# REPLACEMENT ANALYSIS

# General Nature

**Two important terms here in this analysis are,**

**Defender**

- The existing old asset being considered as the asset to be replaced

**Challenger**

- The asset proposed to be the replacement

# Key Points

- The economy of scrapping an efficient old machines lies in the conservation of effort, energy, material and time.
- Additional expenses incurred for the installation of a new machine before operation should be considered as part of initial cost.
- When a old machine is replaced its removal may entail expenses which must be deducted from the amount received to arrive at net salvage value.

# Terminologies

- **Sunk cost**

For example, suppose a machine acquired for $50,000 three years ago has a book value of $20,000. The $30,000 is a sunk cost that does not affect a future decision involving its replacement.

**Present book value – Present market value**

- **Economic life – Estimating economic life in any organization is very useful.**

# Methods

1. **Outsider's point of view/Opportunity cost approach**
2. **Cash flow approach- ONLY for equal life**
3. **Economic life of an asset**

# Numerical

- Macintosh Printing, Inc. purchased a $20,000 printing machine 2 years ago. The company expects this machine to have 3more years of useful life and a salvage value of $5,000. The company spent $5,000 last year on repairs, and current operating costs are running at the rate of $8,000/year. The anticipated salvage value of the machine has been reduced to $2,500 at the end of its remaining service life. ***The company has found that the current market value of the machine is $10,000***.

# Cont'd

- The company has been offered a chance to purchase another printing machine for $15,000, over its 3- year useful life, the machine will reduce the usage of the labor and raw materials sufficiently to cut operating costs from $8,000 to $6,000. It is estimated that the new machine can be sold for $5,500 at the end of year 3.
- ***Assuming that the firm's interest rate is 12%, decide whether the replacement is justified now.***

- Air Links, a commuter airline company, is considering replacing one of its baggage-handling machines with a newer and more efficient one. The current book value of the old machine is $50,000 and it has a remaining useful life of 5years. The salvage value expected at the end of 5years is 0, but the company can sell the machine now to another firm in the industry for $10,000.

The new baggage-handling machine has a purchase price of $120,000 and an estimated useful life of 7years. It has an estimated salvage value of $30,000 and is expected to realize economic savings on electric power usage, labor, and repair costs and also to reduce the amount of damaged luggage. In total, an annual savings of $50,000 will be realized if the new machine is installed. The firm uses a 15% MARR. Should the machine be replaced now? What is the sunk cost? Use opportunity cost or outsider's point of view approach.

- **A company purchased machine X a year ago for Rs.8500 with the following characteristics,**

**Remaining service life- 5years**

**Salvage value- Rs.1000**

**Operating expenses- Rs.8000/year**

**At the end of 1st year a salesman offers machine Y for Rs.11500 which has estimated life of 5 years, salvage value of Rs.1500 and an operation cost of Rs.5500/year due to improvement. The salesman offers Rs.3500 for machine X, if machine Y is purchased. Assume an interest rate of 8% and determine the best course of action by using Outsider's point of view and Cash flow approach.**

# CASH FLOW APPROACH

# Cash flow approach

**Problem 1:**

**A company purchased machine X a year ago for Rs.8500 with the following characteristics,**

**Remaining service life from now- 5 years**

**Salvage value- Rs.1000**

**Operating expenses- Rs.8000/year**

**A salesman offers machine Y for Rs.11500 which has estimated life of 5 years, salvage value of Rs.1500 and an operation cost of Rs.5500/year due to improvement. The salesman offers Rs.3500 for machine X, if machine Y is purchased. Assume an interest rate of 8% and determine the best course of action by cash flow approach?**

# CASH FLOW APPROACH- FOR EQUAL LIFE

- This approach is based on the fact that-
- If the challenger is selected, the defender's present market value is a cash inflow to the challenger.
- Alternatively, if the defender is selected there is no actual expenditure of cash for the organization.
- Hence defender's first cost is taken as zero and the market value of the defender is subtracted from the challenger's first cost.

# WHAT HAPPENS FOR UNEQUAL LIFE?

**IN THE ABOVE PROBLEM IF THE CHALLENGER HAS A LIFE OF 10 YEARS.**

***CONCLUSION***

- **The annual saving of replacing m/c A by m/c B considering the outsider's point of view is Rs.1595.85/year.**
- **By cash flow approach is Rs.1240.84/year (sometimes decision may be reverted)**
- **The error is due to the market value of m/c A is Rs.3500, which is annualized over a period of 10 years. Actually it is to be annualized for 5 years since its life is 5 years.**

**HENCE CASH FLOW APPROACH CANNOT BE USED WHEN THE DEFENDER AND CHALLENGER HAS UNEQUAL LIVES. ONLY OUTSIDER'S POINT OF VIEW IS TO BE USED.**

# POLICY OF USING SUNK COST

In problem 1, if the present book value of m/c X is Rs.7250 and if the company decides to recover the sunk cost it has incurred in m/c x by m/c y, what error in equivalent annual costs will result in making the comparison of financial desirability of the 2 machines?

# 2

An 8 year old asset may be replaced with either of the two new assets. Current data for each alternative are given below, using the cash flow approach and interest rate of 18% per year. Determine the best course of action.

| Course of action | Current asset (Rs) | Challenger 1 (Rs) | Challenger 2 (Rs) |
|---|---|---|---|
| First cost | - | 30,000 | 54,000 |
| Defender trade | - | 10,500 | 7,500 |
| Annual cost | 9,000 | 4,500 | 3,600 |
| Salvage value | 1,500 | 3,000 | 1,500 |
| Life, years | 5 | 5 | 5 |

# Conclusion

- It can be seen that the decision has reversed when the sunk cost is added to the challenger's first cost.
- By adding the sunk cost to the first cost of the challenger an attempt has been made to cover up the mistakes of past estimation, and this in turn penalize the challenger.

**Hence using outsider's point of view, which seems to be a economically a sound decision.**

# Comparative Use Value of the Asset

- Use value of the old asset is the balance of the investment remaining in it, at a point of time when it is compared with the new asset.
- That is, **calculating the present value** of the machine to be replaced **(X)** which will result in **annual cost equal** to annual cost of replacement (**challenger).**

$$\mathbf{EUAC_{defender} = EUAC_{challenger}}$$

# 3

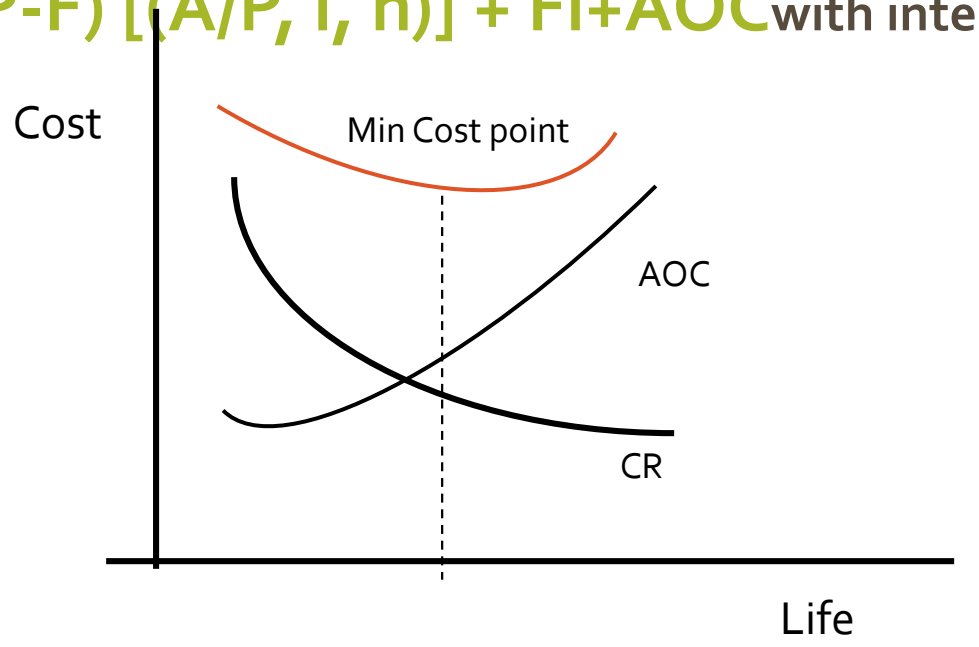
- A soft drink bottler purchased a bottling machine 2years ago for $16800. at that time it was estimated to have a service life of 7 years with no salvage value. Annual operating cost of the machine amounted to $4000.
- A new bottling machine is being considered which would cost $20000 but would match the output of the old machine for an annual operating cost of $1800. The new machine serviceable life is 5years with no salvage value. Current market price is $ 5,000 for the old machine. The interest rate is 10%.

a. Using outsiders point of view and cash flow approach evaluate the best choice.

# Economic life of an asset

- Minimum cost life- optimum time for replacement
- EUAC = Capital Recovery + AOC with interest

**EUAC = [(P-F) [(A/P, i, n)] + Fi+AOC with interest**



# example

An asset purchased 3 years ago is now challenged by a new piece of equipment. The present market value of the defender is Rs.130000. anticipated salvage values and Annual Operating Costs (AOC) for the next 5 years are given in the table. What is the minimum cost life to be used while comparing this defender with a challenger if a 10% year return is required.

| Life in years | Salvage value | OC |
|---|---|---|
| 1 | Rs 90,000 | Rs 25,000 |
| 2 | Rs 80,000 | Rs 27,000 |
| 3 | Rs 60,000 | Rs 30,000 |
| 4 | Rs 20,000 | Rs 35,000 |
| 5 | Rs 0.00 | Rs 45,000 |

# solution

**CR(i) = (P-F) (A/P, i, n) + Fi**

Finding for n=1, 2, 3, 4, 5

n=1,

1.10

CR(i) = **(1,30,000-90,000) (A/P, 10,1)** + 90000 x 0.1= **53000**

n=2,

0.5762

CR= **(1,30,000-80,000) (A/P, 10,2)** + 80000 x 0.1 = **36810**

n=3,

0.4021

CR= (1,30,000-60,000) (A/P, 10,3) + 60000 x 0.1 = **34147**

n=4,

0.3155

CR= (1,30,000-20,000) (A/P, 10,4) + 20000 x 0.1 = **36705**

n=5,

0.2638

CR= (1,30,000-0) (A/P, 10,5) + 0 = **34294**

Equivalent Annual Operating Costs for n= 1,2,3,4,5

n= 1, A= 25,000

n=2,

A= [25000 (P/F,10,1) + 27000 (P/F,10,2)] x (A/P, 10,2)

= 25952

n=3,

A= [25000 (P/F,10,1) + 27000 (P/F,10,2) + 30000 (P/F, 10,3)] x (A/P, 10,3)

= 27174

n=4,

[25000 (P/F,10,1) +27000 (P/F,10,2) +30000 (P/F,10,3) +35000 (P/F, 10,4)] x (A/P, 10,4)

= 28861

n=5 A= [25000 (P/F,10,1) + 27000(P/F,10,2) + 30000 (P/F,10,3) + 35000 (P/F, 10,4) +

45000 (P/F,10,5)] x (A/P, 10,5)

= 31504

# TABULATIONS

| Year | CR (i) | AOC | EUAC |
|---|---|---|---|
| 1 | 53000 | 25000 | 78000 |
| 2 | 36810 | 25952 | 62762 |
| 3 | 34148 | 27174 | 61322 |
| 4 | 36702 | 28861 | 65563 |
| 5 | 34294 | 31504 | 65798 |

Minimum total EUAC occur at year 3.

Hence economic life of the asset is 3 years

# *Replacement analysis using economic life*

- Three years ago a chemical processing plant installed a system at a cost of $ 20,000 to remove pollutants from waste water that is discharged into a nearby river. The present system has **no present salvage value** and will cost **$14500 to operate next year**, with the operating cost expected **to increase at the rate of $500 per year** thereafter.
- A new system has been designed **to replace** the existing system **at a cost of $10000**. The new system is expected to have **first year operating of $9000** with these costs **increasing at the rate of $1000 per year.** The new system is estimated to have a useful life of 12years. The salvage values of **both** the **system at any future time** are expected to **be zero**. If the interest rate is 12% conduct replacement analysis based on the economic life of the asset.

An asset with a first cost of $250,000 is expected to have a maximum useful life of 10 years and a market value that decreases $25,000 each year. The annual operating cost is expected to be constant at $25,000 per year for first 5 years and to increase at a substantial rate of 25% per year thereafter. The interest rate is 4% per year. Calculate the Economic Service Life of the asset.