MARGINAL COST OF INDUSTRIAL PRODUCTION

Man M., Modrak V., Grabara J.K.*

Abstract: One of the important issues of production management is the most efficient possible use of the production capacity as the global level of the production fixed expenses depends on the unit's production capacity and their level per product unit diminishes as the degree of employment of such a capacity tends to be optimum. Accordingly, to a certain volume of achieved production one may add or subtract, under certain circumstances, a certain volume (lot, stratum, and margin) of products; at the same time, the increase or the decrease of production volume determines the change of the total production costs of the unit. As the level of the total costs corresponding to the production that is going to be achieved until the adoption of the decision of increasing or decreasing production level already exists, and the sum total production costs are modified with is determined by the added or subtracted production volume (stratum, lot, and margin).

Keywords: Marginal cost, production, product volume

Introduction

The costs that correspond to the last production lot (stratum, margin) that is added (or subtracted) to its previous volume represent marginal costs which, unlike medium costs that regard the whole production of the unit, are determined only by a part of the unit's production, that is the last volume (lot, stratum, and margin) that is added or subtracted. The newly added production volume determines the increase of the degree of employing the production capacity and vive-versa. The sums received when selling the products primarily cover the costs determined by manufacturing the products and, in case the selling prices are higher, they also determine a gross profit that contributes to the covering of fixed production expenses. Marginal costs are intimately connected with productivity optimum (PO) which is determined by the level of activity of the company where production achievement is done at the lowest medium cost, and both mathematical calculus and economic reasoning show that this optimum appears when medium cost is identical with marginal cost.

* **Prof. Univ. Mariana Man PhD.**, Universitatea din Petroşani, Romania,
✉ corresponding author: manmariana@upet.ro
Prof. Vladimir Modrák PhD., Technical University in Košice, Faculty of Manufacturing Technologies
Prof. Janusz K. Grabara PhD., Faculty of Management, Czestochowa University of Technology

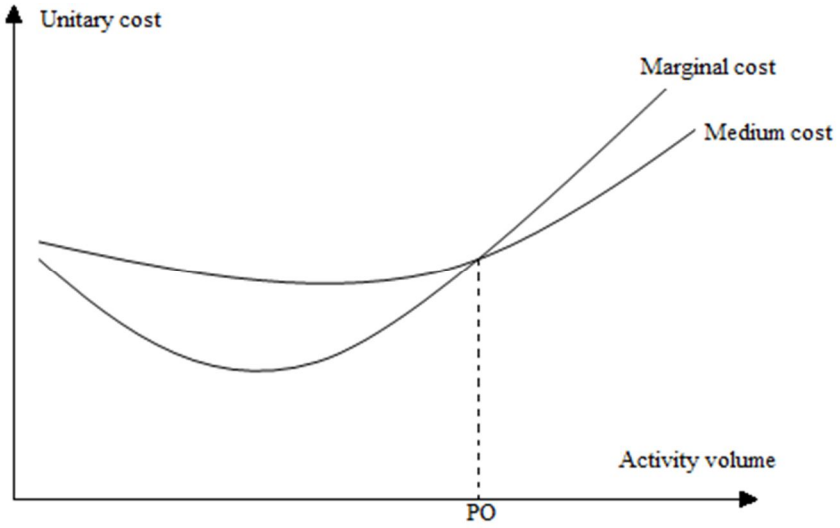

Figure 1. Marginal cost with the PO junction

The theory of marginal costs implied new elements of calculus, and, according to its concepts, calculus has been turned to the calculus of stratified costs and of the global result of the company that increases as long as o supplemental production unit brings an income which is bigger than the costs it determines. In case the selling price is constant, optimum profitableness (OP) is achieved when selling price is equal with marginal cost.

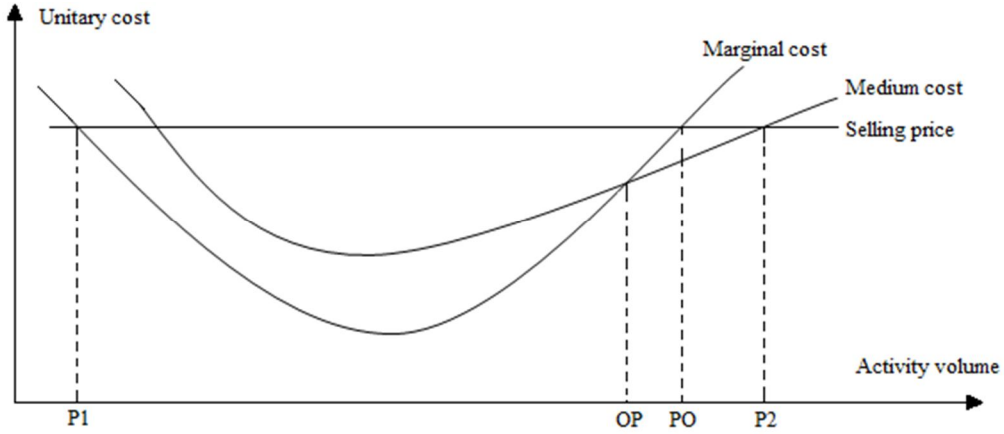

Figure 2. Marginal cost with the OP junction

Between the dead point P1 and the dead point P2 there is profit zone. Dead point P1 corresponds to the minimum level of production the company has to achieve in order to get a profit; over OP point the company's profit begins to diminish until the dead point P2, after which the company will encounter losses.

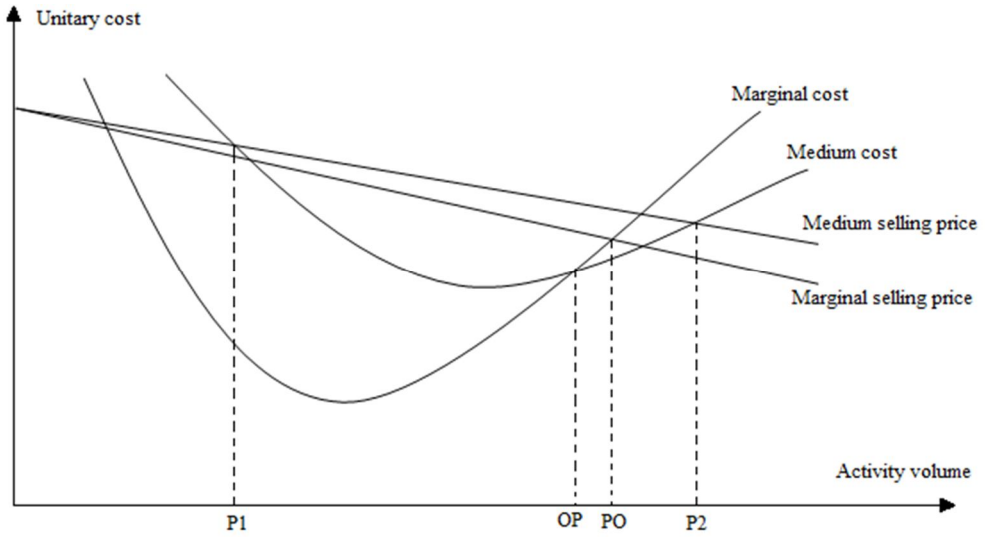

Figure 3. Marginal cost with the OP junction

In case selling price is variable, optimum profitableness is reached when marginal costs is equal with marginal selling price. In case selling price decreases regularly when activity increases then the graphic representation of the profit zone3 is the one in figure 3. According to the definition, marginal costs contain those production expenses determined by manufacturing the last product unit considered as it is or being the value of the consumptions determined by an additional product unit.

The calculus of marginal cost implies, first of all, the determination of the differential cost that is established both as:

a) the total differential cost, being the difference between the costs of two successive products lots, quantitatively different, according to the relation:

$$CTd = CT1 - CT0 \quad (1)$$

b) and as the unitary differential cost by comparing total differential cost to the quantity of additionally manufactured products, according to the relation:

$$ctd = \frac{CT1 - CT0}{Q1 - Q0} \quad (2)$$

Where:
CTd - total differential cost;
CT1 - total cost of the new lot of manufactured product;
CT0 - total cost of the previous lot of products;
ctd - unitary differential cost;
QI = quantity of products manufactured within the new lot;

Q0 = quantity of products manufactured within the previous lot.

In order to exemplify we should assume two successive lots of a same product, namely: the first lot made of 2000 product units that generate total costs of 100,000 m. u., and the next lot that contains 2500 product units that generate total costs of 120,000 m. u.
According to these data one may calculate:
- total differential cost:
CDD = 120000 - 100000 = 20000m.u.
- unitary differential cost:

$$\text{ctd} = \frac{120000 - 100000}{2500 - 2000} = \frac{20000}{500} = 40 \text{ m.u./product unit}$$

Marginal cost is the differential cost per unit of manufactured product within the last volume (lot, stratum, and margin) that is added or subtracted. Assuming that the increase of 500 units of manufactured product represents the last volume (lot, stratum, and margin) added to production volume, the unitary differential cost of 40 m. u., calculated for it, also represents marginal cost. Being calculated for production efficiency, marginal cost is different from medium cost per product unit which is calculated by reporting the total production cost to the volume of the production achieved.
Medium cost calculated according to the data of the previous example, is the folio wing:
- for Q0 lot:
100,000 m.u.: 2,000 units = 50 m.u. / product unit
- for Q1 lot:
120,000 m.u. : 2,500 units = 48 m.u./product unit
The decrease of the medium cost from 50 m.u. / product unit down to 48 m.u. / product unit can be explained by the fact that in the case of the second situation fixed expenses are distributed upon a larger quantity of products.
Similarly, one can as well find out marginal cost for the volume (lot, margin, and stratum) that is subtracted from the previously achieved production volume.
The general calculus formula previously exhibited and the examples based on such a formula emphasize the fact that marginal costs are in fact a derivative of medium costs. The problem of the volume (lot, margin, and stratum) of products that is added or subtracted from the old volume should be settled mainly taking into account market demand, yet without ignoring the possibilities of procuring certain materials, of employing certain technologies, of acquiring equipment's, of advertisement or of the evolution of the ration result/ own capital, etc. The company might be tempted to increase its production volume when the supplemental income obtained due to the retail of the supplemental production volume overpasses the total differential cost of the volume (lot, margin, and stratum). The decrease of the production volume shows when the referred volume (lot, margin, and stratum) cannot bear alone the costs it determines. In order to give

an example lets imagine an industrial unit that manufactures and sells a single product to a certain number of clients on internal market. As a result of the order received from a foreign client (who promises not to retail to the clients on the internal market) regarding the acquiring of 30,000 product units at a price of 265 m. u. / product unit, the general manager of the unit wants to know the global result the unit is going to develop in case it accepts the order, including the cost and the marginal result that has been achieved.

Regarding the previous administration period, the general manager of the unit owns the following data:

manufactured and sold production	80,000 product units
➢ selling price	300 m. u. / product units
➢ own capital	6,000,000 m. u.
➢ fixed expenses, total., out of which:	5,820,000 m. u
- administration and managemeut staff salary expenses	2,820,000 m. u.
- amortization expenses	2,000,000 m. u.
- maintenance expenses	1, 000,000 m. u.
➢ global resul	180, 000 m. u.
➢ unitary variable distribution cost	25 m. u. / product units

The determination of the global result the unit achieves, cost calculus and marginal result will follow the next stages:

a) determination of total cost and of unitary cost specific for the previous administration period:

• Total cost = Business figures - Global result

- Business figures = 80, 000 x 300 = 24, 000, 000 m. u.
- Global result 180,000 m. u.

- Complete cost = 24, 000, 000 - 180,000 = 23, 820, 000 m. u.

• Variable cost = Total cost - Fixed expenses (costs)

- Fixed expenses = 2, 820, 000 + 2, 000, 000 + 1, 000, 000 = 5, 820, 000 m. u.

- Variable cost = 23, 820, 000 - 5, 820, 000 = 18, 000, 000 m. u.

• Unitary variable cost = Variable cost: manufactured production

- Unitary variable cost = 18, 000, 000 : 80, 000 = 225 m. u. / product unit

• Unitary fixed cost = Fixed cost: manufactured production

- Unitary fixed cost = 5, 820, 000 : 80, 000 = 72. 75 m. u. / product unit

• Unitary cost = Unitary variable cost + Unitary fixed cost

- Unitary cost = 225 + 72.75 = 297.75 m. u. / product unit

b) estimation of products quantity that must be manufactured and sold during the administration period:

• Estimated fixed expenses = Fixed expenses of the previous period + supplemental fixed expenses

- Fixed expenses of the previous period 5, 820, 000 m. u.
- Supplemental fixed expenses 1, 020, 000 m. u.

- Amortization of the new, special equipment 720, 000 m. u.
- Advertisement expenses 300, 000 m. u.

- Estimated fixed expenses = 5, 820, 000 + 1, 020, 000 = 6, 840, 000 m. u.

• Estimated variable expenses:

- Production unitary variable cost = Unitary variable cost – Distribution unitary variable cost

- Production unitary variable cost = 225 – 25 = 200 m. u. / product unit
- Distribution unitary variable cost = 25 – (25x6%) = 23.5 m. u. / product unit
- Unitary variable cost = 200 + 23.5 = 223.5 m. u. / product unit

• Estimated manufactured and sold quantity of products:

- rate of the global result within unit's own capital during the previous period = 180, 000 : 6, 000, 000 = 3%

Rate of the global result within unit's own capital during the current period = 2 x 3% = 6%

- Units own capital during the previous period = 6, 000, 000 m, u

- unit's own capital during the current period"

6, 000, 000 + 3, 000, 000 = 9, 000, 000 m. u.

- global result will increase with 6%:

9, 000,000 x 6% = 540, 000 m. u.

Selling price during the previous period = 300 m. u. / product unit

- Selling price during the current period:

300 - (300 x 5%) = 285 m. u.

- quantity of products that should be manufactured and sold during the current period (q):

Business figures - Total cost = Global result
Business figures = 285 x q
Total cost = 223.5 + 6, 840, 000

285q - (223.5q + 6, 840, 000) = 540, 000 m. u.

q = 7, 380, 000 : 61.5 = 120,000 product units

c) estimation of global result, of marginal cost and of marginal result in case of accepting the order received from the foreign customer:

- Total production will be:

120 ,000 + 30, 000 = 150, 000 product units

- Business figures: 42, 150, 000 m. u.
- Internal 120 ,000 x 285 = 34, 000, 000 m. u.
- External 30, 000 x 265 = 7, 950, 000 m. u.
- Total cost: 40, 320, 000 m. u.
- Production variable expenses: 150, 000 x 200 = 30, 000, 000 m. u.
- Distribution variable expenses:
- Internal: 120, 000 x 23.5 = 2, 820, 000 m. u.
- External: 30, 000 x (23.5 - 3.5) = 600, 000 m. u.
- Fixed expenses: 6, 840, 000 + 60, 000 = 6, 900, 000 m. u.

- Global result:	42, 150, 000 - 40, 320, 000 = 1, 830, 000 m. u.
• Marginal cost and marginal result:	
- Supplemented business figures:	30, 000 x 265 = 7, 950, 000 m. u.
- Marginal cost of the order:	6, 660,000 m. u.
▪ Variable expenses:	30, 000 x (200 + 20) = 6, 600,000 m. u.
▪ Fixed expenses	60, 000 m. u.
- Marginal result = 7,950,000 - 6,660,000 = 1,290,000 m. u.	

Summary

For the current administration period, the general manager of the unit takes the following decisions: acceptance of the order from abroad that determines the acquiring of a special equipment which would imply amortization expenses of 60,000 m. u. / year as well as a decrease of the variable distribution cost of 3.5 m. u. / product units; the increase of the capital with 3, 000, 000 m. u.; the doubling of the percent the global result within the unit's own capital; the acquiring of a new, special equipment of 7, 200, 000 m. u. that can be amortized within 10 years; the diminishing of the selling price with 5 %; the increase of advertising expenses with 300, 000 m. u.; amortization expenses for the old corporal immobilizations remain unchanged; unitary variable production cost maintains the level of the previous period; unitary variable distribution cost decreases with 1 % as compared to the selling price.

The level of marginal result of 1,290,000 m. u. is positive as it corresponds to the difference between 1,830,000 m. u. and 540,000 m. u. that represents global results that would be achieved in case the order of 30,000 product units proposed by the foreign customer were accepted, respectively refused.

References:

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Streszczenie: Jednym z ważnych zagadnień zarządzania produkcją jest jak najbardziej efektywne wykorzystanie mocy produkcyjnych jako globalnego poziomu dostosowanych wydatków produkcyjnych zależnych od mocy produkcyjnej jednostki a ich poziomu według zmniejszenia jednostki produkcji jako stopnia zatrudnienia jaki wydaje się być optymalny.
W związku z powyższym, do pewnej wielkości osiągniętej przez produkcję może dodać lub odjąć, w pewnych okolicznościach, określonej wielkości (partii, warstwy, lub marży) produktów, w tym samym czasie, wzrost lub spadek wielkości produkcji określa zmiany całkowitych kosztów produkcji jednostki. Ponieważ poziom całkowitych kosztów odpowiadającej produkcji, który ma zostać osiągnięty do dnia przyjęcia decyzji zwiększenie lub zmniejszenie poziomu produkcji już istnieje, a sumy kosztów produkcji są modyfikowane co ustalane jest przez dodanie lub odjęcie wielkości produkcji (warstwy, partii, a marży).

工业生产边际成本

摘要：由于全球级产品固定费用取决于单位生产能力，同时就业级别的趋于优化，最高效地运用生产能力是生产管理的重要问题之一。因此，在特定情况下，对于完成固定份额产品产品固定容量（批量，阶层，差额）可以加一或减一；与此同时，产品容量的增加或减少决定了单位产品总成本。由于生产中总成本所相应的产品将要被产出直到增加或减少生产水平通过，产品总成本的修改取决于增加或减少产量（批量，阶层，差额）。