SOME ASPECTS REGARDING THE MAINTENANCE ACTIVITY OPTIMIZATION THROUGH COSTS

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1. INTRODUCTION

In the maintenance department, as well as in other company subsystem activities, burning out the production factors is inevitable, thus a frequently asked question results: *How much does producing that service or that product costs?*

Due to the specific activity of the company, there can be some unexpected maintenance costs categories, especially, statistically speaking, because of machinery and equipments failures, not always exactly known by experts. There for it is necessary optimizing the maintenance management through costs.

2. METHOD USED

The maintenance management according to the global cost. Long term maintenance management uses the indicator called *"Life Cycle Cost"*, which obtains certain specifications in relationship with the application domain. The global cost contains all the expenses done by equipment exploitation, from the purchasing time to its elimination [3] (fig. 1).

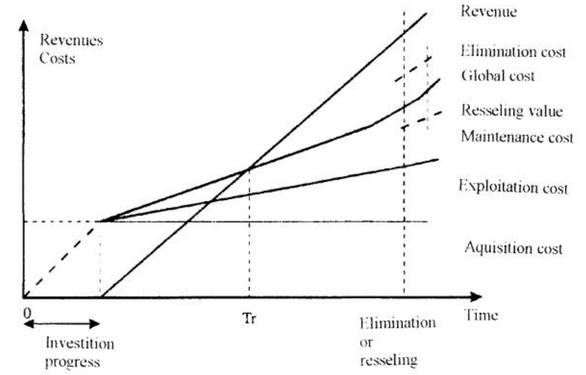

Figure 1. The global cost of an equipment.

The global cost makes sense only when the equipment exploitation conditions are very well stated. When the manufacturing process is homogeneous, the "Q" product quantity made through the machinery lifetime can be known. Thus, the medium global cost "C_M" on product unit can be:

$$C_M = C_g / Q \quad \text{[lei / product]} \qquad (1)$$

This indicator gives away informations about the way the global cost is allocated to the product. This will be included in the fabrication cost, so knowing the C_M, one first decision criteria in choosing the investment variant can be obtained. It is preferred the C_M minimal variant, which assures a bigger revenue quantity.

Considering "V" as the sales volume, it results another essential information in picking the investment variant - the lifetime profit (R):

$$R = V - C_g \quad \text{[lei revenue]} \qquad (2)$$

As a general rule in taking the decision, it will be chosen the investment which assures an "R" profit as higher as it can be (fig. 2).

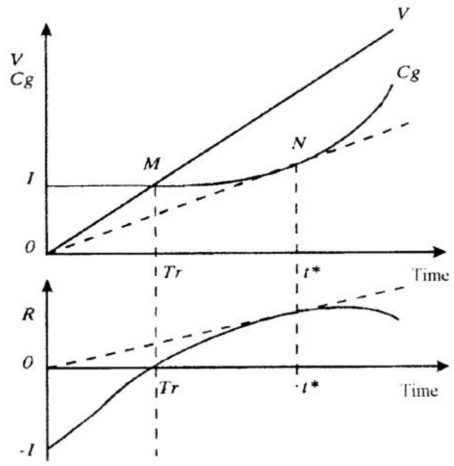

Figure 2. Cumulative profit graphics.

The graphics from fig. 2 give us precious informations towards time related cumulative profit evolution. There are two important moments:

- T_r – the time for investment recovery, which has the correspondence in the "M" point, at the "C_g" and "V" curves intersection; in this point, the "I" investment is totally recovered, there for starts the profit;
- T^* - the time when the maximum global profit is obtained; the correspondence is the tangent, starting in the graphics origin, to the global cost curve (the intersection is made in the "N" point).

Regarding the decisions optimization, the following criteria can be considered [1]:

- It will be chosen the investment with the shortest "T_r" recovery time;
- t^* represents *the optimal replacement age*;
- When the t^* period is left behind, the global profit starts to decrease; it is the time from where the machinery replacement problem must be taken into consideration;
- The machinery elimination must take place before the "C_g" and "V" curves intersect again; at this point, it gets to the situation when the global profit becomes 0, with a straight forward loss tendency.

Having "R" as in the rel. 2 and knowing the "T" equipment exploitation time, it can be released another indicator called: *cumulative profit on time unit (R_t)*:

$$R_t = R / T \quad \text{[lei revenue / t.u.]} \qquad (3)$$

As a general rule in taken the decision, it will be chosen the investment which leads to a maximum "R_t".

Same to the previous indicator, the *cumulative profit on the "R_q" product unit* can be expressed, which can be another appreciation criteria of an investment variant:

$$R_q = R / Q \quad \text{[lei revenue / product]} \qquad (4)$$

This indicator interpretation is the same as in cumulative profit on time unit.

The maintenance management according to reduced global cost. As a global cost essence conclusion it can be said that [2]:

C_g = acquisition cost (- reselling value) + exploitation cost + maintenance cost + elimination cost (5)

Some of these costs are not relevant for the optimal replacement age determination. Thus, using expensive basic materials leads, paradoxically, to a practically confirmed shortening of machinery lifetime. More than that, wage raisings leads to the same finality. There for, machinery optimization evidence will depend on the *reduced "C_{gr}" global cost*:

C_{gr} = acquisition cost (- reselling value) + maintenance cumulative cost + elimination cost (6)

Based on the "C_i" maintenance criteria (corrective and preventive), as well as on their specific costs, *the "C_{cmi}" maintenance cumulative costs* can be defined:

$$C_{cmi} = C_i * T \qquad (7)$$

where : T - represents equipment lifetime.

The decisions regarding the maintenance management costs will follow obtaining a minimum "C_{gr}" on time unit or on product unit (fig. 3). From

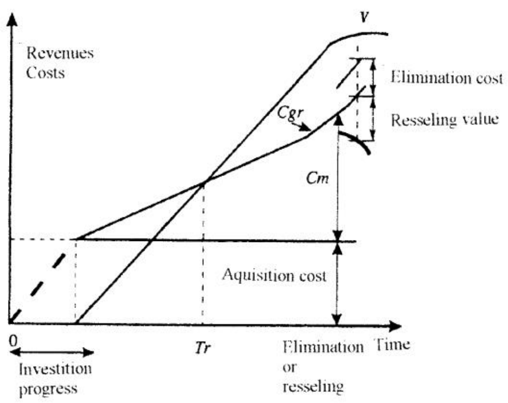

Figure 3. The reduced global cost graphic

the graphic results a new "T_r" investment recovery time, who has a different value than the global cost time. The equipments failures drives to "C_s" exploitation overcosts, obtained through palliative measures, auxiliary work hours, exterior help, etc. If we deduce the exploitation overcosts from the "C_{gr}", we obtain the reduced global cost without the "C_{gr}' " indisponibility:

$$C_{gr}' = C_{gr} - C_s \qquad (8)$$

This formula presents the advantage of the global cost expression in an ideal situation : "zero indisponibilities". Because at the investment moment there are no losses taken into consideration, "C_{gr}' " becomes a choosing criteria in the machinery acquisition variant.

Recognizing the existence of the "D" revenue reductions, the global result becomes "R' ", which represents *the cumulative revenue without production losses*:

$$R' = R - D \qquad (9)$$

In this case, the revenues and the reduced global costs variation graphics become like the ones in fig. 4:

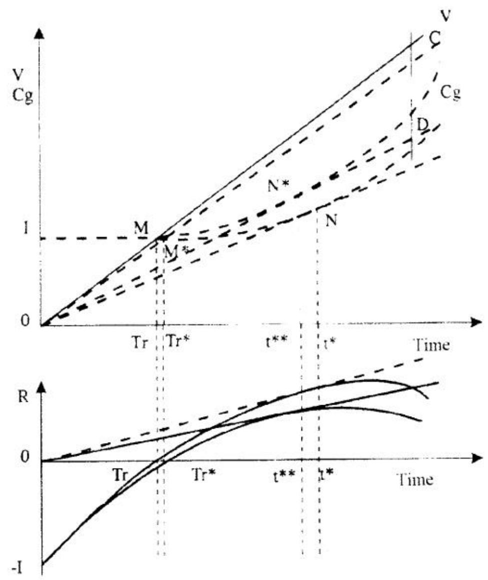

Figure 4. The cost and global revenue graphic, without losses and with zero indisponibilities.

3. CONCLUSIONS

. After analyzing the graphics it observes :

- the global revenues reduction with the "D" value;
- the global cost enhancement with the "C" value;
- there is a reduction of the optimal replacement time, from t* to t** and also the time afterwards a maximum total revenue is obtained;
- the investment recovery time gets from T_r to T_r*.

If the losses mentioned above are taken into consideration, it gets to an equipment exploitation reduction time. In this case, the final decision will be: *it is non-economical the equipment lifetime extension over the "t** " value.*

As a general conclusion, the maintenance management through global cost assures the extension of the maintenance decisions importance from a local level to a strategic level, with a longtime interferences upon company management.

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