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THE ANALYSIS OF COST STRUCTURE AND THE IMPACT ON THE PROFITABILITY OF AGRICULTURAL PRODUCTS IN THE REPUBLIC OF MOLDOVA

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Abstract

In this paper is being studied the structure of the production cost by calculation items for agricultural products from the enterprises of the Central region of the Republic of Moldova. The influence of the unit cost on the change in the rate of return was quantified. The results of the factorial analysis show that the increase of the unit cost for all agricultural products caused the decrease of the rate of returne: for wheat by 3.89 p.p., for corn by 3.36 p.p., for sunflower by 12.03 p.p. This is partly explained by the fact that in the structure of production costs the items "Fertilizers and "Pesticides" and "Seeds" predominate, which are usually imported at exaggerated prices.

Key words**:** *profitability, production costs, calculation items*

INTRODUCTION

Any economic activity involves human, material and financial resources costs that are recorded according to the principles of organizing financial accounting. The total cost of resources that the company incurs to manufacture the products is the production cost [2].

The analysis of the production cost highlights the way in which the resources (human, material, financial) are used and the impact of their allocation on the profit and profitability [10]. For these reasons, it is necessary to study the cost structure by calculation items in order to optimize or reduce them, where possible, without affecting the normal development of the company's activity [7].

MATERIALS AND METHODS

The information base of the investigation is formed of the following sources selected from 68 agricultural enterprises in the Central Region of the Republic of Moldova:

- Annual statistical survey 21-Sale "Sale of agricultural production";
- Register of cost records by types of agricultural products.

The identification of cost elements that most influence the profitability of agricultural products was performed using the methods specific to economic analysis: comparison [11], division, quota participation method, direct and indirect linkage procedure, regression analysis method [4].

The quantification of the factors influence, including the unit cost when changing the rate of return was performed according to the formula:

$$R_p = \frac{P-C}{C} \times 100\% \quad (1)$$

Thus, the factors that influence the rate of return of certain products are:

-change in profit per unit of product, which is the difference between the selling price and the unit cost [$\Delta(P-C)$];

-cost change per unit of product (ΔC).

The calculation of the influence of these factors is performed by applying the formulas [8]:

$$\Delta R_P{}^{P-C} = \left(\frac{P_1 - C_1}{C_1} \times 100\%\right) - \left(\frac{P_0 - C_0}{C_1} \times 100\%\right) \quad (2)$$

$$\Delta R_p{}^{C} = \left(\frac{P_0 - C_0}{C_1} \times 100\%\right) - \left(\frac{P_0 - C_0}{C_0} \times 100\%\right) \quad (3)$$

Authors proposed to calculate the influence of the items of costs on the change in the rate of return according to formula 4.

$$\Delta R_P{}^{Ci} = \frac{\Delta Ci}{\Delta C} \times \Delta R_P{}^{C} \quad (4)$$

where: $\Delta R_P{}^{Ci}$ – change in the rate of return under the influence of the calculation item i; ΔCi – modification of the calculation item i.
The linear regression model used to reflect the interdependence between the rate of return and the independent factors had the formula [9]:

$$Y_{1-3} = a_0 + a_1 x_1 + a_2 x_2 \quad (5)$$

RESULTS AND DISCUSSIONS

The structure of the production cost by calculation items was analyzed in the period 2016 - 2017 for wheat, barley, corn, sunflower and it is presented in Figures 1, 2, 3, and 4.
The study concerning the structure of the production cost based on the Register of cost evidence in the agricultural enterprises from the Central region allowed us to ascertain the following:

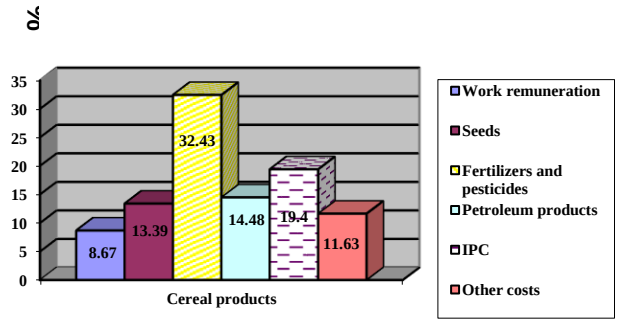

Fig. 1. The structure of the production cost by calculation items for cereal products (including corn) on average for the years 2016-2017
Source: Authors' calculations.

On average for the years 2016-2017, the predominant share belongs to the item "Fertilizers and pesticides", which makes up 32.43% for all cereal products (Figure 1), ranging from 26.27% for barley to 34.93% for wheat (Figure 2), and for corn and sunflower their share is respectively 28.06% (Figure 3) and 32.12% (Figure 4).
The major share belongs to the indirect production costs, which constitute on average for all cereal products 19.4% (Figure 1), for corn - 22.42% (Figure 3) and for sunflower - 17.73% (Figure 4).

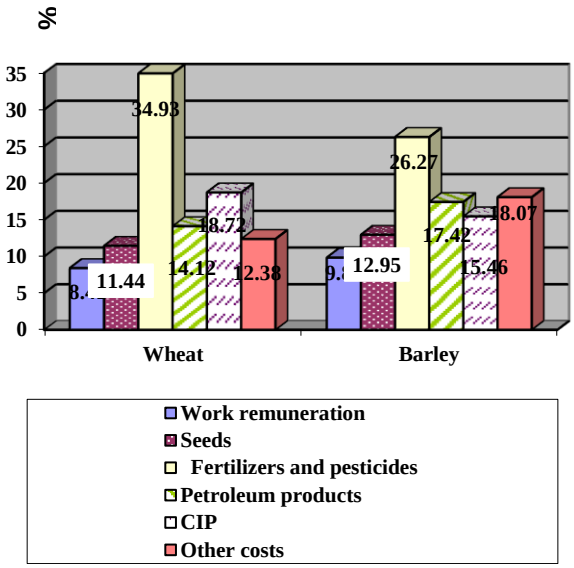

Fig. 2. The structure of the production cost by calculation items for wheat and barley on average for the years 2016-2017
Source: Authors' calculations.

For corn and sunflower, a relatively high share of seed costs in the reference period is 18.3% (Figure 3) and 19.3% (Figure 4).

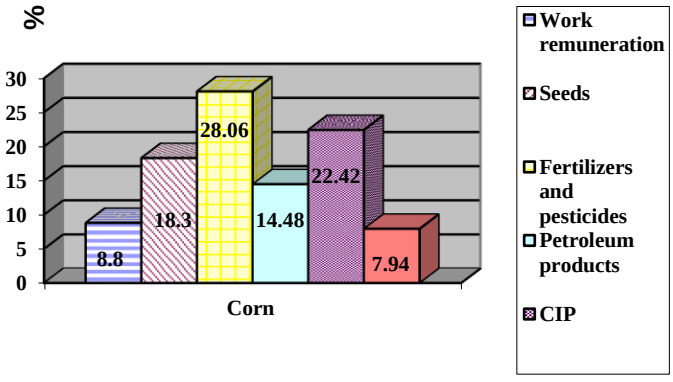

Fig. 3. The structure of the production cost by calculation items for corn on average for the years 2016-2017
Source: Authors' calculations.

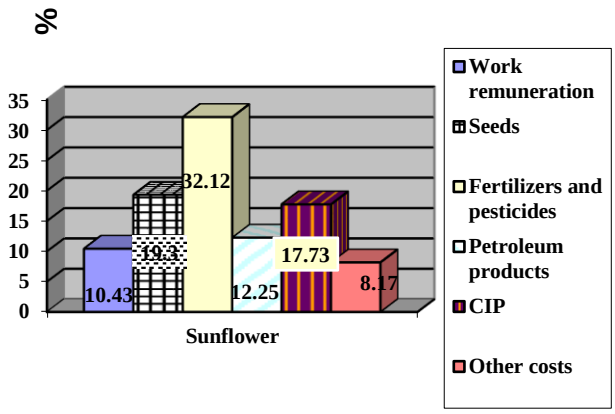

Fig. 4. The structure of the production cost by calculation items for sunflower on average for the years 2016-2017
Source: Authors' calculations.

It explains why some seed material was imported at much higher prices compared to the prices of local seeds.
The costs for the item "Petroleum products" occupy a significant share from 14.12% for wheat to 17.42% for barley (Figure 2), and for sunflower and corn, respectively 12.25% (Figure 4) and 14.48% (Figure 3).
The share of personnel costs is the lowest of all calculation items from 8.41% for wheat (Figure 2) to 10.43% for sunflower (Figure 4), which shows the low level of workers' wages engaged in agriculture.
The analysis of unit cost by types of agricultural products demonstrated increasing trend in the dynamics. Thus, unit cost of corn and of sunflower increased respectively by 41.02 and 81.43 lei (Table 1).

Table 1. Factorial analysis of the rate of return of the main agricultural products in the enterprises of the Central region

Indicator	2014-2015	2016-2017	Calculation of factors influence	The result of the influence ±, p.p.
Wheat				
Factorial 1. Profit calculated by 1q of wheat (B), lei	50.85	38.80	$\left[\left(\frac{38.8}{191.14}\times100\%\right)-\left(\frac{50.85}{191.14}\times100\%\right)\right]$	-6.3
2. Cost of 1q of product (C), lei	166.80	191.14	$\left[\left(\frac{50.85}{191.14}\times100\%\right)-\left(\frac{50.85}{166.80}\times100\%\right)\right]$	-3.89
Resultative Rate of return for wheat R_p, %	30.49	20.30	20.30%-30.49% = -6.3+ (-3.89) -10.19 = -10.19 p.p.	X
Barley				
Factorial 1. Profit calculated by 1q of barley (B), lei	49.61	67.06	$\left[\left(\frac{67.06}{193.62}\times100\%\right)-\left(\frac{49.61}{193.62}\times100\%\right)\right]$	+9.01
2.Cost of 1q of barley (C), lei	182.70	193.62	$\left[\left(\frac{49.61}{193.62}\times100\%-\left(\frac{49.61}{182.70}\times100\%\right)\right]\right.$	-1.53
Resultative 3. Rate of return for barley R_p ,%	27.15	34.63	34.63%-27.15% = 9.01+(-1.53) +7.48 = +7.48 p.p.	X
Corn				
Factorial 1. Profit calculated by 1q of corn (B), lei	26.74	24.89	$\left[\left(\frac{24.89}{202.4}\times100\%\right)-\left(\frac{26.74}{202.4}\times100\%\right)\right]$	-0.91
2.Cost of 1q of corn (C), lei	161.38	202.40	$\left[\left(\frac{26.74}{202.4}\times100\%\right)-\left(\frac{26.74}{161.38}\times100\%\right)\right]$	-3.36
Resultative 3. Rate of return for corn R_p, %	16.57	12.30	12.3%-16.57% = -0.91+ (-3.36) -4.27 = -4.27 p.p.	X
Sunflower				
Factorial 1. Profit calculated by 1q of sunflower seeds (B), lei	180.08	210.09	$\left[\left(\frac{210.09}{392.2}\times100\%\right)-\left(\frac{180.08}{392.2}\times100\%\right)\right]$	+7.65
2.Cost of 1q of sunflower seeds (C), lei	310.77	392.2	$\left[\left(\frac{180.08}{392.2}\times100\%-\left(\frac{180.08}{310.77}\times100\%\right)\right]\right.$	-12.03
Resultative 3. Rate of return for sunflower seeds R_p, %	57.95	53.57	53.57%-57.95% = 7.65+(-12.03) - 4,38 = - 4.38 p.p.	X

Source: Authors' calculations.

The calculations performed in this Table certified that increament of the unit cost negatively influenced the rate of return of all agricultural products bringing about its diminution.

The results of the factor analysis according to formulas (2) and (3) are presented in Table 1.

According to the calculations presented in Table 1, we can draw the following conclusions:

(i) The decrease in the rate of return of wheat production was determined by the decrease in profit per unit of product compared to the base period by 6.3 percentage points and by the increase in the cost of one quintal of wheat which caused the reduction in profitability by 3.89 percentage points. In the same direction, the factors influenced the decrease of the profitability rate of the corn, only that the decisive action was exercised by the increase of the unit cost by 41.02 lei, which caused the reduction of the profitability by 3.36 percentage points.

(ii) In the production of barley and sunflower seeds, the increase in profit per unit of product had a positive influence, increasing the respective rate of return by 9.01 and 7.65 percentage points respectively. At the same time, the increase of the unit cost for these products had an unfavorable influence causing the decrease of the rate of return by 1.53 and 12.03 percentage points, respectively. On the sunflower production is ascertained a difficult situation, because unit cost influenced decisively and therefore on each leu of production cost profit decreased by 4.38 bani compared to the previous period.

Given that in the period 2016-2017 the unit cost of the main agricultural products had an increasing trend and this fact influenced the considerable decrease of profit and rate of return, we will further quantify the influence of cost in the profile of calculation items when changing the rate of return (Tabel 2).

Table 2. Calculation of costs influence by items when changing the rate of return of agricultural products in the enterprises from the Central region

Cost items	**Wheat**		**Corn**		**Sunflower**	
	Absolute cost deviation 1q, lei	Change in profitability,±p.p.	Absolute cost deviation 1q, lei	Change in profitability, ±p.p.	Absolute cost deviation 1q, lei	Change in profitability, ±p.p.
1. Direct personnel costs (work remuneration)	+1.59	-0.254	+4.46	-0.365	+2.83	-0.419
2. Seeds	+3.92	-0.627	+6.03	-0.494	+19.46	-2.875
3. Fertilizers and pesticides	+11.46	-1.831	+10.17	-0.834	+18.26	-2.697
4. Petroleum products	+4.51	-0.721	+3.54	-0.29	+6.31	-0.932
5. Indirect production costs	+1.99	-0.318	+14.56	-1.192	+33.46	-4.943
6. Other costs	+0.87	-0.139	+2.26	-0.185	+1.11	-0.164
7. Total cost 1q	**+24.34**	**-3.89**	**+41.02**	**-3.36**	**+81.43**	**-12.03**

Source: Authors' calculation.

The calculations made in Table 2 show that the rate of return decreased under the influence of growth of all cost items. However, its impact is different. Thus, for wheat, the increase of the cost of 1q per item of „Fertilizers and pesticides" by 11.46 lei compared to the previous period determined the decrease of profitability by 1.831 percentage points. The increase of the cost of one quintal of wheat on cost items „Petroleum products" and „Seeds" by 4.51 lei and 3.92 lei caused the reduction of the rate of return respectively by 0.721 and 0.627 percentage points.

For corn and sunflower, the main items that influenced the increase of the unit cost and the reduction of the rate of return are: „Indirect production costs", „Fertilizers and pesticides", „Seeds". Thus, the increase of indirect production costs in the calculation of one quintal of corn by 14.56 lei caused the decrease of profitability by 1.192 percentage points.

For sunflower, significant influence is found on the cost item „Indirect production costs"

which increment caused growth of the unit cost by 33.46 lei and consequently led to the decrease of the rate of return by 4.943 percentage points.

The increase of the cost of a quintal of corn and sunflower for the item „Fertilizers and pesticides" by 10.17 lei and 18.26 lei respectively caused the decrease of profitability by 0.834 and 2.697 percentage points respectively. The costs for the item of „Seeds" per one quintal of sunflower increased by 19.46 lei, which led to a decrease in the rate of return by 2.875 percentage points. For a more convincing argument of the influence of the unit cost on the change of the rate of return, is recomended the application of the regression analysis method [1], [3], [6], [10].

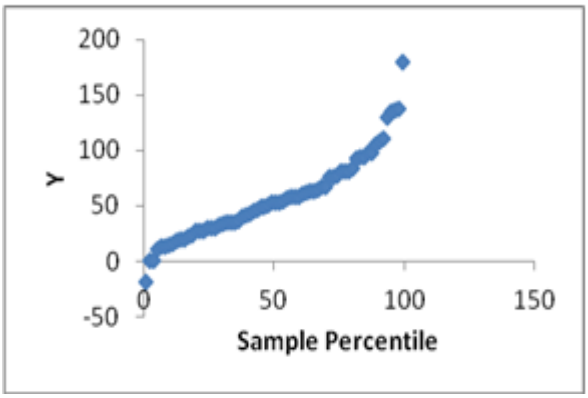

Fig. 5. Normal probability plot
Source: Authors' calculations.

In this context we studied the correlation between the rate of return at product level (y_{1-3}) as a dependent variable and the independent variables: the cost of a quintal of product (x_1), the average selling price of one quintal of product (x_2). Preventively, the connection between the variables that form the structure of the mathematical model of the profitability of wheat, corn, sunflower was studied graphically (Figure 5). The analysis of the graphical representation (Figure 5) allowed us to conclude that in this case the linear regression model can be applied which adequately synthesizes the interdependence between the rate of return with the factors: unit cost of product (x_1); average selling price (x_2) according to formula 3. As a result of the calculations, the following regression equations were obtained (Table 3). The regression coefficients of the equations presented in Table 3 demonstrate the following:

-The increase of the cost of a quintal of product by one leu lead to the decrease of the rate of return for wheat by 1.02 p.p., for corn by 0.99 p.p. and for sunflower by 0.48 p.p.;

-The increase of the selling price of a quintal of product by one leu contributes to the increase of the rate of return for wheat by 0.77 p.p., for corn by 0.78 p.p. and for sunflower by 0.3 p.p.

Tabel 3. Equations of the rate of return regression at product level in agricultural enterprises in the Central region

Products	Regression equation	Multiple correlation coefficient (R)	Coefficient of determination (R^2)
Wheat	$y_1 = 45.65 - 1.023 x_1 + 0.77 x_2$	0.883	0.78
Corn	$y_2 = 51.84 - 0.99 x_1 + 0.775 x_2$	0.827	0.684
Sunflower	$y_3 = 65.04 - 0.475 x_1 + 0.3 x_2$	0.95	0.9

Source: Authors' calculations.

These changes are valid, if other variables remain stable on the same level [3].

Testing the significance of the parameters of the regression equations with the help of the multiple correlation coefficient (R) shows us that there is a strong connection between the variables of the studied system (0.827-0.95). This conclusion is also confirmed by the values of the coefficient of determination (R^2) based on which we can deduce that the rate of return on agricultural products is determined by the factors included in the mathematical model in the proportion of 68.4% -90%.

CONCLUSIONS

The researches showed us that during the reference period the unit cost of main agricultural products in the enterprises of the Central Region of the Republic of Moldova had an increasing trend, which caused a considerable decrease in profit and rate of

return. This is partly explained by the fact that in the structure of production costs the articles "Fertilizers and "Pesticides" and "Seeds" predominate, which are usually imported at exaggerated prices. Thus, for sunflower, these articles caused the increase of the unit cost in the respective reference period by 18.26 and 19.46 lei, respectively, and consequently led to the decrease of the rate of return, respectively by 2.7 and 2.88 percentage points. The testing of the parameters of the regression equations shows us that they can be used to estimate the forecast in the conditions of adopting real variants aimed at changing the unit costs and the selling prices for agricultural products [5].

In the context of complex efforts to increase profitability, measures are required to diagnose on the one hand the costs of production, and on the other - the commercial policy of the company with reference to the selling prices of agricultural products. The setting of sale prices must attract as wide a segment of buyers as possible, after which, depending on the evolution of the supply-demand ratio, the entity can choose the most appropriate strategy.

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