

CHAPTER 7 DRAGLINE COST ANALYSIS

7.1 Cost analysis

Figure 7.1 shows a summary of the costing procedure designed to complete the dragline digging method selection process.

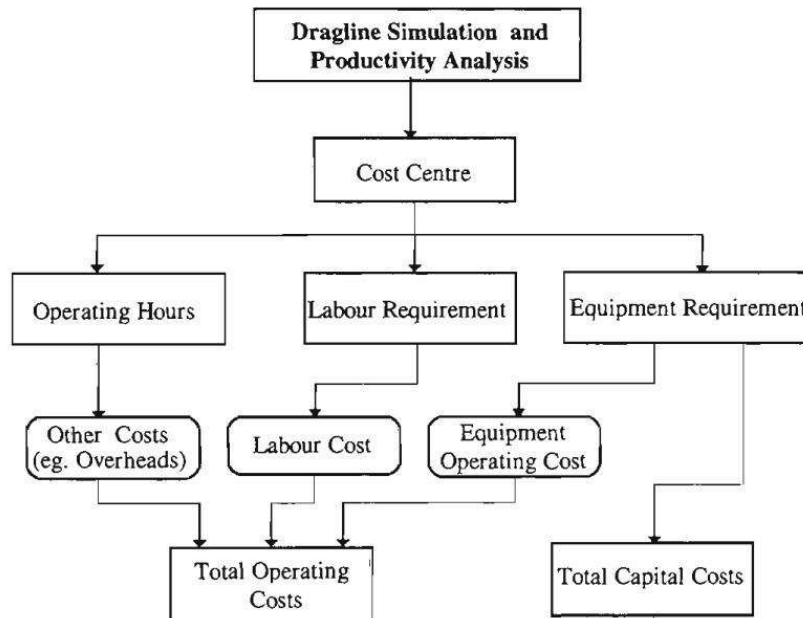


Figure 7.1: Costing flow chart (Modified after Noakes and Lanz, 1993).

7.1.1 Calculation of cost of dragline operation in mines under case study

Calculation of operating cost of 24/96 dragline operation

The following norms have been adopted for calculation purposes:

No. of annual working days = 300

No. of daily shifts = 3

Duration of each shift = 8 hours

Life of Dragline 24/96 in years = 25

No. of operators required for Dragline 24/96 in each shift = 1

No. of helper per shift = 1

The cost calculation has been made on the basis of general information provided by original equipment manufacturers (OEM) and mine management.

Operating and Ownership cost of new dragline 24/96

Consider the following conditions

Cost of Dragline 24/96 = Rs. 1800 million

Life of Dragline 24/96 = 25 years

Depreciation cost for 25 years i.e. annual flat rate of 4%

So, Annual Depreciation Cost = Rs. 1800 million /25 = Rs. 72.00 million

Average annual cost of ownership dragline 24/96

Average annual investment of equipment = $(n+1)/2n$ * cost of dragline 24/96

= Rs. $((25+1)/2*25)$ *1800

= Rs 936.00 million

Assuming annually interest, insurance and tax of the equipment is estimated at the rate of 12.5 % = Rs. 12.5 % of 936.00 million

= Rs. 936.00 * 12.5 % million

= Rs. 117.00 million

Total ownership cost per year = Depreciation cost of equipment per year + cost associated with interest, insurance, and taxes

= Rs. 72.00 + 117.00 million

= Rs. 189.00 million

Operating cost per year

Annual Manpower Cost (Salary and wages)

Six operators are operating the Dragline 24/96 in three working shifts i.e., each 8 hours a day.

Operator Salary per month = Rs. 0.14 million/ operator/month

Operators' monthly salary = Rs. 6 operator * 0.14 million

= Rs. 0.84 million

Operators' annual salary = Rs. 0.84 *12 million

= Rs. 10.08 million

Helper cost @ Rs. 0.05 million/ month/helper

Total helper cost annually = Rs. 0.05 million/helper/month *

3 helper /day*12 months = Rs. 1.80 million

Total Manpower cost annually = (annual operator cost + annual helper cost)

= Rs. 10.08 + 1.80million = Rs. 11.88 million

Annual power/energy consumption by dragline 24/96 on the basis of 13.65 M kWh

Annual power consumption cost @ 7.00/kWh

Annually energy consumption cost by dragline

= Rs. 7.00*13.65 million

= Rs. 95.55 million

Annual lubrication cost (as per rule) = annual lubrication cost @ 30 % of the power consumption

$$= \text{Rs. } 30 \% * 95.55 \text{ million} = \text{Rs. } 28.67 \text{ million}$$

Annual maintenance cost

Routine maintenance cost = 20% of the depreciation cost annually

$$= \text{Rs. } 20 * 72.00 \text{ million}$$

$$= \text{Rs. } 14.40 \text{ million}$$

Major breakdown maintenance cost @ 2% of cost of equipment

$$= \text{Rs. } 2 * 1800 / 100$$

$$= \text{Rs. } 36.00 \text{ million}$$

Total maintenance cost = Routine maintenance cost + Major breakdown maintenance cost

$$= \text{Rs. } 14.40 + 36.00 \text{ million} = \text{Rs. } 50.04 \text{ million}$$

Total annual operating cost = Manpower cost per year + power consumption cost per year + Maintenance cost per year + Lubrication cost per year

$$= \text{Rs. } (11.88 + 95.55 + 50.40 + 28.67) \text{ million} = \text{Rs. } 186.50 \text{ million}$$

Total annual ownership cost and operating cost = Annual ownership cost + Annual operating cost = Rs. 189.00 + 186.50 million = Rs. 375.50 million

Calculation of cost per m³ overburden removed by new dragline 24/96

Operating cost by dragline 24/96 in per m³ of overburden = (total operating cost annually + total ownership cost of annually dragline) / annual overburden removal by dragline in m³

$$= \text{Rs. } 375.50 \text{ million} / 3.48 \text{ Mm}^3 = \text{Rs. } 108.00/\text{m}^3$$

Though the mine has overall stripping ratio of approx. 1:6.7 but the effective stripping ratio for dragline 24/96 is vary from 1:1.3 to 1:1.5 (due to variation of overburden bench height and density of coal). Assume, stripping ratio = 1.5 m³/te. Annual overburden removal by dragline 24/96 was calculated 3.48 Mm³ using equation 7.1.

Then coal exposed by dragline 24/96 = (annually overburden removal by dragline 24/96)/stripping ratio = Rs. 3.48 Mm³/(1.5 m³/te) = Rs. 2.32 million te

Estimated Cost per tonne of coal exposed = Rs. 375.50 million/2.32 million te

= Rs. 161.00 / te of coal exposed.

Using similar calculations, various cost of different dragline models in the mines are calculated and summarised in table 7.1.

Table 7.1: Various cost of different dragline model.

Dragline model	Cost of dragline (In million)	Average annual cost of ownership (In million)	Annual operating cost (In million)	*Per m³ overburden removal cost (In rupees)	*Per tonne of coal exposure cost (In rupees)
24/96	1800	189.00	186.50	108.00	161.00
20/90	1650	172.00	167.00	118.00	164.50
15/90	1500	159.00	154.50	124.00	169.50
10/70	1400	147.00	142.00	127.00	173.00

*As the stripping ratio of the mine vary, so these costs also vary accordingly.