricole, ținînd cont de specificul acestora, prezintă un proces destul de complicat. Aceasta se explică prin caracterul sezonier al activității și dependența semnificativă de factorii externi. Din acest motiv, este necesară o eficiență înaltă a muncii personalului managerial, exprimată prin determinarea strategiei de dezvoltare, abilitatea de a analiza rezultatele curente atinse în corelație cu acestea și, în funcție de rezultatele analizei, de a aduce corectări în strategia de dezvoltare

și în activitatea curentă. Pentru realizarea acestor obiective este important de a identifica un sistem de indicatori prin care pot fi determinate concluzii obiective în baza analizei obiectului corespunzător de cercetare.

În articolul dat autorul utilizează metoda de corelație pentru analiza și studierea influenței asupra rentabilității vânzărilor a indicatorilor, cum ar fi: productivitatea muncii, randamentul fondurilor, rotația activelor circulante, înzestrarea cu mijloace fixe, coeficientul lichidității curente, investițiile raportate la 1 hectar de teren agricol.

Obiectul de studiu este pentru prima dată reprezentat de douăzeci de gospodării agrare de fermieri din regiune.

În urma analizei, a fost făcută o prognoză privind nivelul dependenței eficienței managementului de factorii selectați, calculată pe baza datelor întreprinderilor studiate din regiune.

Utilizarea sistemului de analiză prin corelație permite de a introduce corectări în activitatea curentă și, astfel, asigurarea unei dinamici pozitive și atingerea obiectivului final - asigurarea stabilității financiare.

***Cuvinte-cheie**: ritmul de creștere a volumului de producție și vânzare, profitul brut, profitul net, înzestrarea cu mijloace fixe, productivitatea muncii, randamentul capitalului, rotația activelor circulante, investiții, rentabilitatea, coeficientul de lichiditate curentă*

Аннотация

Обеспечение положительной динамики развития сельскохозяйственных организаций с учетом их специфики является крайне сложным процессом. Это вызвано сезонным характером деятельности и значительной зависимостью от внешних факторов. В связи с этим это требует высокой эффективности труда управленческого персонала, которая выражается в качестве разрабатываемой стратегии развития, умении анализировать достигнутые текущие результаты в их корреляционной связи, исходя из результатов анализа вносить коррективы в стратегию развития и в текущую деятельность. Для решения данных задач важное значение имеет система показателей, которая позволит сделать объективные выводы по анализу соответствующего предмета исследования.

В предлагаемой статье автор использует метод корреляционных связей для анализа и изучения влияния на рентабельность продаж таких показателей как: производительность труда, фондоотдача производственных средств, оборачиваемость оборотных средств, фондовооруженность труда, коэффициент текущей ликвидности, инвестиции в расчете на 1 гектар сельскохозяйственных угодий.

Объектом исследования впервые явились двадцать крестьянско-фермерских хозяйств региона.

В результате анализа сделан прогноз уровня зависимости эффективности управления от выбранных факторов, рассчитанном на базе данных исследуемых предприятий региона.

Применение системного анализа корреляционных связей позволит вносить коррективы в текущую деятельность и таким образом обеспечивать ее положительную динамику и достижение конечной цели - обеспечение финансовой устойчивости.

***Ключевые слова:** темп роста обьемов производства и продаж, валовая прибыль, чистая прибыль, фондовооруженность труда, производительность труда, фондоотдача, оборачиваемость оборотных средств, инвестиции, чистая рентабельность, коэффициент текущей ликвидности*

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