Iqra National University

Department of Civil Engineering

Final- Term Examination 2020

Discipline: MS Civil Engineering

Course Title: Construction Financial Management

Instructor Name: Engr. Dr. Muhammad Zeeshan Ahad

SUBMITTED BY: AFZAL HUSSAIN

ID: 15429

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Q1. What is net present value and Equivalent Annual cost? What is the benefit of Benefit-cost ratio?

Answer: Present Value:

Present value (PV) is the current value of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are discounted at the discount rate, and the higher the discount rate, the lower the present value of the future cash flows.

Present value is the concept that states an amount of money today is worth more than that same amount in the future. In other words, money received in the future is not worth as much as an equal amount received today.

PV Formula:

$$\text{Present Value} = FV / (1+r)^n$$

Where: FV = Future Value, r = Rate of return, n = Number of periods

Equivalent Annual cost:

Equivalent annual cost (or EAC) is the cost per year of owning, operating, and maintaining an asset over its lifetime. Equivalent annual cost (EAC) is the annual cost of owning and maintaining an asset determined by dividing the net present value of the asset purchase, operations and maintenance cost by the present value of annuity factor. It is a capital budgeting tool used by companies to compare assets with unequal useful lives.

Formula:

$$\text{Equivalent Annual Cost} = NPV \times r / 1 - (1 + r)^{-n}$$

Benefit of Benefit-cost ratio:

The benefit of using the benefit-cost ratio (BCR) is that it helps to compare various projects in a single term and helps to decide faster which projects should be preferred and which projects should be rejected.

If a project has a BCR greater than 1.0, the project is expected to deliver a positive net present value to a firm and its investors. If a project's BCR is less than 1.0, the project's costs outweigh the benefits, and it should not be considered.

Formula:

Benefit-Cost Ratio = PV of Benefit Expected from the Project / PV of the Cost of the Project

Q1 (i) The construction cost of a service reservoir for supplying water to a housing estate is estimated to be PKR 9,000,000,000. The annual operation and maintenance cost are estimated to be PKR 375,000,000 per year. The annual income from the collection of water supply fee from the users will be PKR 1,050,000,000. Assuming a time horizon of 30 years and taking i as 5% p.a., find out if the project is financially feasible. Use both methods equivalent annual costs and present value method also use benefit-cost ratio.

Solution:

Question 1:-

a) Answer:-

i) PV for benefit in 30 years:-

$$\Rightarrow F \times \left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$$

$F = 1050,000,00$
$i = 0.05$
$n = 30$

$\Rightarrow 1050,000,00 \times (15.3724)$.

$\Rightarrow$ PKR 1614102000

ii) Present value of construction cost:.

PV of operation and Maintaince cost:.

$$\Rightarrow F \times \left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$$

$F = 375,000,000$
$n = 30$
$i = 0.05$

$\Rightarrow 375,000,000 \times (15.3724)$.

$\Rightarrow$ PKR 5764650,000

iii) NPV :-

NPV = (PV of total Benefit − PV of total cost)

⇒ (16141020000 − 57645,000)

NPV = Rs −4150548000

The −ve NPV shows that the project is not feasible.

b) Equivalent annual cost Method :-

i) Annual Benefit = 1050,000,000.

ii) Annual operation and Maintance cost:

⇒ 375,000,000.

Equivalent Annual cost of construction:

$$\Rightarrow F \times \left[\frac{i(1+i)^4}{(1+i)^4 - 1} \right].$$

⇒ 9000,000,000 × (0.06505).

⇒ PKR 58545000.00

(3)

(iii) Net Annual Benefit (NAB):-

NAB ⇒ 1050,000,000 − 585450000.00

⇒ PKR −480,450,0000

-ve value show that project is not feasible.

Q2. What is internal rate of Return? What is the difference between IRR and NPV? Also Please explain Inflation?

Answer:

Internal rate of return (IRR) is the minimum discount rate that management uses to identify what capital investments or future projects will yield an acceptable return and be worth pursuing. The IRR for a specific project is the rate that equates the net present value of future cash flows from the project to zero. In other words, if we computed the present value of future cash flows from a potential project using the internal rate as the discount rate and subtracted out the original investment, our net present value of the project would be zero.

$$IRR = \frac{(Cash\ flows)}{(1+r)^i} - Initial\ Investment$$

Where:
Cash flows= Cash flows in the time period
r = Discount rate
i = Time period

Difference between NPV and IRR:

The Net Present Value (NPV) method calculates the dollar value of future cash flows which the project will produce during the particular period of time by taking into account different factors whereas the internal rate of return (IRR) refers to the percentage rate of return which is expected to be created by the project.

- NPV expressed in absolute terms while IIR expressed in percentage terms.
- Decision making in NPV is easy while IRR does not help in decision making.
- NPV shows cost of capital rate while IRR shows internal rate of return.
- Variation in the cash out flow will not affect by NPV while will show negative or multiple IRR.

Inflation:

- Inflation is a situation of rising prices in the economy.
- A more exact definition of inflation is a sustained increase in the general price level in an economy. Inflation means an increase in the cost of living as the price of goods and services rise.
- The rate of inflation measures the annual percentage change in the general price level.
- Inflation leads to a decline in the value of money. "Inflation means that your money won't buy as much today as you could yesterday."
- If the prices of goods rise the same amount of money will purchase a smaller quantity of goods.

Types of inflation:

Cost-push inflation: when a rise in prices is caused by a rise in the cost of production, such as higher oil prices

Demand-pull inflation: when a rise in prices is caused by rising aggregate demand and firms pushing up prices due to the shortage of goods.

Q2: (11) : An Asset was purchased four years ago at PKR 9,000,000 and had a life of four years. This investment resulted in actual annual cash receipt of PKR 2,100,000, 2,700,000, 3,450,000, 4,200,000 respectively in the past four years. These figures are found from the accounting record of each year in the past four years. The average inflation rate in these four years was 4% p.a. find the real Internal Rate of Return (IRR).

Question (2)

Part (b). Answer:

End of Year	(1) NCF	(2) $\left[\frac{1}{1+i)^n}\right]$	(3) (DCF) 8% 1×2	(4) $\left[\frac{1}{(1+i)^n}\right]$	(5) (DCF) 1×4.
0	-9000,000	1.0000	-9000,000	1	-9000,000
1	21,00,000	0.9259	1944390	0.9871	2072910
2	2700,000	0.8573	2314710	0.9744	2630880
3	345,0000	0.7938	2738610	0.9619	3318555
4	42,00,000	0.7350	3087000	0.9496	3988320
			1084710		3010665

$$i = 8\% + \left(\frac{1084710}{1084710 + 3010665}\right) \times (13 - 8)\%$$

$$i = 8\% + \left(\frac{1084710}{4095375}\right) \times 5\%$$

$$i = 9.32\%$$

$\Rightarrow i = (1+i)(1+6)-1$

$= (1+0.093)(1+0.034)-1$

$= (1.093)(1.034)-1$

$\Rightarrow 0.136.$

Taking % to i gives $i = 8.136\%$.

Answer.

Q3.A subcontractor specialized in wastewater disposal makes and sells cast iron pipes, steel pipes and concrete pipes. The following variable costs and selling prices/sales volumes are obtained from the cost accounting department and sales department respectively.

Question (3) ①

Answer:- (part a)

BEP of the Subcontractor:-

Given Data:-

pipe	P	V	volume (% Rs sales)
cast Iron	Rs 450,000	Rs 300,000	25%
steel	Rs 525,000	Rs 375,000	35%
concrete	Rs 600,000	Rs 450,000	40%

Contribution per unit expressed in percentage

$\Rightarrow [(P-V)/P] \times 100\%$

i) Contribution per unit due to cast iron pipes

$\Rightarrow [(450,000 - 300,000)/450,000] * 100\%$

$\Rightarrow$ 33.33% $\Rightarrow$ 0.333

ii) Contribution per unit due to steel pipes:-

$\Rightarrow [(525,000 - 375000)/525,000] * 100\%$

$\Rightarrow$ 28.57% $\Rightarrow$ 0.2857

③ Construction per unit to concrete pipe

[(600,000 − 450,000)/600,000] * 100 %.

→ 25.00 % ⇒ 0.25

Contribution % of scale:-

⇒ Cast iron pipes ⇒ 33.33 % x 25 % = 8.33.

Steel pipes ⇒ 28.57 % x 35 % = 9.99.

Concrete pipes ⇒ 25.00 % x 40 % = 10

⇒ 28.32 %.

This 28.32 % is the total contribution per overall scale in Rupees.

⑨ BEP = FC/Contribution = $ 200 M / 0.2832

⇒ ⇒ 706.2

Therefore at BEP the Subcontractor is operating at 78.4 % of capacity

(i.e 706/900 = 78.4 %)

xt (B) :-

AT 95% of capacity.

Profit = TR - TC.

$\Rightarrow (900m \times 95\%) - VC - VF$

$= 855m - 810m \times (1 - 02832) - 200m.$

$\Rightarrow 855m - 580m - 200m$

$\Rightarrow$ **$75 Million**

Q4: A sewage pumping station is being designed. Three possible pumping schemes are proposed and the itemized costs of each scheme are shown below:

What is the most economical range of pumping time in hours/year for each scheme? (Take i = 5% p.a. and maximum pumping hours in a year = 8,760 hours)

Question:- 4. (1)

Answer:-

Scheme A:-

Equivalent Annual Cost of Installation and Maintance:-

$$\Rightarrow \$120,000 \times \left[\frac{0.05(1+0.05)^{14}}{(1+0.05)^{14}-1}\right] + \$200,000 \times \left[\frac{0.05(1+0.05)^{30}}{(1+0.05)^{30}-1}\right] + \$18000$$

$$\Rightarrow \$120,000 \times 0.1010 + \$200,000 \times 0.0651 + \$18000$$

$$\Rightarrow \$43,140$$

Scheme B:- Equivalent annual cost of Installation and Maintance:-

$$\Rightarrow \$190,000 \times \left[\frac{0.05(1+0.05)^{16}}{(1+0.05)^{16}-1}\right] + \$160,000 \times \left[\frac{0.05(1+0.05)^{30}}{(1+0.05)^{30}-1}\right]$$

$$+ \$16,500.$$

$$\Rightarrow \$44,453$$

Scheme C: Equivalent annual cost of Installation and Maintainence =

$$\Rightarrow \$285,000 \times \left[\frac{0.05(1+0.05)^{20}}{(1+0.05)^{20}-1}\right] + \$100,000 \left[\frac{0.05(1+0.05)^{30}}{(1+0.05)^{30}-1}\right]$$

$$+ \$16000$$

$$\Rightarrow \$285,000 \times 0.0802 + \$100,000 \times 0.0651 + \$16000$$

$$\Rightarrow \boxed{\$45,367}$$