RESEARCH REGARDING THE ANALYSIS OF VARIABLE COST- A WAY TO INCREASE FARM PROFITABILITY

CERCETARI PRIVIND ANALIZA COSTULUI VARIABIL – CALE DE CRESTERE A PROFITABILITATII FERMEI

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Abstrac:. *The paper aimed to present an analysis of crop economic efficiency based on variable costing method using the data from a farm cultivating wheat, barley, maize, sunflower and rape in the Southern Plain of Romania. Gross margin, gross margin rate, variable cost rate, production and sales breakeven points, coverage factor, dynamic safety coefficient, safety interval, withdrawal index and operational leverage were calculated by crop and at farm level for the year 2011. The conclusion was that in order to increase profitability, the farmer has to optimize crop structure by increasing sunflower and rape production which are the most profitable crops and decreasing barley production whish is less profitable.*

Key words: *variable cost, profitability, vegetal farm, direct costing method*

INTRODUCTION

Production cost represents a major factor with a deep impact on efficiency and profitability in agriculture as its main component, variable cost, varies proportionally to production. In vegetal sector, variable cost consists of the expense for seed, fertilizer, herbicide, pesticide, insecticide, irrigation water, fuel and lubricant, part time labor etc.

Variable cost is closely related to crop technology. From this point of view, there are crops requiring a high variable cost and other crops which are less costing.

The most utilized method for calculating and analyzing variable cost is “Direct or Variable Costing”. It is extremely helpful for farmers in order to identify faster the ways to improve economic efficiency of a product,

activity or enterprise (5,6).According to 'Variable Costing Method", unitary cost of a product is given by the ratio between variable cost and the obtained production units (1,4,7).Fixed cost is determined separately and then distributed among products. The analysis of cost trend is compulsory before separating production cost into variable and fixed cost (2) and fixed cost treated as cost of the period (8,9,10, 11).

In order to increase profitability, production has to be higher and unitary cost to decrease (3).

In this context, this paper aimed to present an analysis of crop economic efficiency using variable costing method in order to increase farm profitability (12).

MATERIALS AND METHODS

The research work was experienced in a vegetal farm, SC GUT SRL, situated in the Romanian Southern Plain. The farm has 1,860 ha and cultivates wheat, barley, maize, sunflower and rape. The data were collected for the agricultural year 2010-2011 and the variable costing method was applied for cost analysis in order to increase farm profitability.

In this purpose, the following indicators were determined:

-Gross margin of variable cost, GM, based on the formula: GM_p=GP=VC, where GM_p=gross product, VC=variable cost at product level and $GM_t = \sum_{i=1}^{n}(GMp)$= S-VCh, where S= sales, VCh=variable cost at farm level and i=1,2,..n products or crops.

-Gross margin rate, r_{GM}, based on the formula: r_{GM} = GM/S x 100.

-Variable cost rate, r', based on the formula: r' = VCh/S x 100 or r'=100-r.

-Break-even point, e, was determined in its two forms: *(a)Production break-even point, P_e,* using the formula P_e=FC/Ac_a, where FC= fixed cost and Ac_a=average coverage contribution, calculated according to the formula: $Ac_a = C_A / \sum_{i=1}^{n}(qi)$, where C_A= total coverage contribution and q_i= amount of i=1,2…n produced and sold products; *(b)Sales break-even point, S_e*, using the formula S_e= FC x S/(S-VCh), where FC=fixed cost, S=sales, VCh=variable cost at farm level.

-Coverage factor, CF, was calculated using the formula: CF=CA/S x 100, where C_A= total gross contribution and S=sales or CF=FC/S_e x 100, where FC = fixed cost, S_e=sales break-even point.

-Dynamic Safety Coefficient, K_s, was determined with the formula: K_s=(S-S_e)/S x 100 or K_s=R/S x 100, where S=sales, S_e= sales break-even point, R= financial result (profit or loss).

-Safety Interval, SI, was calculated with the formula: SI=S-S_e, where S=sales, S_e= sales break-even point.

-Withdrawal Index (WI), based on the formula: WI=FC/S x 100, where FC=fixed cost and S=sales.

-Volatility Coefficient or Operational Leverage, Lo, determined with the formula: L_o= (ΔR/R)/(ΔS/S) or L_o=1+FC/R where R=financial result, S=sales, FC=fixed cost or L_o=S/(S-S_e), where S_e= sales break-even point.

RESULTS AND DISCUSSIONS

Cultivated area counted for 1,860 ha, of which 45.16 % wheat, 16.12 % barley, 8.61 % maize, 21.50 % sunflower and 8.61 % rape. **Average Production per ha** was 5,800 kg wheat, 5,000 kg barley, 8,000 kg maize, 5,400 g sunflower and 3,700 kg rape seeds. **Total Production** represented 10,404 tons of which 46.82 % wheat, 14.42 % barley, 12.30 % maize, 20.76 % sunflower and 5.70 % rape grains (Table 1).

Table 1.Production Structure in the year 2010-2011

Specification	MU	Wheat	Barley	Maize	Sunflower	Rape	Farm level
Cultivated area	ha	840	300	160	400	160	1,860
	%	45.16	16.12	8.61	21.50	8.61	100.00
Average Production	Kg/ha	5,800	5,000	8,000	5,400	3,700	-
Total Production	Thou.tons	4,872	1,500	1,280	2,160	592	10,404
Crop contribution to total product.	%	46.82	14.42	12.30	20.76	5.70	100.00

Sales by crop varied according to marketed production and sale price. Sales at farm level counted for Lei thousand 8,955.36. The crops contribution to sales was: 34.28 % from wheat, 10.38 % from barley, 10 % from maize, 33.77 % from sunflower and 11.57 % from rape (Table 2).

Production cost at farm level represented Lei thousand 4,701.32.The decreasing order of crops based on total production cost was the following one: wheat, barley, sunflower, maize and rape.

Table 2. Sales by crop in the year 2011

Specification	MU	Wheat	Barley	Maize	Sunflower	Rape	Farm level
Total Production	t	4,872	1,500	1,280	2,160	592	10,404
Sale Price	Lei/t	630	620	700	1,400	1,750	-
Sales	Thou. Lei	3,069.36	930	896	3,024	1,036	8,955.36
Crop contribution to Sales	%	34.28	10.38	10.00	33.77	11.57	100.00

Unitary production cost per ton was: Lei 563 for rape, Lei 552 for barley, Lei 470 for wheat, Lei 384 for maize and Lei 351 for sunflower. Therefore for producing a ton of grains, the highest costing crop is rape and the lowest costing crop is sunflower.

The Share of variable cost in product cost per ton was: 64.89 % for wheat, 69.02 % for barley, 79.16 % for maize, 63.81 % for sunflower and 71.58 % for rape (Table 3).

Table 3.Production Cost by Crop

Specification	MU	Wheat	Barley	Maize	Sunflower	Rape	Farm level
Total Cost							
Production Cost, of which	Thou. Lei	2,289.84	828.00	491.52	758.16	333.88	4,701.32
Variable Cost	Thou. Lei	1,485.96	571.50	389.12	483.84	238.58	3,169.00
Fixed Cost	Thou. Lei	803.88	256.50	102.40	274.32	94.71	1,531.82
Unitary Cost							
Production Cost, of which	Lei/ton	470	552	384	351	563	451
Variable Cost	Lei/ton	305	381	304	224	403	304.5
Fixed Cost	Lei/ton	165	171	80	127	160	147
Share of Variable cost in Production Cost	%	64.89	69.02	79.16	63.81	71.58	67.51

Variable cost totalized Lei thousand 3,169 at farm level. Variable cost varied by crop from Lei thousand 1,485.96 for wheat, the highest level, to Lei thousand 238.58 for ape, the lowest one. **Fixed cost** totalized Lei thousand 1,531.82 at farm level, varying from Lei thousand 803.88 for wheat and Lei thousand 94.72 for rape (Table 4).

Gross margin related to variable cost(GM), calculated as difference between sales and variable cost, counted for Le thousand 5,786.36 at farm level. The crop contribution to gross margin at farm level was: 43.89 % sunflower, 27.36 % wheat, 13.78 % rape, 8.75 % maize and 6.22 % barley. These percentages show that the most efficient crop is sunflower and the lowest efficient is barley. **Gross margin rate in Sales, r_{GM}**, was 64.61 % at farm level. The decreasing order by crop based on this indicator was: sunflower, rape, maize, wheat and barley. Therefore, from

this point of view, sunflower is the most efficient crop, followed by rape and the lowest efficient crop is barley (Table 4).

Table 4.Analysis of Variable Cost by Crop in the year 2011

	Specification	MU	Wheat	Barley	Maize	Sunflower	Rape	Farm level
1	Variable cost (VC)	Lei Thousand	1,485.96	571.50	389.12	483.84	238.58	3,169.00
2	Fixed Cost (FC)	Lei Thousand	803.88	256.50	102.40	274.32	94.72	1,531.82
3	Sales (S)	Lei Thousand	3,069.36	930.00	896.00	3,024.00	1,036.00	8,955.36
4	Gross margin related to variable cost (GM) 4=3-1	Lei Thousand	1,583.40	358.50	506.88	2,540.16	797.42	5,786.36
5	Gross margin rate in Sales (r_{GM}) 5=4/3 x 100	%	51.58	38.54	56.57	84.00	76.97	64.61
6	Variable cost rate (r') 6=100-5	%	40.42	61.46	43.43	16.00	23.03	35.39
7	Production break-even point (P_e)	T	1,289.43	397.13	338.74	571.73	156.97	2,754
8	Sales break-even point (S_e)	Lei thousand	812.34	246.22	237.118	800.422	274.698	2,370.747 = 2,371
9	Coverage factor (CF) 8=4/3 x 100	%	98.95	104.17	43.18	34.27	34.48	64.61
10	Dynamic Safety Coefficient (K_s) 10=(3-8)x100/3	%	73.53	73.53	73.53	73.53	73.53	73.53
11	Safety interval (SI) 11=3-8	Lei thousand	2,257.02	683.78	658.882	2,223.578	761.302	6,584.613
12	Withdrawal Index (WI) 12=2/3 x 100	%	26.19	2758	11.42	9.07	9.14	17.10
13	Volatility Coefficient - Operational Leverage ($L_{o)}$ 13=3/11	-	1.36	1.36	1.36	1.36	1.36	1.36

Variable cost rate in Sales, r', reflected the share of variable cost in turnover and varied from 61.46 % for barley and 16 % for sunflower.

Therefore, the decreasing hierarchy of the crops based on this criterium is the reverse of the order established by gross margin rate in sales (Table 4).

Production break-even point, P_e, at farm level showed that 2,754 tons of grains are should be produced as revenues to cover total production cost and profit to be zero. Production break-even point by crop was: 1,289.43 tons for wheat, 571.73 tons for sunflower, 397.13 tons for barley, 338.74 tons for maize and 156.97 tons for rape (Table 4).

Sales break-even point, S_e, counted for Lei thousand at farm level, showing that this was the figure required for sales in order to entirely cover production cost. Sales break-even point calculated for each crop was the following one: Lei thousand 812.34 for wheat, Lei thousand 800.42 for sunflower, Lei thousand 274.69 for rape, Lei thousand 246.22 for barley and Lei thousand 237.11 for maize (Table 4).

Calculation of Production and Sales break-even points by crop. In order to determine the volume of each product (wheat, barley, maize, sunflower and rape grains) has to be produced and sold in the future in order to attain the break-even point and not register losses, it was necessary to take into account the share of each product into total production, production break-even point P_e and sales, S. Only having this production structure, the farm could obtain a gross contribution (C_A) of Lei thousand 5,786.364 (Table 5).

Table 5.Calculation of Production and Sales break-even points by crop

Crop	Production break-even point at farm level (P_e) -Tons	Share of crops in total production %	Production break-even point by crop (P_e)- Tons	Sale price by product Lei/Ton	Sales break-even point by crop (S_e) Lei thousand
Wheat	2,754	46.82	1,289.43	630	812.34
Barley	2,754	14.42	397.13	620	246.22
Maize	2,754	12.30	338.74	700	237.118
Sunflower	2,754	20.76	571.73	1,400	800.422
Rape	2,754	5.70	156.97	1,750	274.698
Total	2,754	100.00	2,754	-	2,370.79=2,371

Coverage factor, CF, showed that at farm level, 64.61 % of sales was needed to cover production cost and assure profit. The analysis of coverage factor is important for decision making concerning what future strategy to be applied based on the most profitable crops. Therefore, based on the coverage factor, the farmer is able now to make the correct decision

to increase sunflower and rape production and diminish barley which is a less efficient crop. (Table 4 and 6).

Table 6.Analysis of Coverage Factor by crop

	Specification	MU	Wheat	Barley	Maize	Sunflower	Rape
1	Sale Price	Lei/t	630	620	700	1,400	1,750
2	Unitary variable cost	Lei/t	305	381	304	224	403
3	Unitary gross contribution 3=1-2	Lei/t	325	239	396	1,176	1,347
4	Coverage factor, CF, 4=3/1 x100	%	51.58	38.54	56.57	84.00	76.97
5	Fixed cost	Lei/t	165	171	80	127	160
6	Profit, 6=3-5	Lei/t	160	68	316	1,049	1,187
7	Profit percentage in sale price	%	25.39	10.96	45.14	74.92	67.82

Dynamic Safety Coefficient (K_s) showed that 73.53 % of sales could be diminished so that the farm to reach the break-even point without losses (Table 4).

Safety Interval, SI, showed that sales could be decreased by Lei thousand 6,584.613 at farm level so that the farm to reach its break-even point without losses (Table 4).

Withdrawal Index, WI, sowed that 17.10 % sales are needed to cover fixed cost at farm level. By crop, the situation was: 907 % for sunflower, 9.14 % for rape, 11.42 % for maize, 26.19 % for wheat and 27.58 % for barley (Table 4).

Operational Leverage, L_o, was 1.36 showing that for 1 % sales variation, financial result will vary by 1.36. It emphasizes the influence of the farm status compared to the break-even point on the financial result. This reflects the relationship existing between economic risk and sales: the farther the sales from break-even point, the less risky the farm's activity is. Therefore, this index is useful for assessing economic risk and farm's lack of adaptability to the continuous change of the business environment.

CONCLUSIONS

Variable costing method is a useful tool for identifying the ways to increase farm profitability. For this reason it could be successfully used in decision making in vegetal farms in order to optimize crop and production structure as well as sales and profit.

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