

# EE-287 Engineering Economics

**Lecture Title:**

Benefit/Cost Analysis (**Single Project**)

**Instructor:**

Dr. Muhammad Amir (DEE, UET, Peshawar)



**Put on your headphones. Click Slideshow. Play the Speaker icon on each Slide and listen to the Lecture. Change Slide through Right/Left arrow keys or Page Down/Page Up keys**

## Benefit/Cost Ratio (Model - 1)

$$\text{Benefit/Cost Ratio} = B/C = \frac{PW \text{ of Benefits}}{PW \text{ of Costs}} = \frac{AW \text{ of Benefits}}{AW \text{ of Costs}} = \frac{FW \text{ of Benefits}}{FW \text{ of Costs}} \text{-----(1)}$$

### Important:

1. The **Sign convention** for B/C analysis is +ve (positive) signs, so costs are preceded by a +ve sign – **WHY?** – because it is an analysis and not a cash flow {as we already know that costs are outflows and are represented by –ve (negative) sign}.
2. Salvage values are subtracted from costs.
3. Disbenefits are subtracted from benefits and placed in the numerator.
4. Decision **guideline** for a single project:

If **B/C ≥ 1.0** (Accept the project as it is economically feasible)

(Governmental ≥ & Private >)

If **B/C < 1.0** (Reject the project as it is economically infeasible)

(Governmental may be acceptable & Private completely reject)

So,

$$B/C = \frac{\text{Benefits} - \text{Disbenefits}}{\text{Costs}} = \frac{B - D}{C} \text{-----(2)}$$



## Modified Benefit/Cost Ratio (**Model - 2**)

$$\text{Modified Benefit/Cost Ratio} = \frac{\text{Benefits} - \text{Disbenefits} - M \& O \text{ Costs}}{\text{Initial Investment}} \text{-----}(3)$$

### **Important:**

In equation (3), estimated Salvage value is included in the **denominator** with a –ve (negative) sign.

## Benefit & Cost difference measure of worth (**Model - 3**)

**This measure of worth is not a ratio but simply a difference**

$$\begin{aligned} &\text{Benefits} - \text{Costs} \\ &B - C \end{aligned}$$

If  $B - C \geq 0$  (**the project is economically acceptable**)

**Example:** Lets suppose if, Benefits (B) = 10, Disbenefits (D) = 8 and Costs (C) = 5 then,

**Scenario 1:** Subtracting Disbenefits from Benefits:  $B - C = (10 - 8) - 5 = -3$

**Scenario 2:** Adding Disbenefits to Costs:  $B - C = 10 - (8 + 5) = -3$

We get the same result (**Reject**) from both scenarios.



## Comprehensive Example

**Example:** The government is to award Rs.150 million in grants to Universities to improve the teaching of Fundamentals of Engineering. The grants are for 10 years and will create Rs.10.5 million per year savings in faculty savings and student related expenses. The government uses a discount rate of 6% per year. But these grants will take Rs.20,00,000/- from other programs. To make the grants program successful, Rs.50,00,000/- per year operating cost will be taken from the regular M&O budget. Use the Benefit Cost analysis methods to determine if the government's grants program is economically justified or not.

**Solution:** We will use AW analysis here and all three Benefit Cost models can be applied.

AW of investment cost:                      150,000,000 (A/P, 6%, 10)  
= Rs.20,380,194/- per year (How we got this?)

By using relation 2 from Uniform series formulas:  $A = P[i(1 + i)^n / (1 + i)^n - 1]$

**and as we know:**

AW of M&O costs:      Rs.50,00,000/- per year  
AW of Benefit:        Rs.105,00,000/- per year  
AW of Disbenefit:     Rs.20,00,000/- per year



## Comprehensive Example (Continued)

**1<sup>st</sup> analysis:** If we use equation (2) from Slide 2:

$$B/C = \frac{\text{Benefits} - \text{Disbenefits}}{\text{Costs}} = \frac{B - D}{C} \text{-----(2)}$$

Where, C = AW of investment cost + AW of M&O costs

$$\text{So (2) implies, } B/C = \frac{105,00,000 - 20,00,000}{20,380,194 + 50,00,000} = 0.33 \text{ (Not justified as } B/C < 1.0)$$

**2<sup>nd</sup> analysis:** If we use equation (3) from Slide 3:

$$\text{Modified Benefit/Cost Ratio} = \frac{\text{Benefits} - \text{Disbenefits} - M \& O \text{ Costs}}{\text{Initial Investment}} \text{-----(3)}$$

$$\begin{aligned} \text{So (3) implies, Modified Benefit/Cost Ratio} &= \frac{105,00,000 - 20,00,000 - 50,00,000}{20,380,194} \\ &= 0.2 \text{ (Not justified as } B/C < 1.0) \end{aligned}$$

**3<sup>rd</sup> analysis:** If we use the B – C model:

$$B - C = (B - D) - (C + M\&O \text{ costs})$$

$$B - C = (105,00,000 - 20,00,000) - (20,380,194 + 50,00,000)$$

$$B - C = -16,880,194\text{Rs (Not justified as } B - C < 0)$$



**Thank You for listening**

