

# A Study of an Alternate Preference of Machines & Equipments before Failure

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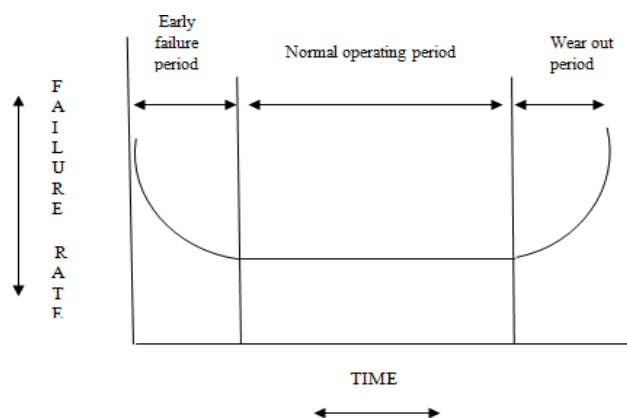
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**Abstract:** Many researchers have studied the machine replacement problem which is a significant area in operations research and industrial engineering. This research work focuses on striking a balance between the cost and the competitive environment which is going in recent industry. Replacement theory is loose sleep with the problem of replacement of man, machines, and equipments due to deterioration which is caused by regular use in industry. This research work discusses the importance and value of replacement in production atmosphere.

**Keywords:** Replacement Reasons, Qualitative Assessment, Maintenance, Constant Usage.

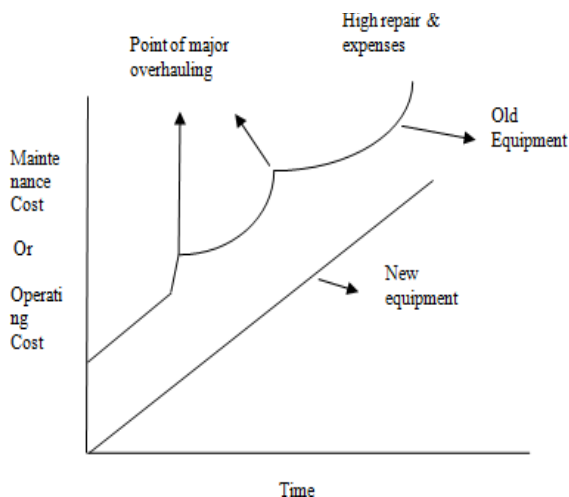
## 1. Introduction

The major conflict lies in deciding that “Should we replace an asset that we own now or later?”. This article helps the owners and manufacturer in analyzing and supports them in taking their decision on the area of replacement by exploring the numerous possibilities of taking replacement decision. The main intension of replacement is to decide the Economic life i.e. the period of time in terms of years that yields the minimum equivalent uniform annual cost (EUAC) of owning and operating an asset or equipment. The Replacement Theory is a decision making process of replacing a used equipment with a alternate substitute; mostly by a new equipment of superior practice. The replacement might be necessary due to the deteriorating property or malfunction or breakdown of particular equipment. Replacement Theory is used in many cases such as accessible items have outlived, or it may not be economical any longer to continue with them, or the items might have been ruined their life or destroyed either by accident or else. The life of any operating asset generally follow failure pattern and is represented by bath tub curve. When the failure rate (number of failures per unit time) is plotted against a continuous time scale then the resulting curve is known as bath tub curve which exhibits three zones as shown in **Fig (1)** below [1-5].



**Figure: 1** Bath tub curve

In the third zone the curve represents high maintenance due to abrasion, creep, fatigue, corrosion, vibration etc. after the end of that phase the machinery generally replaces by the owner or manufacturer as it becomes useless as the metal becomes embrittled and the insulation dries out. The work outline here shown that irrespective of the third phase of bath curve there can be the various different possibilities and the unlikely cases which demands the requirement of replacement. The work presented would like to draw the attention of the owner in the field of replacement. The **Fig (2)** Presented depicts the differential requirement of the maintenance action between the new and old equipment with respect to time.



**Figure 2:** Differential requirement of the maintenance action between the new and old equipment with respect to time

## 2. Life Cycle Cost

The life cycle cost of the equipment/machines is generally composed of original cost, salvage value, operating costs, maintenance costs, renewal costs, decommissioning costs and is represented by the following function [1-8]:

$$F(x) = P - Q + R + S + T + U$$

### Where

$F(x)$  = Life Cycle Cost

$P$  = Original Cost

$Q$  = Salvage Value

$R$  = Operating Costs

$S$  = Maintenance Costs

$T$  = Renewal Costs

$U$  = Decommissioning Costs

When the average life cycle cost of the equipment is minimum, then after the end of that time span the replacement is usually preferable. The life cycle cost of the equipment generally deals with the quantitative assessment and deals with cost optimization. The work presented here shows the requirement of replacement based on qualitative assessment rather than quantitative.

## 3. Rationale for Favoring Replacement of Assets

Large number of factors is responsible to replace the equipments before its estimated useful life. The various possible reasons which necessitate the replacement of equipment and machines are [8-18]:

- Depreciation of the equipments due to wear and tear
- Increment in maintenance costs, reduction in product quality.
- Decrement in rate of output, increase in labor costs etc
- Unavailability of spare parts
- Possibility of performing additional operations by new machines
- Obsolescence caused due to technological development
- Profit reduction and competitive strength of the firm to remain rival in the market due to changed machinery

- Change in product design or automation
- Reduction in scrap or spoiled work by new machines.
- Reduced safety as compared to new machines available and developed
- Replacing old machines which creates unpleasant i.e. smoky, noisy, pollution and hazardous working conditions causing workers un-safety and leading to accidents
- More reliable machines developed
- Saving resulting from consumption of less power or fuel by the new machine
- High maintenance and repair cost of existing equipments and machines
- Improvement in quality and productivity by the use of new machine
- To reduce down time of existing equipments due to breakdown, repairs
- Reduction in the cost of jigs, fixtures, special tools etc by the use of new machines.
- Salvage value of new equipment and its useful life
- Lesser space requirement by the new machine

## 4. Conclusion

Many researchers studied the machine replacement problem which is a significant area in operations research, industrial engineering and management science. Items which are under regular and constant usage experience replacement at an appropriate time due to competence and efficiency of the working system. In the work we highlighted that many people feel that equipment should not be replaced until it is bodily and physically worn out. But, it is not right, operational equipment must be regularly, persistently and constantly rehabilitated and modernized and updated to remain competitive and to retain efficiency otherwise it will be in the menace of malfunction or it may become obsolete and out dated.

The paper discusses the value and importance of replacement in production atmosphere. The objective of the proposed work focuses on striking a balance between the cost and the competitive environment. The possibilities of equipment replacement are discussed to ensure delivering the normal performance of the equipment. This script also discusses the life cycle and the life cycle cost of the assets. These work discussed with respect to the parameters like maintenance cost, time and obsolescence.

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