CB 311
Introduction to Construction Management

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Economic Comparisons

Money based – P, A, F, B/C
Interest based - i
Time based - n

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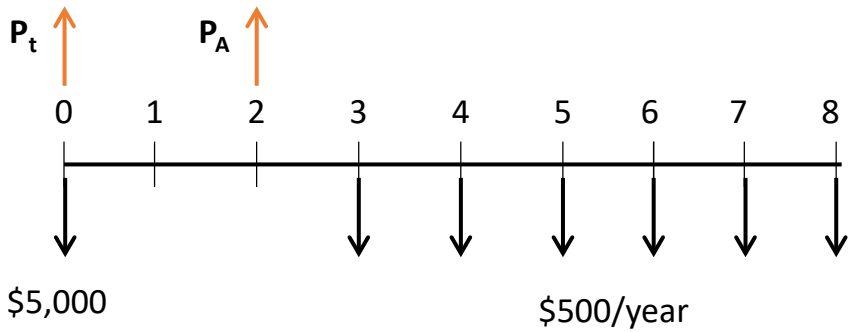
Example

- A person buys a piece of property for $5,000 down and deferred annual payments of $500 a year for 6 years starting 3 years from now. What is the present worth of the investment if the interest rate is 8% per year?



$ 6,981.61

Present worth & Capitalized-Cost Evaluation

- Comparison of **Equal-lived Alternatives**
- Example: Make a present worth comparison of equal-service machines for which the costs are shown below if i=10%

	Type A	Type B
First cost, P	2,500	3,500
Annual operation cost	900	700
Salvage value	200	350
Life, years	5	5
	5,787.53	**5,936.23**

Present worth & Capitalized-Cost Evaluation

- Comparison of **Different-lived Alternatives**
- i=10%

	Machine A	Machine B
First cost, P	11,000	18,000
Annual operation cost	3,500	3,000
Salvage value	1,000	2,000
Life, years	5	10
	61,730.29	**35,662.61**

Capitalized Cost

- Capitalized cost refers to the present worth value of a project that is assumed to last forever.
- Certain public work projects such as dams, irrigation systems, and rail roads fall into this category
- Capitalized Cost = EUAW/i

  (EUAW = Equivalent Uniform Annual Worth)

- CC = A/i

Example

- A city plans a pipeline to transport water from a distant watershed area to the city. The pipeline will cost LE8 million and have an expected life of seventy years. The city anticipates it will need to keep the water line in service indefinitely. Compute the capitalized cost assuming 7% interest.

$A = P(A/P, i, n) = LE8,000,000(0.0706)$

$= LE565,000$

Now, the infinite series payment formula could be applied for $n = \infty$:

$CC = A / i$

$= 565,000 / 0.07$

$= LE8,071,000$

Economic Comparisons

Benefit-Cost Ratio

Benefit/Cost Ratio Evaluation

- The method for selecting alternatives that is most commonly used by federal agencies for analyzing the desirability of public works projects is the benefit / cost ratio (B/C ratio). As its name suggests, the B/C method of analysis is based on the ratio of the benefits to costs associated with a particular project. A project is considered to be attractive when the benefits derived from its implementation exceed its associated costs.

Benefits, Disbenefits & Cost Calculations

- There are several forms of (B/C) ratios. The Traditional or Conventional B/C ratio, probably the most widely used is calculated as follows:

$$\frac{B}{C} = \frac{benefits - disbenefits}{costs}$$

- Benefits, disbenefits and costs must be in same units (P, A, or F).
- A (B/C) ratio greater than 1.0 indicates that the project evaluation is economically advantageous

Benefits, Disbenefits & Cost Calculations

- The modified (B/C) ratio, which is gaining support, included operation and maintenance (O&M) costs in the numerator and treats them in a manner similar to disbenefits as follows:

$$Modified\ \frac{B}{C} = \frac{benefits - disbenefits - O\&M\ costs}{Initial\ Investment}$$

- A benefit /cost evaluation that does not involve a ratio is based on the difference between benefits and costs, that is, (B-C). In this case, if (B-C) is greater than or equal to zero, then the project is acceptable.

Example

Two alternative routes are being considered by the state highway department for location of a new highway. Route A, costing $4,000,000 to build, will provide annual benefits of $125,000 to local business. Route B cost $6,000,000 and will provide $100,000 in benefits. The annual cost of maintenance is $200,000 for (A) and $120,000 for (B), respectively. If the life of the road is 20 years and an interest rate of 8% per year is used, which alternative should be selected on the basis of B/C analysis?

Solution

Route A

- **Benefits** → 125,000 per yr.
- **Costs**
  - Initial cost = P= $4,000,000 = A=$407,000 per yr. (i=8%, n=20)
- **Maintenance**
  - 200,000 per yr.
- **B/C = 125,000/607,000 = 0.21**

Route B

- **Benefits** → 100,000 per yr.
- **Costs**
  - Initial cost = P= $6,000,000 = A=$611,100 per yr. (i=8%, n=20)
- **Maintenance**
  - 120,000 per yr.
- **B/C = 100,000/731,000 = 0.14**

Route (A) would be accepted

Example

- Two machines are being considered for purchase. If the interest rate is 10%, which machine should be bought?

	Machine X	Machine Y
Initial cost	200	700
Annual benefits	95	120
Salvage value	50	150
Useful life, years	6	12

Solution

- Machine X:
  - EUAC = 200 (A/P,10%,6)-50 (A/F,10%,6) = 40
  - EUAB = 95

  → B/C = 95/40 = 2.37
- Machine Y:
  - EUAC = 700 (A/P,10%,12)-150 (A/F,10%,12) = 96
  - EUAB = 120

  → B/C = 120/96 = 1.25