Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 21, Issue 4, 2021
PRINT ISSN 2284-7995, E-ISSN 2285-3952

CORRELATION ANALYSIS OF PROFITABILITY IN THE MANAGEMENT SYSTEM OF AGRICULTURAL ENTERPRISES ON THE BASIS OF SUSTAINABLE DEVELOPMENT

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Abstract

The article considers the specifics of ensuring the efficiency of agricultural enterprises on the example of the Volyn region, Ukraine. The need to achieve the appropriate level of profitability as a criterion for the successful operation of agricultural enterprises is identified. The results of the activity of agricultural enterprises of the region according to the criteria of profitability and profitability are analyzed. The correlation-regression model for the definition of the key criteria which express the efficiency of functioning of the agricultural enterprises is constructed.

Key words**:** *agricultural enterprise, management efficiency, profitability level, efficiency of agricultural enterprises*

INTRODUCTION

The specifics of the current stage of transformation of economic relations in the agro-industrial complex of Ukraine involve the formation of an effective and efficient model of enterprise management, which should be focused on improving the profitability of agricultural enterprises. Of course, for a long time, the transformation of economic relations in the agricultural sector took place and the negative aspects of the interaction of agricultural producers with the state, financial institutions, and trade intermediaries. However, the market mechanism has made it possible to establish the proper efficiency of agricultural enterprises, especially after the opening of solvent markets of the European Union for Ukrainian businesses.

However, it should be noted that the construction of an effective management model should provide for the existence of certain criteria that agricultural enterprises must meet in the process of their activities to ensure high efficiency and proper return on capital. As practice shows, the most successful in this aspect are large agricultural holdings, which have sufficient material and financial resources to ensure an adequate level of profitability. At the same time, medium-sized enterprises and small agricultural producers, who are often forced to work through trade intermediaries in the sale of their products, have difficulty achieving high profits. Therefore, ensuring efficient

economic activity for such agricultural enterprises requires the definition of the criterion of this efficiency, the achievement of which will allow them to count on the appropriate financial return. As practice shows, the key generalized indicator, in this case, is the profitability of economic activity. Accordingly, it is necessary to study the allowable levels of profitability of agricultural enterprises, which provide them with the appropriate level of economic efficiency.

Peculiarities of research of problems of ensuring the increase of efficiency of functioning of the agricultural enterprises consist in a problem of definition of universal criteria of an estimation of their financial reporting. Therefore, most of the work related to this area is aimed at studying the features of ensuring the profitability and profitability of agricultural production. Therefore, a number of studies can be identified, which widely cover the key aspects of ensuring the profitable operation of agricultural enterprises. These include, above all, the work of researchers such as: O. Agres [1], O. Apostolyuk [2], I. Balaniuk [3], O. Binert [4], Y. Chaliuk [5], M. Dziamulych [6-11], Ya. Kostetskyi [14], O. Koval [15], A. Marcuta [17], B. Paskhaver [18], A. Popescu [20-28], T. Shmatkovska [30-32], R. Sodoma [33-35], O. Stashchuk [36-38], I. Yakoviyk [39], Ya. Yanyshyn [40], O. Yatsukh [41], I. Zhurakovska [43] and others.

However, practice shows that relying only on traditional approaches based on the coefficient analysis of the reporting of agricultural enterprises, does not always give an objective answer to achieve the appropriate level of efficiency of their operation through the performance of profitability and profitability. More relevant are the approaches that are based on the definition of relationships between individual indicators of economic efficiency and involve the use of elements of economic and mathematical modelling. Therefore, we consider it appropriate to focus on the implementation of the correlation-regression model of factor analysis of the profitability of agricultural enterprises to determine the main factors of ensuring the efficiency of agricultural production.

MATERIALS AND METHODS

Our study is based on the assessment of the effectiveness and economic feasibility of agricultural enterprises. This assessment is based on the use of not only absolute but also relative indicators, which include a system of profitability indicators.

The economic essence of profitability can be revealed only through the characteristics of the system of indicators. Their general content is to determine the amount of profit from one UAH of invested capital. And because these are relative indicators, they are virtually unaffected by inflation.

The main indicators of profitability, which measure the profitability of enterprises in Ukraine, are the following:

1. Return on assets (R_a) **–** shows what profit the company receives from each UAH invested in assets:

$$R_a = \frac{P}{A},$$

where:

P – profit remaining at the disposal of the enterprise (net profit);

A – the average value of assets.

This indicator characterizes the efficiency of the property of the agricultural enterprise.

2. Return on investment (R_i) – an indicator that reflects the efficiency of the use of funds invested in the enterprise. This indicator reflects the assessment of the "skill" of investment management:

$$R_i = \frac{P}{E+L_l},$$

where:

P – the total amount of profit for the reporting period;

E – the average amount of equity;

L_l – the average size of long-term liabilities.

3. Profitability of production (R_p), which is directly dependent on the profitability of products and inversely dependent on changes in capital intensity of products.

$$R_p = \frac{P_g}{C_a}, \quad (3)$$

where:
P_p – gross profit;
C_a – the average for the analysed period is the balance of the own and borrowed capital of the enterprise.

This indicator characterizes the profitability of the enterprise in relation to the available financial resources that are at its disposal, i.e. such an indicator is the resource [19].
However, since the specifics of calculating the profitability of agricultural enterprises is characterized by significant deviations of the average values when sampling large data sets of enterprises, to form objective and reliable models of efficiency of agricultural enterprises, we propose to apply a coefficient of variation that allows taking into account differences. the studied population.
The calculation of the coefficient of variation is performed by the following method:

$$V = \frac{\delta}{X_{am}},$$

where:
δ – root mean square deviation;
X_{am} – arithmetic mean of the variation series.

It should be borne in mind that if this figure does not exceed 0.333, the variation of the sign is considered weak, and if more than 0.333 - strong. Accordingly, in the case of strong variation, the statistical population is considered to be heterogeneous, and the average value is atypical, so it cannot be used as a generalizing indicator of this population. The lower limit of the coefficient of variation is zero, and the upper limit does not exist. However, increasing variation of the trait increases its value.
Also, when calculating the coefficient of variation, we have to use the standard deviation. It is defined as the square root of the variance, which, in turn, is defined as follows:

$$D = \frac{\sum(X - X_{am})^2}{N}$$

In other words, the variance will be the mean square of the deviation from the arithmetic mean. The standard deviation determines how much on average the specific indicators of the series deviate from their mean value [29].

RESULTS AND DISCUSSIONS

Within the generally accepted approach to determining economic efficiency as the value of the result per unit of resource spent on it as a generalized final indicator of the efficiency of the agricultural enterprise is the level of profitability (level of profitability), which is the ratio of profit from agricultural sales to its total cost multiplied by 100%. According to the "Forms 50 – Agriculture" in Ukraine for 2019, it can be determined both separately for crop production (line 010) and livestock (line 0130), and in general for agriculture (the sum of lines 010 and 0130). Since the available statistical information for 2019 on "Forms 50 – Agriculture" reflects the performance of only medium and large enterprises, this leads to limited factor analysis of the economic efficiency of agricultural enterprises in the Volyn region.
Factor analysis will begin with the study of variations in the level of profitability in 2019 in graphical form (Fig. 1).
The level of profitability of agricultural enterprises in 2019 fluctuated widely and not only in general in business structures, but also in each organizational and legal form. In 105 enterprises it was lower than 0%, in 372 it exceeded it, and in each form, there was a certain number of both unprofitable and profitable enterprises: in limited liability companies – 54 and 193; in joint-stock companies – 11 and 16; in agricultural production cooperatives – 6 and 25; in private enterprises – 16 and 84; in farms – 6 and 45 and in state enterprises – 9 and 5 [16].
Fig. 1 shows that the maximum value of the level of profitability is achieved in the range from 40.1% to 50%, the mode is 37.4%, which reflects the most frequent level of profitability of the sample. The value of asymmetry $S_к$ = 0.86 and excess $E_к$ = -0.54 indicates a slight right-hand asymmetry.

Indeed, to the left of trend, we have 45% of enterprises, to the right – 42%. The basic properties of the normal distribution law are somewhat violated.

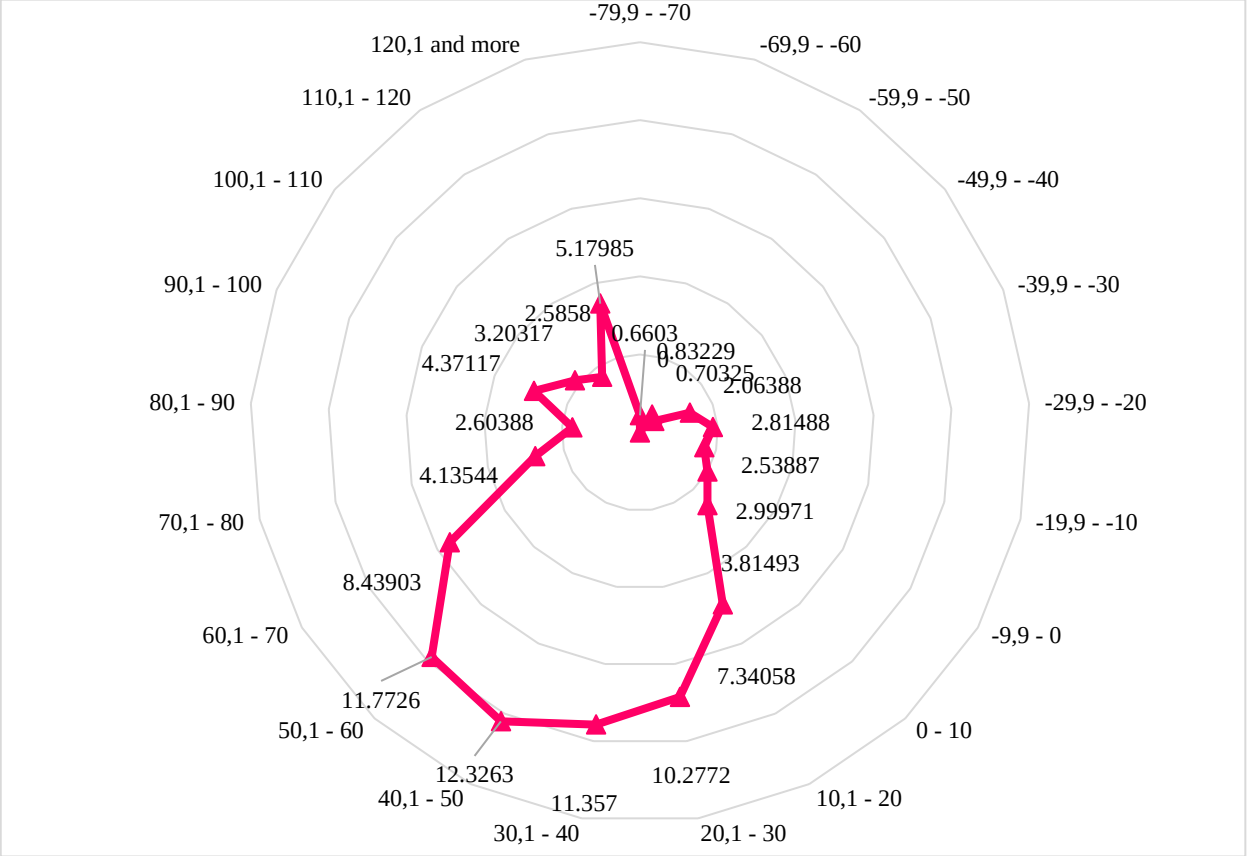

Fig. 1. Distribution of agricultural enterprises of Volyn region of Ukraine by the level of profitability in 2019, %
Source: Own development based on statistical data.

The indicator for the level of profitability of certain forms of management is also characterized by a large variation (Table 1), which does not allow to unambiguously determine the optimal organizational and legal form of entrepreneurship in the region.

However, the results of the study of the spatial variation in the level of profitability of certain forms of entrepreneurship, presented in Table 1, show that the lowest percentage of dispersion of efficiency indicators have farms and limited liability companies, the size of which in both cases does not exceed 70%.

This situation is accompanied by the highest modal and average values of profitability in these structures, which gives grounds to conclude about a more stable position of these forms of management, compared to others, in the agricultural market of the region.

Table 1. Productivity indicators of research of spatial variation of the level of profitability of organizational and legal forms of Volyn region of Ukraine

Legal entity type	Modal value of the level of profitabi-lity, %	Average level of profitability, %	Coefficient of variation, %
Limited Liability Company	57.8	26.2	65.6
Joint stock company	50.2	24.8	76.4
Agricultural production cooperative	43.4	18.35	88.3
Private enterprise	49.4	22.6	81.4
Farm	55.05	30.3	63.6

Source: Own development based on statistical data.

The instability of socio-economic conditions for the functioning of agricultural enterprises, the inconsistency of government reform measures in the development of a market economy cause significant fluctuations in the

indicator of economic efficiency of production – the level of profitability. This indicator primarily depends on internal development factors, in particular, on the level of resource provision [12; 42].

To a large extent, the formation of the dynamics of economic efficiency in various organizational and legal forms in the Volyn region was influenced by the negative dynamics of resource provision of surveyed farms, which is a consequence of reduced investment activity of agricultural enterprises as a result of deteriorating financial and economic condition. To identify the relationship between the level of profitability and indicators of resource supply of agricultural enterprises in terms of groups of the level of profitability of the Volyn region, an effective grouping was carried out. As a result of the statistical combination of groups of the level of profitability of enterprises, a very high level of influence on the performance of all three types of resources, namely the degree of provision of enterprises with land, labour, and capital resources. With the growth of the average size of an agricultural enterprise, the indicators of the obtained level of profitability increase. These indicators of resource supply are both indicators of the size of agricultural enterprises and the level of concentration of production.

One of the reliable statistical patterns identified by domestic and foreign scientists is the positive impact of production growth on economic efficiency [13]. In order to identify such a relationship and its form in the agricultural production of the Volyn region, a multiple correlation-regression analysis was performed, the results of which are shown in Table 2.

The coefficient of determination between performance and factor characteristics in the whole set of agricultural enterprises is 0.96. It is highest in limited liability companies, and much lower in other forms of business management. Since the factor of the scale of production in limited liability companies in 2019 acted as clearly as possible, we can conclude that the highest level of adaptation of this organizational and legal form of agricultural enterprises to modern market economy requirements in the study region.

Each business form, according to the current legislation of Ukraine, has different levels of authoritarianism and responsibility of the head for the final results of management, which, of course, affects the organization of agricultural activities and affects its economic efficiency. We consider this difference to be significant, and therefore we will focus on the peculiarities of the organization and coordination of agricultural production in the business structures of the region.

Table 2. Statistical characteristics of the dependence of the level of profitability of agricultural production on the indicators of resource provision of agricultural enterprises of Volyn region of Ukraine in 2019

Legal entity type	Regression equation	Coefficient of determination
Agricultural enterprises, total	У = -90.31+0.0098x1 +0.0079x2+2.0388x3	0.96
Limited Liability Company	У = -65.318+0.0085x1+ 0.024x2–1.0569x3	0.92
Joint stock company	У = -59.628–0.0036x1– 0.0036x2+0.087x3	0.66
Agricultural production cooperative	У = -40.131–0.019x1+ 0.0019x2–0.103x3	0.65
Private enterprise	У = -70.4+0.0446x1+ 0.0052x2+0.0243x3	0.69
Farm	У = -23.447–0.011x1+ 0.0104x2+1.487x3	0.90
State Enterprise	У = -34.014+0.005x1+ 0.0042x2–0.147x3	0.83

Source: Own development based on statistical data.

An important factor in the efficiency of agricultural enterprises of all organizational and legal forms is the process of organizing an agrarian business as an indicator of its competitiveness. Domestic statistics of the region allow us to track the dependence of the level of profitability on the main competitive indicators at the level of administrative districts. With the help of correlation-regression analysis, we will study the influence of certain factors that are related to the peculiarity of the organization of

agricultural production on its efficiency in agricultural enterprises. We use information about the activities of business structures of 20 administrative districts of the Volyn region, which did not include highly specialized horticultural enterprises, poultry farms, and pig farms. That is, the activity of enterprises with the traditional organization of agricultural production on medium and large tracts of land resources is analyzed.

Effective feature: efficiency criterion – the level of profitability of agricultural production (Ух). The influence of the following factors on it was considered:

– average annual value of assets per 1 ha of agricultural land, UAH (x_1);

– production costs per 1 ha of agricultural land, UAH (x_2);

– administrative costs per 1 ha of agricultural land, UAH (x_3);

– average monthly cash receipts from sales of agricultural products, thousand UAH (x_4) (determines the size of turnover);

– average monthly salary of one average annual employee, UAH (x_5);

– labour costs per 1 hectare of agricultural land, man-hours (x_6);

– the share of costs for the production of livestock products in the structure of production costs of agricultural products, % (x_7).

The obtained regression equation has the form:

$$У_x = -27{,}021 – 0{,}0033X_1 + 0{,}0206X_2 + 0{,}044X_3 + 0{,}0058X_4 + 0{,}007X_5 – 0{,}006X_6 + 0{,}081X_7$$

First of all, we note that on the basis of paired correlation coefficients between performance and individual factors, there is no impact on the level of profitability of agricultural production labour costs per 1 hectare of agricultural land (x_6) and the importance in the economy of livestock enterprises (x_7).

The lack of an obvious link between labour costs per 1 hectare of agricultural land and the level of profitability of production is associated with a range of problems in the use of labour resources in agriculture: irrational use of existing production staff, which does not increase productivity; with shortcomings in the accounting of labour costs, especially in the case of the use of employees involved in seasonal work; high differentiation of living and tangible labour in the production of various types of products, which is associated with the differentiation of the level of its mechanization; as well as seasonal fluctuations in the employment of many workers.

As you know, the production of livestock products in most companies is unprofitable and therefore significantly curtailed. A significant number of enterprises in the region do not produce it at all. This situation is extremely irrational from the standpoint of public interest, as it does not guarantee a reliable supply of the region with meat and dairy products of regional production. However, it does not significantly affect the overall level of profitability of agricultural enterprises: due to reduced livestock production is the release of some economic resources (fixed and working capital, primary production workers, and even land for fodder crops), which increases the production of more profitable crops.

The influence of other factors from our study is essential. This is evidenced by the multiple correlation coefficient between them and the resultant trait, which is 0.95, and other parameters used for statistical testing of hypotheses.

The greatest link is between the performance trait and production costs per hectare of agricultural land. The correlation coefficient between them is 0.92. The parameters of the equation show that with the growth of production costs per 1 ha of land per 1 UAH, we can expect an increase in the level of profitability of production by 0.0206%. In other words, per 1 hectare of land area with an increase in costs by 1 UAH, we can expect an increase in revenue by UAH 1.54, which indicates the full payback of production costs. This indicates a fairly high level of technology in a significant number of enterprises in the region used in agricultural production.

There is also a fairly high relationship

between the performance indicator and the average monthly salary of one average annual employee. The correlation coefficient between them is 0.82. That is, with an increase in the employee's monthly salary by UAH 1. you can expect an increase in profitability by 0.006%. This indicates the activation of work motivation in those enterprises of the Volyn region that seek high results, the main form of which is the material incentives for employees.

There is a direct relationship between the level of administrative costs per 1 ha of land, the level of average monthly cash receipts from sales, and the studied performance indicator. However, the feedback between the value of assets per unit area and the level of profitability of agricultural production is unexpected. The main reason for this is the irrationality of assets. To date, a significant number of fixed assets of agricultural enterprises in the region, both physically and morally, are worn out, in addition, many types of equipment are defective, and empty livestock facilities are not used at all in agricultural production.

Thus, the results of correlation and regression analyzes showed that the most important factors of economic efficiency of agricultural production are: 1) the size of the enterprise; 2) remuneration as a factor motivating work;
3) production intensity (the number of costs and assets per unit area). Therefore, we analyze the level of these factors in the formation of economic efficiency of economic activity in profitable and unprofitable groups of enterprises.

The size of profitable enterprises of each organizational and legal form of management is greater than unprofitable - by the area of productive land by an average of 7.6%, the value of assets – by 43%, the number of employees – by 23.5%, and the amount of cash flow from sales – on average by 58.2%. St. 63 of the Commercial Code of Ukraine, it is established that enterprises with an average number of up to 50 people and the amount of sales revenue up to 500 thousand euro are small [43]. These parameters are almost entirely consistent with the size of unprofitable enterprises of various forms of management in the Volyn region, which can be considered small, and profitable – medium. However, judging objectively, the size of unprofitable enterprises is sufficient for the effective use of machinery in field mechanized work, because, with a 10-field crop rotation and the size of the cultivated contour of 0.5 fields, the working length of the drive can approach 1,000 m. But profitable enterprises of all forms, without exception, stimulate employees much better. Their annual wages are on average 1.3 times higher than unprofitable, although its share in costs and cash inflows of most of them is inferior to unprofitable. Indicators of production intensity are somewhat contradictory. If the value of assets per 1 ha of agricultural land profitable enterprises is inferior to unprofitable (from 1.1 to 34.5%), then the annual amount of production costs for the same area and the cost of mineral fertilizers per 1 ha of arable land is more than 1.5 times on average exceed unprofitably. However, as the regression equation is shown such a situation is quite logical for profitable enterprises in Volyn.

CONCLUSIONS

Thus, the results of studies of internal factors of the level of profitability of agricultural enterprises of the Volyn region showed that the implementation of economic activity of profitable enterprises is different from unprofitable. First, profitable enterprises are much larger in terms of resources, which allows them to actively enjoy the benefits of increasing returns to scale. Secondly, profitable enterprises implement a more effective system of labor incentives, understanding the simple postulate of the economy: if the salary of employees does not change in the direction of increasing its dependence on the level of efficiency of their work, then no practical effect can be expected. Third, unprofitable enterprises choose a non-intensive way of doing business, because their agricultural business is characterized by a low level of additional investment in agricultural production in terms of reduced efficiency of use of assets available on balance sheets.

Thus, we can conclude that to increase the efficiency of enterprises in the Volyn region should first talk about improving the level of management, namely the application of advanced principles of formation and strengthening of the material and technical base, development, and implementation of new approaches to efficient use of labor, rationalization of internal land use.

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