# DIAGNOSTIC ANALYSIS OF THE COST PER UNIT OF PRODUCT

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**Abstract:** This paper treats the methodology used in the product unit diagnostic analysis by entities where products are obtained in several subordinated entities with management autonomy. It also presents the relations based on which overall effects of the structural changes on cost per product unit are quantified, as well as the relations used in the analysis of some calculation items.

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## 1. INTRODUCTION

The sizing as precise as possible of the overall direct and indirect effects of certain factors on some economic and financial indicators will result in a correct assessment of the activity of a company.

The decisions made by the management team concerning the structure of the production per subordinated entities with management autonomy should take into account the fact that this factor will have both a direct and an indirect affect on the average cost at the company level and influences its financial situation.

## 2. DIAGNOSTIC OF THE UNIT COST AT FIRM LEVEL

The cost per unit of product is an indicator meant to emphasise the equivalent value of the factors of production spent in order to obtain one unit of product. It indicates the effort, expressed in monetary units, made in order to obtain one unit of product, so it only reflects one side of the economic efficiency. It is only by comparing it with the selling price of the product that we can estimate whether making a product with a certain cost is economically justified or not.

The diagnostic of the cost per unit of product is closely related to the manner in which the activity of a business entity is organized and to the used calculation method.

In the business entities that manufacture products in several subordinated entities with managerial autonomy, there is an average cost per unit of product at the level of the entire company and there are costs per unit of product at the level of its subordinated entities with managerial autonomy.

The decisions taken by the management are focused on several aspects, among which the following can be mentioned:

- the distribution of the production activity on subordinated entities, so that the minimum average cost per unit of product be obtained at the level of the entire company;
- the expansion of the production capacities due to the demand exceeds the offer at some point in time;
- the optimum combination of the production factors with the purpose of decreasing the cost per unit of product at the level of each subordinated entities with managerial autonomy etc.

For the entire company, the assessment of the cost per unit product starts with the following formula:

$$\bar{c} = \frac{\sum gi \times ci}{100} \qquad (1)$$

where:

gi represents the percentage of each subordinated entity with managerial autonomy in the total production of a certain product;

ci – the cost per unit of product at the level of each subordinated entity.

At the level of each subordinated entity, the manufacturing capacity utilization rate influences the cost per unit of product via the fixed costs as compared to the production volume.

In order to quantify this effect, we start from the formula:

$$c = \frac{Chf}{q} + cv \qquad (2)$$

where:

c represents the cost per unit of product in a subordinated entity with managerial autonomy;

Chf – the total fixed costs at the level of the subordinated entity plus the quota of the management and administration costs at the level of the entire company;

q – the quantity of the product in question which is manufactured;

cv – constant costs per unit of product and which creates variability as compared to the volume of the production volume that is obtained.

The change in the cost per unit of product at the level of the subordinated entities as a result of the changes made in the manufacturing capacity utilization rate will be calculated with one of the formulas below:

$$\Delta c = \left(\frac{Chf}{q_0 \times Igu} + cv\right) - c \qquad (3)$$

$$\Delta c = \frac{Chf}{q_1} - \frac{Chf}{q_0} \qquad (4)$$

where:

Chf represents the fixed costs of the studied subordinated entity;

Igu – the manufacturing capacity utilization rate change index;

$q_0$ - the production made in the subordinated entity in question in the base year;

cv – constant costs per unit of product;

$q_1$ - the production obtained in the current year in the studied subordinated entity;

c – the cost per unit of product in the base year.

The change in the cost per unit of product at the level of the entire company has two elements:

The direct influence of the change in the production structure on subordinated entities;

The indirect influence of the changes in this structure.

The direct influence of the structure is calculated with the formula:

$$\Delta_c^g = \frac{\sum gi_1 \times ci_0}{100} - \frac{\sum gi_0 \times ci_0}{100} \qquad (5)$$

where:

$gi_1$ and $gi_0$ represent the production structure on subordinated entities with managerial autonomy set by a certain decision, and the production structure recorded in the comparison basis;

$ci_0$ - the cost per unit of product at the level of the subordinated entities (cost individual) in the comparison basis.

The change in the average cost as a result of the indirect influence of the production structure on subordinated units is calculated with the formula:

$$\Delta \bar{c} = \frac{\sum gi_1 \times \Delta ci}{100} \qquad (6)$$

where:

$gi_1$ represents the percentage of the subordinated units in the total production of the entire company in the current year;

$\Delta ci$ - the change in the cost at the level of the subordinated entity due to the manufacturing capacity utilization rate.

## 3. CASE STUDY

The example provided is a business entity composed of three subordinated entities with managerial autonomy in reaction to which the following information is available (Table 1):

**Table no. 1**

**Production and costs on subordinated entities with managerial autonomy**

| Specification | Subordinated entity A | Subordinated entity B | Subordinated entity C |
|---|---|---|---|
| Manufacturing capacity - tonnes | 370 | 420 | 310 |
| Production made in the current year - tonnes | 310 | 380 | 270 |
| Total costs – monetary unite | 83,700 | 98,457 | 73,251 |
| - out of which: fixed costs | 20,400 | 23,295 | 18,315 |
| variable costs | 63,300 | 75,162 | 54,936 |

For next year, the market demand is 1020 tonnes

The distribution of the production on subordinated entities with managerial autonomy may be done according to the cost per unit of product recorded in the comparison basis or proportionally with the manufacturing capacity.

In the first case, the production is distributed up to the maximum limit of the manufacturing capacity, firstly, in the subordinated entities with the lowest cost per unit of product, after which the production is distributed to the next entity.

In the comparison basis, the individual cost per unit of production, and the production structure on subordinated entities indicated in Table no. 2.

**Table no. 2**

**The cost per unit of product, the production structure, and the manufacturing capacity utilization rate on subordinated entities in the current period**

| Specification | The cost per unit of product | Production structure on subordinated entities - % | Manufacturing capacity utilization rate -% |
|---|---|---|---|
| Subordinated entity A | 270 | 32.29 | 83.78 |
| Subordinated entity B | 259.1 | 39.58 | 90.48 |
| Subordinated entity C | 271.3 | 28.13 | 87.10 |
| Total | 266.05 | 100 | 87.27 |

In the next period, the manufacturing capacity utilization rate at the level of the company as a whole will be:

$$Guc = \frac{1020}{1100} \times 100 = 92.727\%$$

If the distribution of the production for next year is made in such a way as to provide the same manufacturing capacity utilization rate at the level of each subordinated entity, the production load on subordinated units will be:

- Subordinated entity A: 370 x 0.92727 = 343 tonnes
- Subordinated entity A: 420 x 0.92727 = 389 tonnes
- Subordinated entity A: 310 x 0.92727 = 288 tonnes

Total 1020 tonnes

Assuming that no changes occur in the total fixed costs at the level of subordinated entity, or in the constant cost per unit of product, the costs per unit of product under the new conditions will be (Table no. 3)

**Table no. 3**

| Specification | Fixed costs per unit of product in the base year | Constant costs per unit of product which creates variability as compared to the volume of production | The cost per unit of product in the base year | Production change index | Fixed costs per unit of product in the scheduled period | Cost per unit of product in the schedule d period | D*c* |
|---|---|---|---|---|---|---|---|
| Subordinated entity A | 65.81 | 204.19 | 270 | 110.64 | 59.48 | 263.67 | -6.33 |
| Subordinated entity B | 61.30 | 197.79 | 259.1 | 102.37 | 59.88 | 257.67 | -1.43 |
| Subordinated entity C | 67.83 | 203.47 | 271.3 | 106.66 | 63.59 | 267.06 | -4.24 |
| Total firm | | | | 106.25 | | | |

The percentage of the subordinated entities in the total production at the level of the company as a whole in the scheduled period will be:

$$\text{- Subordinated entity A} = \frac{343}{1020} \times 100 = 33.63\%$$

$$\text{- Subordinated entity B} = \frac{389}{1020} \times 100 = 38.14\%$$

$$\text{- Subordinated entity C} = \frac{288}{1020} \times 100 = 28.23\%$$

The change in the average cost as a result of the direct influence of the structure on subordinated entities with managerial autonomy will be negative as a result of the increase in the percentage on the production in subordinated entities A and C in which the cost per unit of product is higher:

$$D_c^g = \frac{33.63x270 + 38.14x259.1 + 28{,}23x271.3}{100} - 266.05 = 0.16$$

The indirect influence of the change in the structure on the average cost will be:

$$Dc = \frac{33.63(-6{,}23) + 38.14(-1{,}43) + 28.23(-4.24)}{100} = -3.84$$

The overall direct and indirect effect of the structural changes on the average cost at the level of the company as a whole is calculated as the algebraic sum of the two influences.

If the direct influence of the structural changes was negative, leading to an increase by 0.16 monetary units per unit of product, a positive overall economic effect will be generated, i.e. a cost reduction by 3.68 monetary units.

This effect can be explained by the variation of the constant costs per unit of product within each subordinated entities with managerial autonomy.

Of course, other methods for the distribution of the production subordinated entities with managerial autonomy will also be established, such as a distribution function of the cost entered in the comparison basis, in the same proportion as in the previous period, and the decision will be taken function of the total influence of the structural changes on the cost at the level of the company.

At the level of the subordinated entities, decisions concerning the reduction of the cost per unit of product are based on a thorough analysis of each cost pool (cost item).

Consequently, for the assessment of the direct labour costs per unit of product, the decisions take into account the method of remuneration (pay by the hour, piece wages using the tariff per unit of product, or piece wages using the tariff per operations performed, with the purpose of obtaining the products etc.).

In the case of the payment by the hour, the direct labour costs will be calculated with the following formulas:

$$cp = \frac{N \cdot sa \cdot (1+K)}{q} \quad (7) \text{ or } \quad cp = \frac{sa \cdot (1+K)}{wa} \quad (8)$$

where:

N represents the average annual number of employees,

Sa – average annual salary;

K – the social security contribution cost coefficient determined as the ratio between the social security costs and the wages costs;

q – Total production obtained;

wa – annual labour productivity in terms of quantity of products made per year and per employee.

According to the formulas above, the decisions concerning the reduction of direct labour costs per unit of product are meant to substantiate the direct labour requirement according to the volume of activity and of the annual labour productivity, corresponding to the following formula:

$$Np = \frac{q_p}{w_0 \times Kw} \qquad (9)$$

where:

Np represents the direct labour requirement;

$q_p$ - scheduled production;

$w_0$ – annual labour productivity in the base year;

Kw – the coefficient indicating the outrun of the average salary by the labour productivity, which is a coefficient calculated as the ratio between the labour productivity index and the average salary index;

If the remuneration is made as piece wages with the tariff per unit of product, measures should be taken for the decrease in the cyclic time categories (preparation time, finishing time) and also for the improvement of the organization of labour with the purpose of determining the optimal relation among the employers who perform various works or operations.

The tariff per unit of production is calculated with the following formula:

$$t = \frac{s}{z \times nl} \qquad (10)$$

In which

s represents the monthly wages;

z – the number of working days per month;

nl – the workload per shift.

In its turn, the workload per shift is calculated as follows:

$$nl = \frac{To}{nto} \qquad (11)$$

where:

To represents the operating time per shift;

nto – the operating time rate setting the time required in order to perform a certain operation or in order to manufacture a certain product and which is decided following the rate setting works.

The operating time per shift is calculated as the difference between the duration of a shift (8 hours x 60 minutes = 480 minutes) and the following acyclic time categories: preparation time, finishing time, and break time and the time for natural needs.

Whilst the preparation and finishing time is set by the rate setting work, the break time and the time for natural needs is determined as a percentage of the duration of a shift.

The direct cost of raw materials and basic and auxiliary materials are based on the specific consumptions and the book price, according to the following formula.

$$cm = \sum csi \times pi \qquad (12)$$

Where:

csi represents the specific consumption on ranges of raw materials and other resources;

pi – is the book price of the raw materials and other resources.

The specific consumption of raw materials and other resources is determined based on the net quantity of raw materials and other resources found in the finished product and on the processing efficiency:

$$cs = \frac{qn}{h} \qquad (13)$$

where:

*qn* represents the net quantity of the range of raw materials found in the finished product;

$h$ - processing efficiency.

## 4. CONCLUSIONS

The increase in the processing efficiencies is performed by applying the following measures:

- using high-performance technologies,
- buying high-quality raw materials and other resources,
- buying types of raw materials and other resources with dimensions as close as possible to the finished products;
- ensuring a good operating condition of the machines and equipment;
- highly qualified human resources etc.

The assessment of the equipment maintenance and operating costs will take into account the methodology used for the distribution of these costs on products.

If these costs are distributed according to certain distribution bases, these bases will be chosen in such a way as to minimize the transfer of costs from one product to another.

If these costs are distributed according to the running time corresponding to each piece of equipment for the performance of certain works and operations, on one hand, and to the cost per running hour for each piece of equipment, the following formula should be used:

$$cifu = \sum tui \times ci \qquad (14)$$

where:

tiu represents the running time of a certain piece of equipment for the performance of certain works and operations related to a certain product;

ci – cost per running hour for each piece of equipment.

The time spent for each piece of equipment may be influenced to a lower extent by the financial and accounting manager.

This is the reason why decisions should focus on reducing total equipment maintenance and operating costs and on increasing total running time by eliminating or reducing certain categories of time, such as:

- the time for unforeseen repairs, the time required for unforeseen shifts;
- the power failure time;
- the idle time due to lack of orders;
- stoppage due to the lack of raw materials and other resources, etc.

## REFERENCES


1. Oprea, C., Cârstea, Gh. Contabilitatea de gestiune şi calculaţia costurilor (Management Accounting and Cost Calculation), Genicod Publishing House, Bucharest, 2002
2. Pană, I. Analiza economico-financiară aprofundată (Economic and Financial Analysis in Depth), the Publishing House of the University of Piteşti, 2009