STUDY ON ESTABLISHING THE OPTIMUM PRODUCTION CAPACITY

STUDIU PRIVIND DETERMINAREA CAPACITĂȚII OPTIME DE PRODUCȚIE

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Abstract: *Establishing the optimum production capacity represents a fundamental issue for the economic activity. Building of oversized objectives is equal to fund wasting, immobilizing capital in fixed assets which remain unused. Or, building of undersized objectives creates bottlenecks in economic processes. This is why prior to designing the investment objectives thorough calculations are necessary in order to establish the optimum production capacity.*

Key words: *optimum production capacity, specific investment, production cost, recalculated expenses, specific recalculated expenses*

INTRODUCTION

Establishing the production capacity for an economic objective plays a very important part because the level of satisfaction regarding the respective product of the foreign and domestic market depends on the production level. At the same time, the efforts made for accomplishing the economic objective and for obtaining the forecasted production, efforts, which are materialized in the use of human, material and financial resources, also depend on the production capacity.

MATERIAL AND METHODS

The optimization of the production capacity may take into consideration several criteria. In establishing the optimum production capacity, the aim is to accomplish the highest level of labour productivity, to diminish the expenses for raw materials and finished products, to diminish the production unit cost, as well as to diminish the investment effort.

The study was made on a company which will process agricultural products.

Therefore, several alternatives are prepared which different as regard the production capacity volume and the technology used in obtaining the finished product, so the method of variants will be used.

Since, in practice, it is possible that the project variants which are compared to not have the same production capacity, it is recommended that all the expenses to be expressed according to the forecasted production capacity, meaning per measure unit of the finished production. In this case, the investment expenses become specific investment, and the production expenses, the unit cost of production. The two expenses categories may not be added because the investments are made only once, and the production costs in each year of the operation of the production capacity. The adding of the two indicators is made through the recalculated expense indicator which represents the total investment and production effort.

The indicator which takes into consideration the total effort and the volume of the production capacity is the recalculated specific investment.

RESULTS AND DISCUSSIONS

In view of establishing the optimum production capacity, six project variants have been prepared which are different as regards the volume of the production capacity and the technology used for obtaining the production, as shown in the table below (Table 1).

Table 1

No.	Capacity variants (tons)	Specific investment (thousand RON/ton)	Unit costs (thousand RON/ton)
1	4500	81	38
2	4800	79	37.4
3	5100	78.4	37.2
4	5400	80	37.3
5	5700	82.3	37.5
6	6000	82	38.3

By graphically representing the evolution of specific investment (s) as a function of the volume of production capacity, it is noticed that it has the evolution shown in the graphic below (Figure 1). By doing the same for the production unit costs (c), a similar evolution is obtained. By adding the total effort with the help of the recalculated specific expense indicator, it is noticed that the evolution of this indicator corresponds to a parabola of second degree, of type $y = ax^2 + bx + c$, where y is the recalculated specific expenses, and x is the production capacity.

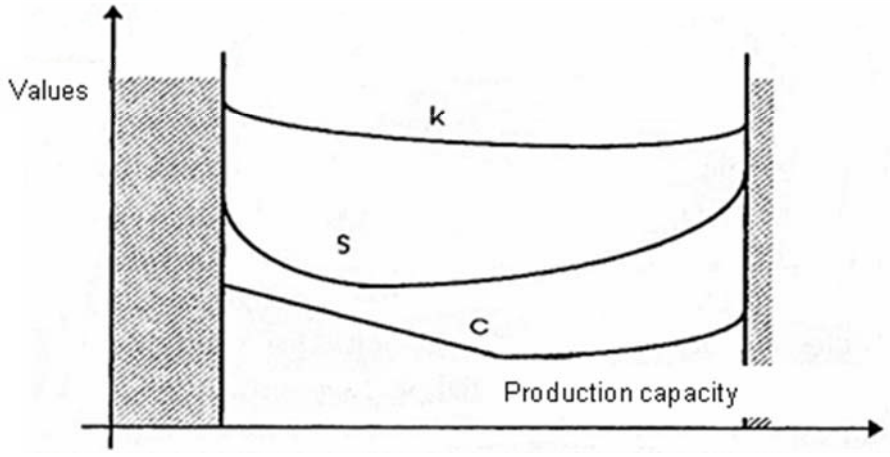


Figure 1

As it is shown by the graphical representation, the establishing of the optimum production capacity is necessary because it is related neither to a low capacity, nor to a high capacity.

Each of them has a series of advantages and disadvantages. For example, if the advantage of the large units is that they offer the reduction of production expenses per product unit, especially through the general expenses and the investment effort which is materialized in common works, they also have a series of disadvantages resulted from the supplementary expenses for the management of production process, job management, difficulties in adapting to the market requirements.

All these issues have to be studied and taken into account in sizing the production capacities.

By using the relation of recalculated expenses, we obtain:

$K_1 = 81 + 38 \times 15 = 651$
$K_2 = 79 + 37.4 \times 15 = 640$
$K_3 = 78.4 + 37.2 \times 15 = 636.4$
$K_4 = 80 + 37.3 \times 15 = 639.5$
$K_5 = 82.3 + 37.5 \times 15 = 644.8$
$K_6 = 82 + 38.3 \times 15 = 656.5$

As it is indicated in the graphic shown, these expenses evolve according to the following parabola: $y = ax^2 + bx + c$.

For establishing the optimum production capacity, meaning the variant in which the recalculated expenses are minimum. It is necessary to calculate the a, b, c coefficients with the help of the system:

$$a \sum_{i=1}^{n} x_i^2 + b \sum_{i=1}^{n} x_i + nc = \sum_{i=1}^{n} y_i$$

$$a \sum_{i=1}^{n} x_i^3 + b \sum_{i=1}^{n} x_i^2 + c \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} x_i y_i$$

$$a \sum_{i=1}^{n} x_i^4 + b \sum_{i=1}^{n} x_i^3 + c \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} x_i^2 y_i$$

The coefficients of the system were obtained based on the following table:

Table 2

x_i	x_i^2	x_i^3	x_i^4	y_i	x_iy_i	x^2y_i
4.5	20.25	91.125	410.0625	651	2929.5	13182.25
4.8	23.04	110.592	530.8416	640	3072	14745.6
5.1	26.01	132.651	676.5201	636.4	3245.64	16552.764
5.4	29.16	157.464	850.3056	639.5	3453.3	18647.82
5.7	32.49	185.193	1055.6001	644.8	3675.36	20949.552
6.0	36.0	216.0	1296.0	656.5	3939.0	23634.0
31.5	166.95	893.025	4819.3299	3868.2	20314.8	107712.48

By replacing the calculated values in the system of equations:
166.96a + 31.5b + 6c = 3868.2
893.025a + 166.95b + 31.5c = 20314.8
4819.3299a + 893.025b + 166.95c = 107712.48;

It results: a = - 21.563; b = 231.632; c = 28.6227.

The function for the evolution of recalculated expenses according to the production capacity is of the following type: $y = -21.563x^2 + 231.632x + 28.6227$.

By knowing that this function accepts a minimum which is given by the first degree derivative, it results:

y' = 2(-21.563)x + 231.632

- 43.126x + 231.632 = 0, and: x = 5.37

The optimum production capacity given by the calculation is of 5370 tons.

CONCLUSIONS

By analyzing the various technical, technological and constructive possibilities for the accomplishment, the conclusion is that the level of optimum capacity is of 5700 tones of finished products per year.

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