IPE 303
Product Design I

Product Analysis

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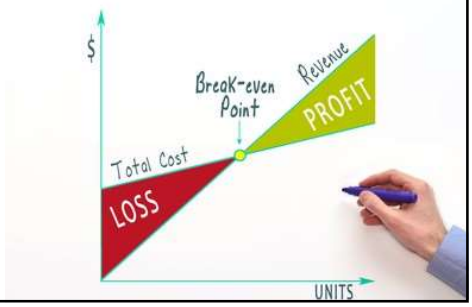

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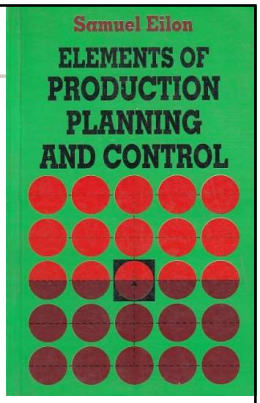

Reference

Chapter 5 - Product Development and Design
Elements of production planning and control by Samuel Eilon

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Product Analysis

- Many factors affiliated with different fields in industrial and production engineering have to be analyzed in connection with design and development of a product.
- Some of these factors may be grouped as follows:

1. Marketing aspect
2. Product Characteristics
   i. Functional aspect
   ii. Operational aspect
   iii. Durability and dependability aspects
3. Economic analysis
   i. The profit consideration
   ii. The effect of standardization, simplification, and specialization
   iii. The break-even analysis
4. Production aspect

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Product Analysis

1. <u>Marketing aspect:</u>

- It is very important to know the marketability of a proposed product
- All further steps are dependent upon the demand for the proposed product and customer acceptability of the product
- If there is no potential market, then it is a wasteful exercise to design and manufacture the product
- The following questions need to be answered:
  - What will be expected demand for the product both short-term and long-term?
  - Whether the function that are offered by the product are desirable and acceptable to the customer?

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Product Analysis

2. Product characteristic:

i. Functional aspect

- When the marketing possibilities have been explored, the functional scope of the product has to be carefully analyzed and properly defined.
- The functional analysis affects the design of a product, its complexity, its appearance, and its price.

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Product Analysis

2. Product characteristic:

i. Functional aspect

- The definition of the objective rarely tells much about the predicted functional scope—
  - A washing machine, for example, has a clearly defined objective: to wash clothes.
  - This doesn't state - how the washing should be carried out; whether rinsing or drying, or both are to be done by the machine; whether the machine should be capable of heating the water prior to washing; and what should be the proportion between automatic functioning and manual supervision*.

*A functional analysis of this kind affects the design of a product, its complexity, its appearance, and its price.

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Product Analysis

2. Product characteristic:

ii. Operational aspect

- The product is not only expected to perform its functions satisfactorily but also it should be easy and safe to operate at the customer end.
- The product is used at different operational conditions and the customers vary with respect to skill and knowledge and the designer's problem becomes complicated with addition of more function.

Picture reference: www.alibaba.com; esquireelectronicsltd.com

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Product Analysis

2. Product characteristic:

iii. Durability and dependability aspects

- These two factors define the quality and reliability of the product
- *Durability* refers to the length of the active life of the product under given working conditions.
- *Dependability* refers to the reliability with which the product serves its intended function.
- Example: water proof jacket. The quality of the jacket (product) is directly proportional to the quality of the inputs and the manufacturing process. It is also a function of cost.

Picture reference: www.amazon.com

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Product Analysis

2. Product characteristic:

iv. Aesthetic aspect

- It refers to the 'external look good' aspect of the product and it is concerned with molding the final shape around the basic skeleton
- It helps the sales function of the product by attracting the customers and creating first impression about the product.
- Designers use variety of tools to build aesthetic characteristics into the product such as: *use of special material*; *use of color*; *texture* and *packaging*.

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Product Analysis

3. Economic analysis:

- An economic analysis is the key to the management decision in product design policy.
- It answer the following questions:
  - What will be the amount of investment needed to manufacture the new product?
  - What are the estimated product cost per piece?
  - What will be the expected profit margin?
  - Whether the price proposed to be offered by the company are competitive?

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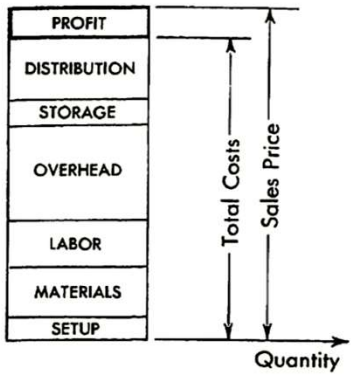
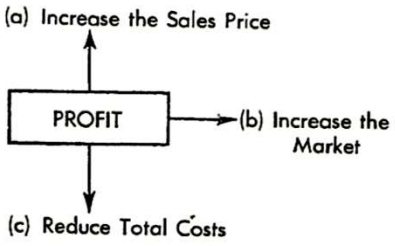
Product Analysis

3. Economic analysis:

i. The profit consideration

- Methods for increasing total profit—





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Product Analysis

3. Economic analysis:

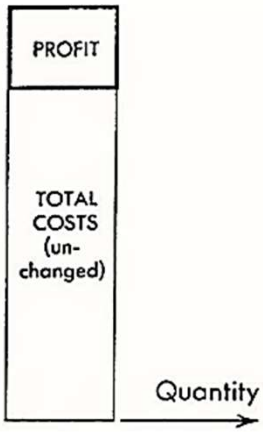
i. The profit consideration

- Methods for increasing total profit—

(a) Increase the sales price by increasing the profit per unit.

Limitations: (i) competition.
(ii) customer's willingness to pay.

Danger: shrinkage of market leading to possible decline in total profit.



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Product Analysis

3. Economic analysis:

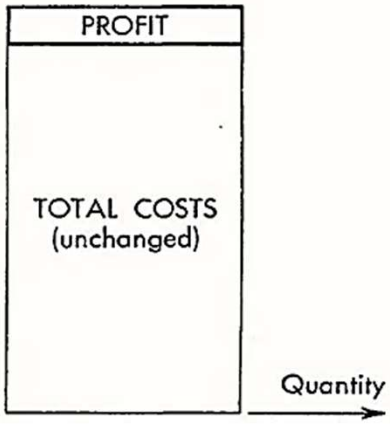
i. The profit consideration

- Methods for increasing total profit—

(b) Increase the market by reducing the profit per unit, etc., by advertising.

Limitation: competition.

Danger: too low a margin of profit per unit should be avoided due to possible instabilities in the market.



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Product Analysis

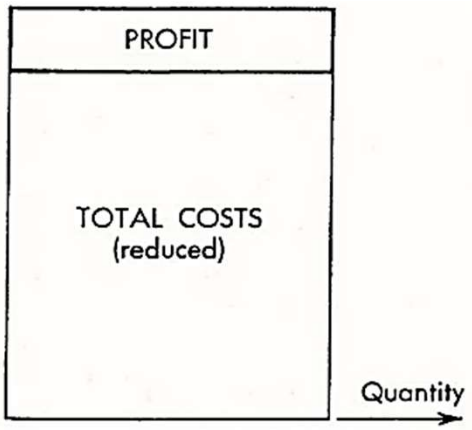
3. Economic analysis:

i. The profit consideration

- Methods for increasing total profit—

(c) Reduce total costs and pass some benefits to customers by reducing sales price.

Limitations: (i) expenditure on new equipment.
(ii) basic labor and materials costs.
(iii) minimum requirements of quality.



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Product Analysis

3. Economic analysis:

ii. *The effect of standardization, simplification, and specialization*

- The three processes are usually linked together and develop as a logical sequence.
- From a wide range of requirements it is first necessary to sort out the essential features, define then, and then work out in a scientific manner the minimum variety required to meet these essentials. This is a process of ***standardization***, and it is mainly an engineering process.

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Product Analysis

3. Economic analysis:

ii. *The effect of standardization, simplification, and specialization*

- Within a given range, whether covered by standards or not, a process of ***simplification*** can be carried out with the view of reducing the variety of products or materials that are produced or purchased. This is both an economic and an engineering process.
- ***Specialization*** is one of the natural outcomes of *simplification*, which is the process whereby particular firms concentrate on the manufacture of a limited number of products or types of products.

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Product Analysis

3. Economic analysis:

ii. *The effect of standardization, simplification, and specialization*

Simplification:

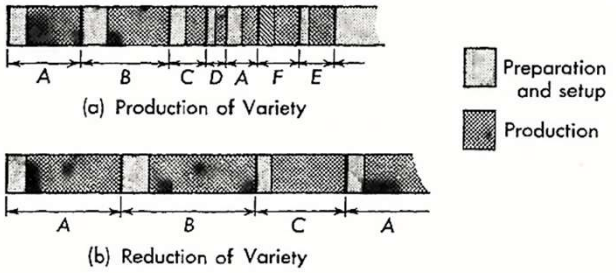

Figure 5–8. ***Effect of variety on scheduling.***

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Product Analysis

3. Economic analysis:

ii. *The effect of standardization, simplification, and specialization*

Simplification:

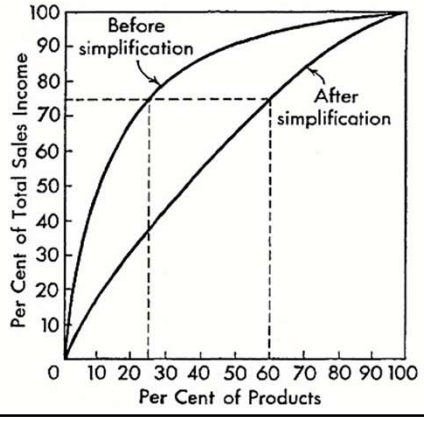

Figure 5–9. ***Analysis of sales by products.***

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Product Analysis

3. Economic analysis:

iii. The break-even analysis

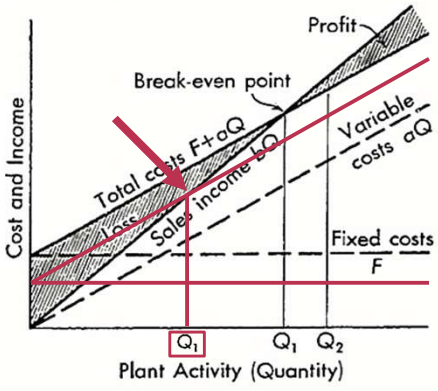

Figure 5–10. *A break-even chart.*

What are the possible ways of lowering the BEP?

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Product Analysis

3. Economic analysis:

iii. The break-even analysis

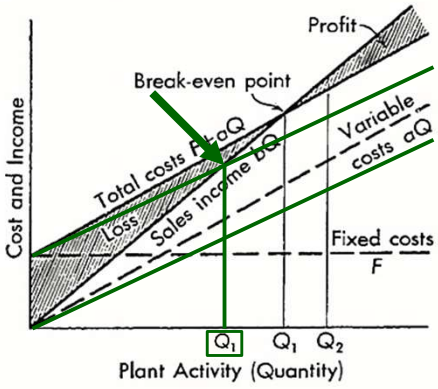

Figure 5–10. *A break-even chart.*

What are the possible ways of lowering the BEP?

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Product Analysis

3. Economic analysis:

iii. The break-even analysis

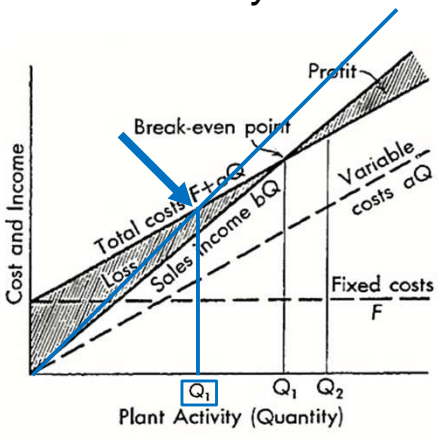

Figure 5–10. *A break-even chart.*

What are the possible ways of lowering the BEP?

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Product Analysis

4. Production aspect:

- Three aspects of production engineering:
  i. Selection of process that will be most suitable and economical for the purpose. Such a selection will have to consider:
     a) The production quantities involved (Inj. molding vs 3D printing)
     b) Utilization of existing equipment (may override ideal process)
     c) Selection of jigs and fixtures and other production aids (may affect deign of components)
     d) Sequence of operations and methods for sub-assembling and assembling
     e) Limitation of skill (skilled labor vs. automated equipment)
     f) Consideration and application of new production process

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Product Analysis

4. Production aspect:

- Three aspects of production engineering:
  - ii. Utilization of materials and components with the view of:
    - a) Selection of materials having appropriate specifications
    - b) Selection of method or design to reduce waste as scrap
    - c) Using standard components and assemblies
    - d) Having interchangeability of components and assemblies within the product

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Product Analysis

4. Production aspect:

- Three aspects of production engineering:
  - iii. Selection of appropriate workmanship and tolerances that satisfies quality requirements, but which are at the same time compatible with the precision and quality that can be attained through the available processes. Specification of quality may also affect the selection of process.

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