

COST ESTIMATION

ESTIMATION OF TOTAL INVESTMENT COST:

1) Direct Cost

a) Purchased Cost Equipment

Equipment	Capacity (Q ₁)	Capacity (Q ₂)	Cost (C ₁) \$	Exponent n	Number of Equipment (N)	Cost C ₂ $= C_1 * (Q_2/Q_1)^n * \frac{1105 * N}{1000}$
Centrifugal pump	10hp	15 hp	1600	0.3	4	7987
Centrifuge	1.86 m ² of filter area	0.5 m ²	1x10 ⁵	0.65	1	47045
Crystalliser	100 TPD	5TPD	2.83 x10 ⁵	0.59	3	160200
Heat exchanger	9.3m ²	70m ²	21700	0.78	1	115766
Reactor	3.8m ³	1.34 m ³	12300	0.5	2	16142
Fractionator	4000 trays	150	33x10 ⁵	1	1	1367437
Motors	10 hp	15 hp	12.3 x10 ³	0.56	3	51168
Storage tanks	3.8m ³	3m ³	3.3 x10 ³	0.3	5	5662

Total Equipment Cost = 1.77 x 10⁶ \$

There are also some minor equipments to account for these equipment

$$\begin{aligned}\text{Let total equipment purchase} &= 1.2 * 1.77 * 10^6 \\ &= 2.12 * 10^6 \$ \\ &= 1.008 * 10^8 \text{Rs}\end{aligned}$$

2. Installation cost:

(25-55% of purchased equipment cost)

Considering 30% of purchased equipment cost

$$\Rightarrow 0.3 * 1.008 * 10^8 = \text{Rs } 0.4032 * 10^8$$

3. Instrumentation and control installed cost

(6-30% of purchased equipment cost)

considering 15% of purchased equipment cost

$$\Rightarrow 0.15 * 1.008 * 10^8 = \text{Rs } 0.152 * 10^8$$

4. Piping installation cost

(10-80% of purchased equipment cost)

considering 40% of purchased equipment cost

$$\Rightarrow 0.4 * 1.008 * 10^8 = \text{Rs } 0.4032 * 10^8$$

5. Electrical installation cost

(10-40% of purchased equipment cost)

using 25% of purchased equipment cost

$$\Rightarrow 0.25 * 1.008 * 10^8 = \text{Rs } 0.25 * 10^8$$

6. Buildings process and Auxillaries

(10-70% of purchased equipment cost)

Considering 40% of purchased equipment cost

$$\Rightarrow 0.4 * 1.008 * 10^8 = \text{Rs } 0.432 * 10^8$$

7. Service facilities and yard improvements

(40-100% of purchased equipment cost)

using 60% of purchased equipment cost

$$\Rightarrow 0.6 * 1.008 * 10^8 = \text{Rs } 0.65 * 10^8$$

8. Land

(1-2% of fixed capital investment)

Using 5% of fixed capital investment

$$\Rightarrow 0.05 * 4.62 * 10^9 = \text{Rs} 0.0504 * 10^7$$

Therefore Direct cost = Rs 2.9124 * 10⁸

INDIRECT COST:

(15-30% of fixed capital investment)

A. Engineering and supervision

(15-30% of direct cost)

Using 15% of direct cost

$$\Rightarrow 0.15 * 0.29124 * 10^9 = \text{Rs} 0.4369 * 10^8$$

B. Construction expense and contractors fee

(6-30% of fixed capital investment)

Using 16% of fixed capital investment

$$\Rightarrow 0.16 * 0.29124 * 10^9 = \text{Rs} 0.46 * 10^8$$

C. Contingency

(5-15% of fixed capital investment)

Using 10% of fixed capital investment

$$\Rightarrow 0.1 * 0.29124 * 10^9 = \text{Rs} 0.2912 * 10^8$$

Therefore indirect cost = Rs 1.1353 * 10⁸

Therefore fixed capital investment = Direct cost + Indirect cost

$$= 2.9124 * 10^9 + \text{Rs} 1.1353 * 10^8$$

$$= 4.048 * 10^8$$

Working capital estimation:

(10-20% of fixed capital investment)

Using 15% of fixed capital investment

$$\Rightarrow 0.15 * 4.048 * 10^8 = \text{Rs} 6.07 * 10^7$$

Total capital investment = fixed capital investment + working capital

$$= 4.048 * 10^8 + 6.07 * 10^7$$

$$= \text{Rs} 4.6552 * 10^8$$

ESTIMATION OF TOTAL PRODUCT COST:

Manufacturing cost = direct cost + fixed charges + plant overhead cost

A. FIXED CHARGES:

1. Depreciation:

(10 % of fixed capital investment, 3% of building cost)

$$=4.048*10^8 +6.07*10^7$$

$$=4.6552*10^8$$

2. Local taxes

(1-4% of fixed capital investment)

using 4% of fixed capital investment

$$\Rightarrow 0.04*4.6552*10^8 = \text{Rs } 1.619*10^7$$

3. Insurance:

(0.4-1% of fixed capital investment)

using 0.6% of fixed capital investment

$$\Rightarrow 0.0006*4.6552*10^8 = \text{Rs } 0.243*10^7$$

4. Rent:

(8-12% of fixed capital investment)

using 10% of fixed capital investment

$$\Rightarrow 0.1*4.6552*10^8 = \text{Rs } 4.048*10^7$$

$$\begin{aligned} \text{Therefore fixed charges} &= 0.4169*10^8 + 1.619*10^7 + 0.243*10^7 + 4.048*10^7 \\ &= \text{Rs } 1.008*10^8 \end{aligned}$$

Since fixed charge is (10-20%) of total product cost

$$\text{Therefore, Total product cost} = 1.04*10^9 / 0.15 = \text{Rs } 6.72*10^8$$

B. DIRECT PRODUCTION:

1. Raw materials: (10-50% of total product cost)

Using 30% of total product cost

$$\Rightarrow 0.3*6.72*10^8 = \text{Rs } 0.2016*10^9$$

2. Operating labor: (10-20% of total product cost)

Using 15% of total product cost

$$\Rightarrow 0.15 * 6.72 * 10^8 = \text{Rs } 1.008 * 10^8$$

3. Direct supervisory and Electrical work (10-25% of operating labor cost)

using 12% of operating labor cost

$$\Rightarrow 0.12 * 1.008 * 10^8 = \text{Rs } 0.808 * 10^8$$

4. Utilities: (10-20% of total product cost)

using 15% of total product cost

$$\Rightarrow 0.15 * 6.72 * 10^8 = \text{Rs } 1.008 * 10^8$$

5. Maintenance and repairs (2-10% of fixed capital investment)

using 5% of fixed capital investment

$$\Rightarrow 0.05 * 4.048 * 10^8 = \text{Rs } 0.2024 * 10^8$$

6. Operating supplies: (10-20% of cost for maintenance repairs)

using 15% of cost for maintenance repairs

$$\Rightarrow 0.15 * 0.2024 * 10^8 = \text{Rs } 0.304 * 10^7$$

7. Laboratory charges: (10-20% of operating labor)

using 15% of operating labor

$$\Rightarrow 0.15 * \text{Rs } 1.008 * 10^8 = \text{Rs } 0.1552 * 10^8$$

8. Patents and Royalties: (0-6% of total product cost)

using 5% of total product cost

$$\Rightarrow 0.05 * 6.72 * 10^8 = \text{Rs } 1.56 * 10^8$$

Therefore direct production cost = Rs $5.6 * 10^8$

C. Plant overhead cost:

(50-70)% of (Operating labor + direct supervisory + maintenance)

Using 60%

$$= \text{Rs } 1.21 * 10^8$$

GENERAL EXPENSES:

A. Administrative costs: (40-60% of operating labor cost)

Using 50%

$$\Rightarrow 0.5 * 6.72 * 10^8 = \text{Rs } 0.504 * 10^8$$

B. Distribution and setting costs: (2-20% of total product cost)

Using 10% of total product cost

$$\Rightarrow 0.1 * 6.72 * 10^8 = \text{Rs } 0.672 * 10^8$$

C. Research and development cost: (3% of total product cost)

$$\Rightarrow 0.03 * 6.72 * 10^8 = \text{Rs } 0.2 * 10^8$$

Therefore general expenses = Rs 1.38 * 10⁸

Manufacturing cost = fixed charge + plant overhead cost + direct production

$$= 4.048 * 10^8 + 1.21 * 10^8 + 8.1 * 10^8$$

$$= \text{Rs } 1.34 * 10^9$$

Total production cost = Manufacturing cost + general expenses

$$= 6.72 * 10^8 + 1.38 * 10^8$$

$$= \text{Rs } 8.1 * 10^8$$

Cost of p-nitrotoluene per kg = Rs.160

Cost of o-nitrotoluene per kg = Rs.150

Therefore total income = $160 * 330 * 10^3 + 1777 * 150$

$$= \text{Rs } 7.95 * 10^8$$

Gross earning = Total income – Total product cost

$$= 7.95 * 10^8 - 6.72 * 10^8$$

$$= \text{Rs } 1.23 * 10^8$$

Tax on gross earning = 40% of gross earning

$$= 0.4 * 1.23 * 10^8$$

$$= 0.492 * 10^8$$

Net profit = $0.6 * 1.23 * 10^8 = \text{Rs } 0.738 * 10^8$

Therefore rate of return = (Net profit/Total capital investment)

$$= (0.738 * 10^8 / 4.6552 * 10^8)$$

$$= 0.158$$

Hence the rate of return is **15.8%**