

# Application of Break-Even Point Analysis

## Primjena Break-Even Point analize

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### Summary

The determination of Break-even point represents the important information for the enterprise because it defines the minimum amount of products that enterprise needs to produce for cover their fixed and variable costs. Knowing the Break-even point allows enterprise to properly estimate revenues necessary to ensure profits. In this paper, authors deal with the identifying Break-even point and indicate a model example of its calculation.

### KEY WORDS

logistics  
costs  
enterprise  
break-event point

### Sažetak

*Određivanje Break-even point analize predstavlja važnu informaciju za tvrtku jer definira minimalan iznos proizvoda koju tvrtka treba proizvoditi da bi pokrila svoje fiksne i promjenjive troškove. Poznavanje Break-even point analize dozvoljava tvrtci da pravilno procijeni prihode potrebne da bi se osigurali profiti. U ovom članku, autori se bave identifikacijom Break-even point analize i navode ogledni primjerak njena izračuna.*

### KLJUČNE RIJEČI

logistika  
troškovi  
tvrtka  
break-even točka

## 1. INTRODUCTION

The current market is characterized by high competition, so if the enterprise wants to succeed in such environment, it must focus its attention on the cost structure. For basic financial goal of enterprise, it can be considered the maximization of the market value of the enterprise. This goal can be met if the cost management is effective. Although, for enterprises is well known theory and optimization of cost management, there is incorrect implementation into practice. It should also be noted that in case of any major decisions it is necessary to take into account cost impact on the quality of offered products and services. Efficient does not mean cheapest.

## 2. PRINCIPLES OF LOGISTICS COSTING IN ENTERPRISES

Many problems at the operational level in logistics management arise because all the impacts of specific decisions, both direct and indirect are not taken into account throughout the corporate system. Too often decisions taken in one area can lead to unforeseen results in other areas. Changes in policy on minimum order value, for example, may influence customer ordering patterns and lead to additional costs. Similarly changes in production schedules that aim to improve production efficiency may lead to fluctuations in finished stock availability and thus affect customer service.

The problems associated with identifying the total system impact of distribution policies are immense. By its very nature logistics cuts across traditional company organization functions with cost impacts on most of those functions. Conventional accounting systems do not usually assist in the identification of

these company-wide impacts, frequently absorbing logistics-related costs in other cost elements. The cost of processing orders for example is an amalgam of specific costs incurred in different functional areas of the business which generally prove extremely difficult to bring together.

Accounting practice for budgeting and standard-setting has tended to result in a compartmentalization of company accounts; thus budgets tend to be set on a functional basis. The trouble is that policy costs do not usually confine themselves within the same watertight boundaries. It is the nature of logistics that, like a stone thrown into a pond, the effects of specific policies spread beyond their immediate area of impact.

It will be apparent from the previous comments that the problem of developing an appropriate logistics-oriented costing system is primarily one of focus. What is required is the ability to focus upon the output of the distribution system, in essence the provision of customer service, and to identify the unique costs associated with that output. Traditional accounting methods lack this focus, mainly because they were designed with something else in mind.

One of the basic principles of logistics costing, it has been argued, is that the system should mirror the materials flow, i.e. it should be capable of identifying the costs that result from providing customer service in the marketplace. A second principle is that it should be capable of enabling separate cost and revenue analyses to be made by customer type and by market segment or distribution channel.

This latter requirement emerges because of the dangers inherent in dealing solely with averages, e.g. the average cost

per delivery, since they can often conceal substantial variations either side of the mean. To operationalize these principles requires an output orientation to costing. In other words we must first define the desired outputs of the logistics system and then seek to identify the costs associated with providing those outputs. A useful concept here is the idea of mission. In the context of logistics, a mission is a set of customer service goals to be achieved by the system within a specific product/market context. Missions can be defined in terms of the type of market served, by which products and within what constraints of service and cost. A mission by its very nature cuts across traditional company lines.

The successful achievement of defined mission goals involves inputs from a large number of functional areas and activity centres within the firm. Thus an effective logistics costing system must seek to determine the total systems cost of meeting desired logistic objectives (the output of the system) and the costs of the various inputs involved in meeting these outputs. Interest has been growing in an approach to this problem, known as mission costing [1-5].

### 3. THE STATUS OF COSTS IN THE ENTERPRISE

The costs are of interest to any manager because belong to the most important characteristics of the enterprise. Their knowledge is essential for the achievement of goals and improving the enterprises management. Defining the concept of cost in the world is not uniform and corresponds to a degree in which is defined and plan to be performed [4].

The cost is generally defined as expending economic resources of enterprise on certain performance, the result of activity, from which is expected economic effect. In other words, it is expressed in money purposeful consumption of the factors associated with the activity in the enterprise.

Another definition indicates costs as monetization of enterprise resource consumption necessary for carrying out manufacturing or other activity of enterprise. Costs represent the material and financial resources, as well as works that enterprise spends on its activities for a certain period and acting on its final profit or loss. Virtually costs reflect purposeful transformation of spent resources on the appropriate performances. The total earnings are the counterpart of the total costs. Content counterpart of the total cost is the total earning.

Cost management has for each enterprise the paramount importance because profits grow primarily by reducing costs.

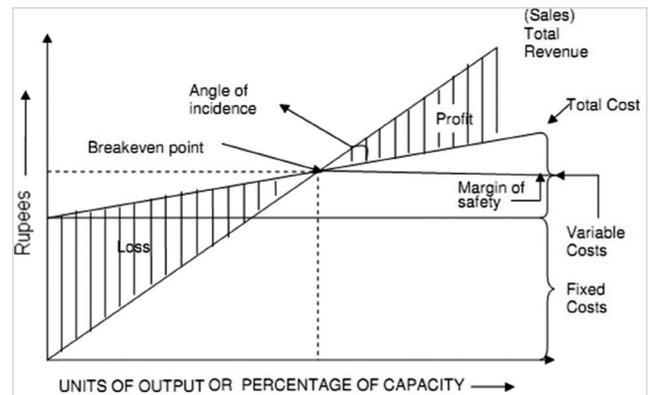
Costs are indicators of the enterprise quality therefore their management requires also their detailed classification [6-10].

### 4. BREAK-EVEN POINT ANALYSIS

Break-even analysis is a useful tool to study the relationship between fixed costs, variable costs and returns. A break-even point defines when an investment will generate a positive return and can be determined graphically or with simple mathematics. Break-even analysis computes the volume of production at a given price necessary to cover all costs. Break-even price analysis computes the price necessary at a given level of production to cover all costs. To explain how Break-even analysis works, it is necessary to define the cost items [3], [11].

Break-even point is where sales revenues less variable and fixed costs produce zero profits. The place in which the total revenues (sales) and total costs cross in the graphic below is Break-even point. To the left of this point the business makes

a loss and to the right, with more sales, then profits begin to increase [12-17]. In Figure 1, the graphic representation of Break-even point is illustrated.



Source: [13]

Figure 1 Break-even point illustration

Graphical solution of Break-even point can be verified by a mathematical calculation as follows:

Revenues are calculated from equation: [5]

$$R = p \times q \quad (1)$$

Where:  $R$  - revenues;  $p$  - price;  $q$  - quantity of production.

Costs can be expressed by the equation: [11]

$$C = FC + vc \times q \quad (2)$$

Where:  $C$  - costs;  $FC$  - fixed costs;  $vc$  - variable costs per a piece;  $q$  - quantity of production.

Profit is given well-known equation: [5]

$$P = R - C \quad (3)$$

Where:  $P$  - profit,  $R$  - revenues,  $C$  - costs.

To make the profit = 0, it is necessary to apply the equation ( $R=C$ ): [11]

$$p \times q = FC + vc \times q \quad (4)$$

A critical amount of production, which characterizes Break-even point, is calculated by gradual modifications of equations: [11]

$$q = FC / (p - vc) \quad (5)$$

The equation  $(p - vc)$  is called allowance for payment of fixed costs and profit, thus covering allowance. The higher the value of the covering allowance, the smaller the quantity of production to achieve a profit. [5]

It applies: [11]

$$p - vc = FC / q \quad (6)$$

From above mentioned, it can be stated that if the covering allowance equals the fixed costs per unit of production, break-even point is achieved.

It follows that if the allowance covers equal fixed costs per unit of production, break-even point is achieved.

Critical production capacity utilization  $PC_{crit}$  is the percentage usage of maximum capacity according to equation: [7]

$$PC_{crit} = (BEP \times 100) / APC \quad (7)$$

Where:  $BEP$  - production volume in Break-even point,  $APC$  - amount of production capacity.

According to Kučerková (2011) if shareholders want to achieve some profit  $P_{min}$ , Break-even point, which reckon with minimal profit before tax, it can be determined from equation:

$$BEP = (FC + P_{min}) / (p - vc) \quad (8)$$

Where:  $BEP$  - production volume in Break-even point,  $FC$  - fixed costs,  $p$  - price,  $vc$  - variable costs per a piece.

## 5. MATHEMATICAL CALCULATION OF BREAK-EVEN POINT ON A MODEL EXAMPLE

The mathematical calculation can be presented using a specific example.

*Example:* Enterprise X produces pumps. The production capacity of enterprise is maximum 25000 pieces pumps per year. The average pump price is 550 EUR / piece. Fixed costs are 150000 EUR, variable costs are 400 EUR / piece [2], [6], [18-22].

*Questions:*

- What volume of production must the enterprise X produce to reach Break-even point?
- How many percent are used the maximum production capacity of enterprise X?
- How many pumps must produce enterprise X in order to achieve the planned profit after tax of 100000 EUR if the tax rate is 19%?

*Solutions:*

- Break-even point BEP:

$$BEP = FC / (p - vc) = 150000 / (550 - 400) = 1000 \text{ pieces}$$

Enterprise X reaches break-even point in the production of 1000 pumps.

- Critical production capacity utilization  $PC_{crit}$ :

$$PC_{crit} = (BEP \times 100) / APC = 1000 \times 100 / 25000 = 4\%$$

The maximum production capacity is used at 4%.

- Production volume needed to achieve the required profit:

$$BEP = (FC + P_{min}) / (p - vc) = (150000 + 100000 / (1-0,19)) / (550-400) = 1823 \text{ pieces}$$

If the enterprise X wants achieve the planned profit 100000 EUR after tax, it must produce at least 1823 pumps.

In practice, situation may arise when it is impossible to reach Break-even point [23]:

- if applies: price of the product ( $p$ ) < variable costs per piece ( $vc$ ),
- if the production capacity is limited or is the little volume of effective demand.

## 6. CONCLUSION

The paper aimed to highlight the importance of costs position in the enterprise. If the effort of enterprise is to continuously improve and consolidate its market position, it is necessary to know the exact details of costs area. Knowledge of costs is especially important because the amount of profit usually depends just on the amount of costs. Based on the above are in the paper characterized fixed and variable costs, which depend on changes in production volume and are the basis for determining Break-even point. For enterprise, the Break-even point analysis represents the calculation of the production volume needed to cover all the costs [2], [19-21], [24].

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