



BANGLADESH
COST ACCOUNTING
STANDARDS

BCAS - 15

Product Mix
Decisions

BCAS 15: Product Mix Decisions

15.1 Introduction

Product mix (also called product assortment) is the set of all product lines and items that a particular manufacturer plans to produce. A manufacturer's product mix will have a certain width, length, depth, and consistency. The width of product mix refers to how many different products lines the company carries. The length of product mix refers to the total number of items the company holds in its product mix. The depth of product mix refers to how many variants are offered of each product in the line. The consistency of the product mix refers to how closely the various product lines are related in end use, production requirements, distribution channels, or some other ways. Product mix decision refers to the decisions regarding adding a new or eliminating any existing product from the product mix, adding a new product line, lengthening any existing line, or bringing new variants of a brand to expand the business and to increase the profitability. This standard attempts to provide a general guideline on these issues to companies involved with these types of decisions.

15.2 Objectives

In the product mix decision the organization identifies which products, i.e., goods or services; it will produce and deliver to its customers. The purpose of this standard is to identify the role of cost information in product mix decision.

15.3 Scope

15.3.1 The purpose of this standard is to guide the respective management with the rational combination of product lines in typical product mix decisions.

15.3.2 More particularly, the standard supports to take basic product mix decisions including -

- a) □ Reviewing the mix of existing product lines;
- b) □ Adding new lines to and deleting existing lines from the product mix;
- c) □ Determining the relative emphasis on new versus existing product lines in the mix;
- d) □ Determining the appropriate emphasis on internal development versus external □ □ acquisition in the product mix;
- e) □ Gauge the effects of adding or deleting a product line in relationship to other lines □ □ in the product mix; and
- f) □ Forecasting the effects of future external change on the company's product mix.

15.3.3 This standard may be followed by companies and other business or non-business organizations where cost and management accounting is in practice either as a statutory obligation or to support management decision making process.

15.4 Key Features

The key features of this standard are pointed below -

- a) □ Presents a comparative picture of planning and operation phase;
- b) □ Identifies capacity related costs and flexible costs;
- c) □ Brings theory of constraints and its application in capacity related decisions;
- d) □ Differentiates between long term and short term capacity decisions with impact on □ □ product mix decisions;

- e) Analyses relevant information in product mix decisions critically; and
- f) Aligns production budget with long term capacity related decisions.

15.5 Definitions

The following terms are used in this standard with the meanings specified -

- 15.5.1 Flexible costs: As defined in BCAS 2.5.2.
- 15.5.2 Capacity-related costs: As defined in BCAS 2.5.3.
- 15.5.3 Contribution margin: Contribution margin, defined as selling price minus variable cost, is a measure of the ability of a company to cover variable costs with revenue.
- 15.5.4 Production budget: The production budget calculates the number of units of products that must be manufactured, and is derived from a combination of the sales forecast and the planned amount of finished goods inventory to have on hand (usually as safety stock to cover unexpected increases in demand).
- 15.5.5 Theory of constraints: The theory of constraints (TOC) is a management paradigm that views any manageable system as being limited in achieving more of its goals by a very small number of constraints. There is always at least one constraint, and TOC uses a focusing process to identify the constraint and restructure the rest of the organization around it.

15.6 Standards

- 15.6.1 **Management should clearly identify capacity planning phase and operation phase with respective roles to be played by designated personnel to align product mix related decisions properly.**
- 15.6.2 During the capacity planning phase, planners compare the contribution margin expected to be provided by a production budget with the cost of the capacity that enables that production budget. The capacity is acquired if the contribution margin that it enables exceeds its cost.
- 15.6.3 During the operations phase, which takes the level and mix of capacity as given, it is imperative that the costs used in choosing the optimal product mix do not include any capacity-related costs. Capacity-related costs include the cost of any productive resource whose cost depends on the amount acquired rather than the amount used. Generally, capacity-related costs will include the cost of machinery and equipment, the cost of other general overhead resources, and, for some organizations, the cost of labor.
- 15.6.4 **The management should align long run and short run decisions relating to capacity properly so that capacity can be utilized for the maximum benefit of the company.**
- 15.6.5 The long-run is defined as the time period over which capacity levels can be adjusted. The focus of long-run planning is to choose the level and mix of capacity that will be made available in the short-run.
- 15.6.6 The short-run is defined as the time period over which capacity cannot be adjusted. The focus of short-run planning is to use the existing capacity in the best possible way to

achieve the organization's objectives.

15.6.7 The notion that cost considerations are different in the long-run and the short-run is well established in both economic and accounting thinking. Economists speak of short-run and long-run costs. Accountants speak of flexible (variable) and capacity-related (fixed) costs. The economist's notion of short-run cost is captured by the accounting notion of flexible cost. The sum of a product's flexible cost and its allocated share of the cost of the capacity that it consumes capture the economist's notion of long-run marginal cost. Therefore, a product's long-run marginal cost includes its share of the cost of the capacity that it uses. In equation format, for a specific product:

$$\text{Long-run marginal cost} = \text{Flexible cost} + \text{Capacity-related cost}$$

15.6.8 The economic principle is that, in the long-run, product viability demands that a product's price be equal to, or greater than, its long-run marginal cost. Once capacity is in place, the long-run marginal cost becomes the target price the organization aims to achieve. When the organization has the ability to set prices, planners try to keep the price from falling below the long-run marginal cost. The long-run marginal cost defines the minimum price required to sustain the product in the long run, since that is the only price that will recover all costs and create a profit for the organization.

15.6.9 However, if the product price is determined by the market, once capacity is in place the role of capacity related costs ceases and they are no longer relevant. The economic principle is to maximize the short-run contribution margin of products, where the contribution margin is defined as price less flexible cost.

15.6.10 There are many approaches that have been used during capacity planning phase to choose the mix and level of capacity that will be made available in the short-run. The most systematic of these approaches is the capital budgeting model. The capital budgeting model compares the capacity-related costs, which are usually expressed as up-front costs, with the annuity (revenues less flexible costs) provided by the production budget that uses that capacity.

15.6.11 Therefore, the capital budgeting model provides a systematic comparison of the costs and benefits of capacity and results in putting a mix and level of capacity in place. The approach is to ensure that the cash outflows associated with acquiring capacity are met or exceeded by the net cash inflows associated with using the capacity.

15.6.12 During the operational phase, decision makers use the available mix and level of capacity to choose the mix of goods or services that the organization will create and distribute to its customers or clients.

15.6.13 The operational objective is to develop a production budget that provides the highest possible contribution to the organization's objectives. This standard assumes that the objective is profits.

15.6.14 The short-run product mix decision is part of the family of relevant cost decisions. This means that during operation phase, only flexible costs should be considered in choosing the production budget. Capacity-related costs are not relevant in the short-run because these costs are committed (sunk) and will not be affected by how the capacity is used.

15.7 Recording and Reporting

15.7.1 Management should form a focused team to deal with product mix decisions which usually manned by top level management. It is a part of organizational culture patronized

by top level management.

15.7.2 Organization should have its own mechanism to generate the following information and reporting the same through proper channel so that product mix decisions can be easily undertaken:

- a) Contribution margin
- b) Level and mix of capacity
- c) Capacity related costs
- d) Total capacity (long term) and operational capacity (short term)
- e) Flexible costs
- f) Capacity utilization status
- g) Production budget
- h) Any other types of reporting as required.

15.7.3 Reporting under this standard must be destined to proper authority as this information is critical to the organization.

15.8 Effective Date

This standard will be effective from January 1, 2017 onwards.

Appendix 15A

No Long-Run Decisions

An organization has two products, Product X and Product Y. There is a marketing constraint such that a maximum of 3,000 units of Product X and 5,000 units of Product Y can be sold.

The two products each use different raw materials, which are purchased as required from an external supplier. The two products each use labor time, which the organization acquires as needed from an external supplier. The organization pays the external supplier Tk. 200 for every labor hour supplied. There is an unlimited supply of this labor.

The two products consume indirect supplies in proportion to the number of units made and sold. These indirect supplies are purchased from an external supplier as needed.

The two products consume machine time on a machine that is rented from an external supplier. The rental agreement is that the organization will pay the external supplier Tk.600 for every machine hour used. There is a maximum of 10,000 machine hours available for rent. That is, the constraint on machine time is 10,000 hours.

The organization incurs flexible selling and distribution costs to sell and distribute the two products to customers.

The objective is to choose a product mix that provides the greatest contribution to capacity-related costs, which include only general and administrative expenses and amount to Tk. 500,000 per period.

Note that in this initial example there are no long-term considerations since the organization acquires no capacity. The focus is entirely on the short-run since all costs, except general and administrative costs, are flexible.

The following table summarizes the per unit revenue and cost (flexible) information for the two products.

	Product X			Product Y		
	Units	Tk./Units	Total Tk.	Units	Tk./Units	Total Tk.
Revenue	1	3,000	3,000	1	3,500	3,500
Cost Items:						
Materials	3	180	540	2	150	300
Labor	3	200	600	1	200	200
Supplies	4	120	480	2	100	200
Machine hour (MH)	2	600	1,200	4	600	2,400
Selling and distribution	1	100	100	1	120	120
Total Cost			2,920			3,220
Contribution			80			280
Contribution per MH		(Tk. 80/2 hour)	40		(Tk. 280/4 hour)	70

The method used to allocate short-run capacity when there is a single constraining factor of production. In this case, machine time is the constraining factor and the profit contribution per machine hour is highest for Product Y.

This means that the organization should produce as much of Product Y as it can sell. Because of the machine hour's limitation, the maximum the organization can produce is 2500 units (10,000/4) of Product Y. Since the maximum sales of Product Y are 5,000 units, the organization will produce and sell 2,500 units of Product Y. **Therefore, the optimal short-run production budget is to make 2,500 units of Product Y.**

This production budget will, if expectations are realized, create a contribution of Tk.700, 000 ((Tk. 3,500-Tk. 3,220) x 2,500) to general and administrative expenses, resulting in a periodic profit of Tk. 200,000 (Tk. 700,000 - Tk. 500,000).

Long-Run Considerations

Assume now that the organization must rent the machine from another external supplier. The machine capacity is 10,000 hours and the periodic rent for the machine is Tk. 6,000,000 irrespective of how many hours it is used. The machine cost now becomes a capacity-related or committed cost and joins the general and administrative costs as part of the group of costs that cannot be varied in the short-run. The constraint on machine hours is 10,000.

The following table summarizes the relevant costs.

	Product X			Product Y		
	Units	Tk./Units	Total Tk.	Units	Tk./Units	Total Tk.
Revenue	1	3,000	3,000	1	3,500	3,500
Cost Items:						
Materials	3	180	540	2	150	300
Labor	3	200	600	1	200	200
Supplies	4	120	480	2	100	200
Selling and distribution	1	100	100	1	120	120
Total Flexible Cost			1,720			820
Contribution Margin			1,280			2,680
Contribution per MH		(Tk.1,280/2 hour)	640		(Tk.2,680/4 hour)	670

Note that the machine cost component of total cost has now been eliminated, since machine cost is now a committed (fixed) capacity-related cost and therefore is not relevant in the decision. This is the characteristic of capacity-related costs whose level depends on the amount of capacity acquired rather than the amount of capacity used.

The ranking of the two products remains the same as in the first example. Therefore, the optimal production budget will be the same as in the first example produce 2,500 (10,000/4) units of Product Y. This production budget will provide a contribution of Tk. 6,700,000 (2,500 x [Tk. 3,500 - Tk. 820]) to capacity-related costs, which include general and administrative expenses and the rent for the machine.

Note that the profit in the first example was Tk. 200,000. The profit was also Tk. 200,000 (Tk. 6,700,000 - Tk. 6,000,000 - Tk. 500,000) in the second example again; this is because the rankings of the two products remain the same as in the first example and because the optimal production budget calls for the use of all the available capacity.

Labor as a Committed Cost

Suppose we now assume that, in addition to machine costs, labor costs are also committed. This would reflect a situation where employees are fixed employment for the planning period. The following table summarizes these circumstances.

	Product X			Product Y		
	Units	Tk./Units	Total Tk.	Units	Tk./Units	Total Tk.
Revenue	1	3,000	3,000	1	3,500	3,500
Cost Items:						
Materials	3	180	540	2	150	300
Supplies	4	120	480	2	100	200
Selling and distribution	1	100	100	1	120	120
Total Cost			1,120			620
Contribution			1,880			2,880
Contribution per MH		(Tk. 1,880/2 hour)	940		(Tk. 2,880/4 hour)	720

Assuming that only machine time provides a constraint on production, the optimal production budget now includes Product X since it provides the highest contribution per unit of machine time. Therefore, the organization would produce as much Product X as the machine time and marketing constraints allow, given the assumption that there is sufficient labor, indirect supplies, and selling and distribution capacity to handle any production budget.

Therefore, the organization will produce 3,000 units of Product X, which is what the marketing constraint allows. This will leave 4,000 (10,000 - [3,000 x 2]) hours of machine time that can be used to make a maximum of 1,000 (4,000/4) units of Product Y. Since the marketing constraint allows the sale of 5,000 units of Product Y, the organization will make the 1,000 units of Product Y that the machine hour constraint allows.

More Long-Run Considerations

Suppose we now assume that all costs, except materials costs, are capacity-related or committed costs. We will assume that the committed costs for labor, suppliers, and selling and distribution activities are such that none of these will constrain any production budget.

The following table summarizes these circumstances and introduces a new term, "throughput" which is revenue minus materials cost.

	Product X			Product Y		
	Units	Tk./Units	Total Tk.	Units	Tk./Units	Total Tk.
Revenue	1	3,000	3,000	1	3,500	3,500
Cost Items:						
Materials	3	180	540	2	150	300
Total Cost			540			300
Contribution			2,460			3,200
Contribution per MH		(Tk.2,460/2 hour)	1,230		(Tk.3,200/4 hour)	800

When we consider only materials costs flexible, Product X again provides the highest contribution per hour of machine hour, and, as calculated above, the optimal production budget would be to produce 3,000 units of Product X and 1,000 units of Product Y.

From the above examples it is evident that the optimal short-run production plan will depend critically on, among other things, the assumptions made regarding the behavior of the various product-related costs. The product mix decision will depend critically on what are deemed to be flexible or relevant costs.

Since the optimal decision depends on the behavior of the individual costs, it follows that misclassifying a flexible cost as a committed cost or misclassifying a committed cost as a flexible cost will misinform decision makers and may lead, as in the examples above, to a suboptimal decision. The treatment of the cost must be consistent with its behavior in a particular setting.

For example, if employees are paid by the hour and only if work is available, then labor cost is flexible and is relevant in short-run capacity use decisions. If employees are paid a salary, irrespective of whether work is available, then labor cost is capacity related, or committed, and is not relevant in short-run capacity use decisions.

Multiple Production Constraints

We have made the assumption that while machine time and labor hours is committed only machine hours will constrain production.

Continuing the example where only material costs are flexible, suppose that the number of labor hours committed is 8,000 and this commitment provides a capacity-related cost of Tk. 1,600,000. In this scenario, the production budget found above to produce 3,000 units of Product X and 1,000 units of Product Y is infeasible since it calls for the use of 10,000 ($[3,000 \times 3] + [1,000 \times 1]$) labor hours.

In this situation the theory of constraints advocates attacking the labor constraint by making labor more efficient or redesigning the production process or product to use less labor which are both reengineering activities.

In the presence of multiple constraints, we can no longer use the method of sequentially allocating productive capacity based on contribution per unit of the constraining factor of production, since it is not clear which constraint we should consider first.

Assuming that neither production constraint can be relaxed, we can show that the optimal production budget is to produce 2,200 units of Product X and 1,400 units of Product Y. This production budget consumes all the available machine time (10,000 hours) and labor time (8,000 hours). Choosing this optimal production budget involves the consideration of only flexible costs. Capacity-related costs are, again, irrelevant and not considered in the analysis.

The theory of constraints that have been particularly critical of the role of costing in supporting decision-making, the choice of the optimal production budget and the choice of the best allocation of continuous improvement activities does not rely on, any consideration of capacity-related costs.