ECONOMIC ANALYSIS
FOR
ROBOTICS

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INTRODUCTION

- The economy is an important issue while setting up a new automated firm. An economic analysis of the proposed engineering project must be done. On the basis of this analysis, the management usually decides the feasibility of the project.

- To perform the economic analysis of the proposed robot project, we require certain basic information about the project. This information includes the following:

1. Type of robot installation.

2. Cost of robot installation.

3. Production cycle time.

4. Savings and benefits resulting from the project.

TYPE OF ROBOT INSTALLATION

- There are two basic categories of robot installation:

  ➢ **New application:** Here we have to begin from the scratch. So we are in a need for new facilities, and the robot installation is the only facility to satisfy that need. In this case, the best alternative is selected after comparing various alternatives and the selected alternative should meet the investment criteria of the firm.

  ➢ **Existing application:** Here, the robot is employed as a substitute for the human labour. In this scenario, the economic justification of the robot installation depends on how inefficient and costly the manual method is, rather than the absolute merits of the method.

- In either of these situations, certain basic cost information is needed in order to perform the economic analysis.

COST DATA REQUIRED FOR THE ANALYSIS

- The cost data required for the economic analysis involves the following:

  ➢ Investment costs

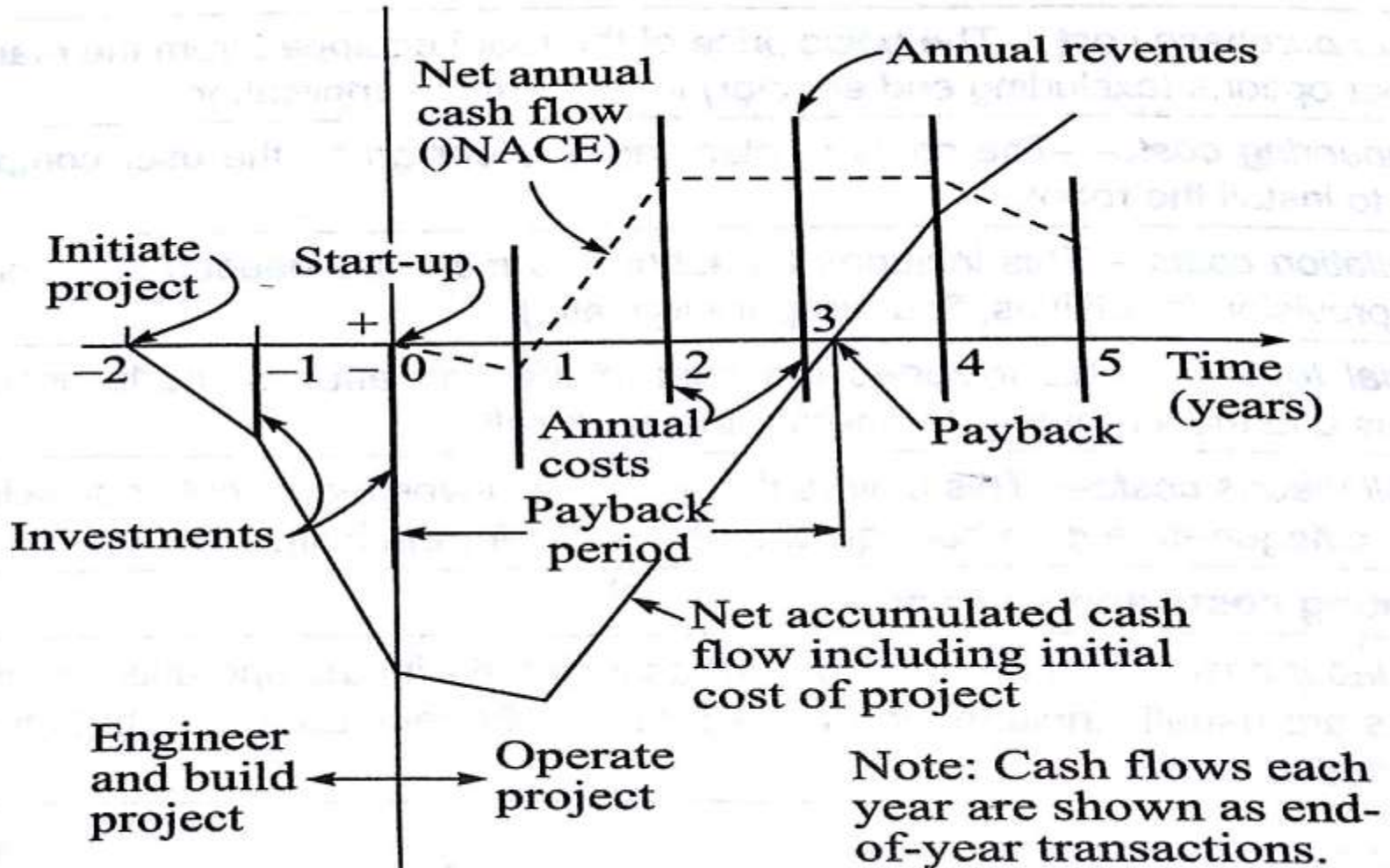 ➢ Operating costs

Investment costs	**Operating costs**
✓Robot purchase cost	✓ Direct labour cost
✓Engineering cost	✓ Indirect labour cost
✓Installation cost	✓ Maintenance cost
✓Special tooling cost	✓ Utilities cost
✓Miscellaneous cost	✓ Training cost

LIFE CYCLE OF CASH FLOW

Net Annual Cash flow (NACF) = Revenues – Operating cost

METHODS OF ECONOMIC ANALYSIS

• The methods of economic analysis are listed below:

➢ Payback (or payback period) Method

➢ Equivalent Uniform Annual Cost (EUAC) Method

➢ Rate on Investment (ROI) Method

PAYBACK PERIOS METHOD

- Payback period means the period of time that a project requires to recover the money invested On it.

- The payback period of a project is expressed in years and is computed using the following formula:

$$n = \frac{IC}{NACF}$$

Where   n = Payback period   **Assumptions:**

        IC = Investment cost   ✓ NACF is + ve. [Revenues > Operating Cost]

        NACF = Net Annual Cash Flow ✓ All cash flows occur at the end of the year.

        ✓ All the investments are done at beginning of the year.

        ✓ NACF is calculated at the end of the year.

- Most of the companies require a payback period of not more than two to three years.

Ex1 – the total investment cost is estimated to be Rs. 1,00,000 for a particular robot project. The total operating costs (labour, maintenance, and other annual expenses) are expected to be Rs 20,000 per year and the anticipated revenue from the robot installation are Rs. 65,000 annually. It is expected that the robot project will have a service life of 5 years. Determine the payback period that is expected of the investment.

Sol: The net cash flow for the robot project is

Rs 65,000 - Rs 20,000 = Rs. 45,000

N = 1,00,000/45,000 = 2.2 years

Disadvantage of payback period method:
It ignores the time value of money

EUAC METHOD

- The equivalent uniform annual cost (EUAC) is the annual cost of owning an asset over its entire life. Equivalent uniform annual cost is often used by firms for capital budgeting decisions. Equivalent uniform annual cost is calculated as:

$$= \frac{\text{Asset Price} \times \text{Discount Rate}}{1 - (1 + \text{Discount Rate})^{-\text{Number of Periods}}}$$

- This method converts all of the present, future investments and the cash flows into their equivalent uniform cash flows over the anticipated life of the project. This is accomplished by using various interest factors associated with engineering economic calculations.

- When the company is to be started it must select the minimum attractive rate of return (MARR). This is used to decide whether funding is to be made or not.

- If the sum of **EUAC > 0** then the company is attractive. If the sum of **EUAC < 0** then the company is non attractive.

EX2: In Ex 1 , the company uses a 30% MARR as a criterion for selecting its investment projects. As mentioned in Ex 1 the robot project is expected to have a 5-year service life and that is what we shall use in determining the values for any interest factors required in our calculations.

Sol:

- The annual operating cost Rs 20,000 and the annual revenues Rs 65,000 are already expressed as uniform annual cash flows.

- The initial investment cost Rs 1,00,000 must be converted to its equivalent uniform annual cash value using the capital recovery factor from appendix (refer book)

- EUAC = 1,00,000 (A/P, 30%, 5) + 65,000-20,000
- EUAC = -1,00,000(0.41058) + 45,000
- EUAC = +Rs. 3942

- Since the uniform annual cost value in positive this robot project would be a good investment

ROI METHOD

- This method determines the rate of returns on the proposed work based on estimated cost and revenues.

- To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment, and the result is expressed as a percentage or a ratio.

- The return on investment formula:

$$ROI = \frac{(\text{Gain from Investment} - \text{Cost of Investment})}{\text{Cost of Investment}}$$

- This rate of return is compared with company's MARR to determine whether the investment is justified or not.

THANK YOU