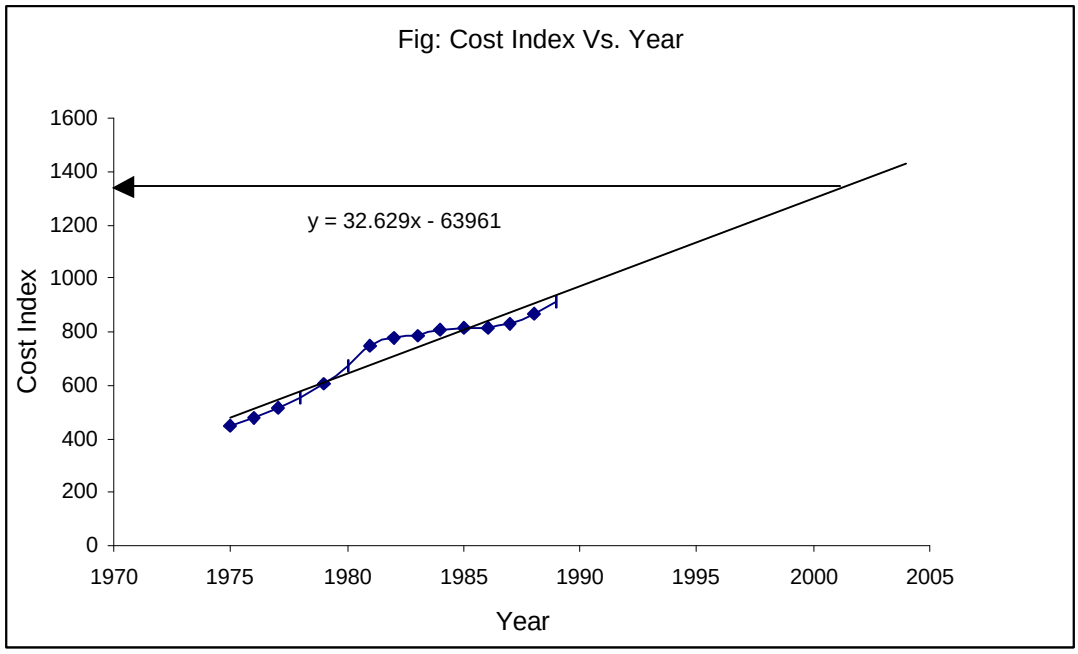
Estimation of total capital investment and production cost

ESTIMATION OF TOTAL CAPITAL INVESTMENT AND PRODUCT COST:

For this cost estimation we assumed the current exchange: 1$=57.48 TK.



Marshall and swift installed equipment index

Year	Process industry
1990(Jan)	924
2001(July)	1350 (From graph)

Cost data on table 25-49 of Perry's chemical engineering handbook (6th edition) is based on Marshall swift index of 1000.

$$\text{Cost of equipment(New)} = \text{Cost of equip.(Old)} \times \left(\frac{\text{Capacity of new equip.}}{\text{Capacity of Old equip.}} \right)^{n}$$

$$\text{Present cost} = \text{Original cost} \times \left(\frac{\text{Index value of present time}}{\text{Index value at time original cost was obtained}} \right)$$

COST OF EQUIPMENY:

Table-1: Cost for pump

Equipment	Identifi	Quant	Expone	Capacity	Source	U.S. $	Taka

name	cation no.	ity	nt	(unit)			Million
Pump	P-101	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-102	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-103	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-104	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-105	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-106	2	0.3	7.5 h_p	Perry	2362.4*2	0.2716
Pump	P-107	2	0.3	7.5 h_p	Perry	2362.4*2	0.2716
Pump	P-108	2	0.3	3 h_p	Perry	1661.7*2	0.1910
Pump	P-109	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-110	1	0.3	10 h_p	Perry	2575.4	0.1480
Pump	P-111	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-112	1	0.3	7.5 h_p	Perry	2362.4	0.1358
Pump	P-113	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-114	1	0.3	10 h_p	Perry	2575.4	0.1480
Pump	P-115	1	0.3	5 h_p	Perry	2000	0.1150
Pump	P-201	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-202	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-203	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-204	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-205	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-206	1	0.3	3 h_p	Perry	1661.7	0.0955
Pump	P-207	1	0.3	3 h_p	Perry	1661.7	0.0955
						TOTAL PUMP COST=	2.9553

Table-2: Cost of different type vessel:

Equipment name	Identification no.	Quantity	Source	U.S. $	Taka (Million)
NaOH Storage tank	VE-101	1	Perry	14904*2	1.71336
Coconut oil storage tank	VE-102	1	Perry	13010	0.7478
oil storage tank	VE-103	1	Perry	13010	0.7478
oil storage tank	VE-104	1	Perry	13010	0.7478
Water storage tank	VE-105	1	Perry	6505	0.374
Blender	VE-106	2	Perry	14352*2	1.650
Demoisturizer tank	VE-107	2	Perry	14904*2	1.713
Bleacher tank	VE-108	3	Perry	7590*3	1.308
Filtrated storage tank	VE-109	2	Perry	7716*2	0.887
Saponifier pan	VE-110	4	Perry	146302*4	33.63
Divided pan unit	VE-111	2	Perry	8352*2	0.960
Batch fitting & settling tank	VE-112	2	Perry	162507*2	18.68
First treatment tank	VE-201	1	Perry	13800	0.793
Filtrated storage tank	VE-202	1	Perry	14352	0.825
Second treatment tank	VE-203	1	Perry	13800	0.793
Filtrated storage tank	VE-204	1	Perry	14352	0.25
Brine preparation tank	VE-205	1	Perry	8280	0.476

TOTALVESSEL COST=	66.291

Table-3: Cost of Heat Exchanger:

Equipment name	Identification no.	Quantity	Source	U.S. $	Taka Million
1st Soap Heater	HE-101	1	Perry	2505.3	0.144
2nd Soap Heater	HE-102	1	Perry	2505.3	0.144
Soap dryer	DA-101	1	Perry	7300	0.4196
First effect body	EV-201	1	Perry	15500	0.8909
Second effect body	EV-202	1	Perry	15500	0.8909
Finisher	EV-203	1	Perry	19375	1.1136
Packed bed distillation column	D-201	1	Perry	25860	1.4864
Boiler	B-101	1	Perry	17532	1.008
Barometric condenser	BC-201			9482	0.545
Barometric condenser	BC-202			9482	0.545
TOTAL Cost of Heat Exchanger=					7.1874

Table-4: **Cost of other equipment:**

Equipment name	Identification no.	Quantity	Source	U.S. $	Taka Million
Plate&Filter press	FL-101	2	Perry	3577*2	0.2056
Plate & Filter press	FL-201	1	Perry	3577	0.2056
Plate & Filter press	FL-202	1	Perry	3577	0.2056

Ejector	EJ-101	1	Perry	2533	0.1455
Ejector	EJ-201	1	Perry	2533	0.1455
Ejector	EJ-202	1	Perry	2533	0.1455
Centrifuge	CE-201	1	Perry	6900	0.3966
TOTAL Cost of other equipment=					1.450

$\therefore$ TOTAL EQUIPMENT COST =2.9553+66.291+7.1874+1.45

=77.8827 Taka(million)

ATTACHMENT: 1

For, P-101

Capacity=7.5

Given capacity=10

From 25-49 (Perry)

N=0.3

SO cost pf equipment= $\$1.1\times10^3(7.5/10)^{0.3}$

=\$1750

Present cost =1750(1350/1000)

=\$2362.4

Cost for P-101 =2362.4$\times$57.48 Tk.

=12946 Tk.

ATTACHMENT: 2

For, Saponifier pan ,VE-110

Capacity=43.3 m^3

Given capacity=0.38 m^3

From 25-49 (Perry)

N=0.43

SO cost of pan= $\$5300(40.3/0.38)^{0.43}$

=$\$ 40612.406$

Present cost =40612.406 ***4**(1350/1000)

=$146302

TABLE: ESTIMATE OF CAPITAL INVESTMENT (For solid-fluid processing plant)

Items	Factor	Cost Million(Tk.)
Direct cost		
Purchased equipment	1	77.8827
Purchased equipment installation	0.39	30.374253
Instrumentation and Control	0.13	10.124751
Piping (installed)	0.31	24.143637
Electrical (installed)	0.1	7.78827
Building	0.29	22.585983
Yard Improvement	0.1	7.78827

Service Facilities	0.55	42.835485
Land	0.06	4.672962
Total direct plant cost		228.196311
Indirect cost		
Engineering & Supervision	0.32	24.922464
Construction & Expenses	0.34	26.480118
Total direct & Indirect cost		279.598893
Contractor's fee	0.18	14.018886
Contingency	0.36	28.037772
Fixed Capital Investment		321.655551
Working Capital Investment	0.74	57.633198
Total Capital Investment		379.288749
Location factor for Bangladesh	1.8	
Fixed Capital Investment		578.98
Total Capital Investment		682.719

MANUFACTURING EXPENCES:

Assume plant operate 330 day/yr.

Given, Production rate 40 ton/day

So, $330 \times 40 = 13200$ ton/yr.

COST TYPE	ITEM	COST/UNIT	COST/Yr (Tk.Million)
DIRECT	RAW MATERIAL		
	Coconut oil	80 Tk/Kg	171.072
	Palm oil	35 Tk/Kg	299.376
	Caustic soda	30 Tk/Kg	204.64
	NaCl Salt	5 Tk/Kg	1.092
	Other chemical		2.39
	Operating labor (10%raw material)		67.857
	Supervisory & clerical labor (10% of operating labor)		6.7857
	UTILITIES		
	Electricity	2.65Tk/(Kw-h)	12.00
	Steam	0.18 Tk/Kg	
	Demin. water	0.0085Tk/Kg	
	Waste disposal	0.095Tk/Kg	0.22
	Maintain & repair (2%of fixed capital)		4.74
	Operating expenses (10% of maintain Tk/Kg & repair		0.474
	Laboratory charges (10% of operating labor)		6.785
Total annual direct manufacturing expenses =			777.346
INDIRECT	Overhead, Packing, Storage (50% of operating labor plus supervision & maintenance		36.298
	Local taxes (4% of fixed capital)		9.489
	Insurance (0.4% of fixed capital)		0.9485
Total annual indirect manufacturing expenses =			46.735

Total annual manufacturing expenses =		824.0815
GENERAL EXPENSES	Administrative cost (2.5% of O/H)	0.907
	Distribution of selling cost (10% of total expenses)	82.408
	Research & development (5% of Total expenses)	41.204
DEPRICIATION (straight line method for 15 yr. Service life)		45.5146
Total annual expenses=		994.1095

Total expenses or Total production cost (A_{TE}) = 994.1095 Tk.(Million)

Annual revenue (A_R) 92857 Tk/ton =1225.714

Gross annual profit (A_R-A_{TE}) =231.6045

Income tax on gross profit (30%) A_{IT} =69.48

Net annual profit after tax (A_{NP}=AGP-A_{IT}) =162.1186Tk.(Million)

∴ % Profit =162.1186$_{\times}$100/994.1095

∴ =16.3

CAPITAL INVESTMENT

Total capital investment for the plant is=682.719 Tk. (Million)

PRODUCTION COST

Production cost == 994.1095 $\times 10^6$/13200 Tk./ton

= 75311.326 Tk./ton

Economic analysis

ECONOMIC EVALUATION:

Calculation of internal of rate of return:

Total income = Total sales – Total production cost

=(1225.714 –994.1095) Tk. (million)

=231.60 Tk. (million)

Tax on Income = 30%

$\therefore$ Net profit after tax = 231.6(1-0.3) Tk. (million)

=162.1186 Tk. (million)

So, Percent rate of return =Profit after tax/ Total capital investment

$$=\frac{162.1186\times100}{682.719}$$

=23.7 %

Calculation for payout period (without interest)

Depreciation of FCI:

Project life =15 yr.

Straight line method, depreciation = depreciable FCI / project life

$$=\frac{578.98}{15} = 38.59 \text{ Tk. (million)}$$

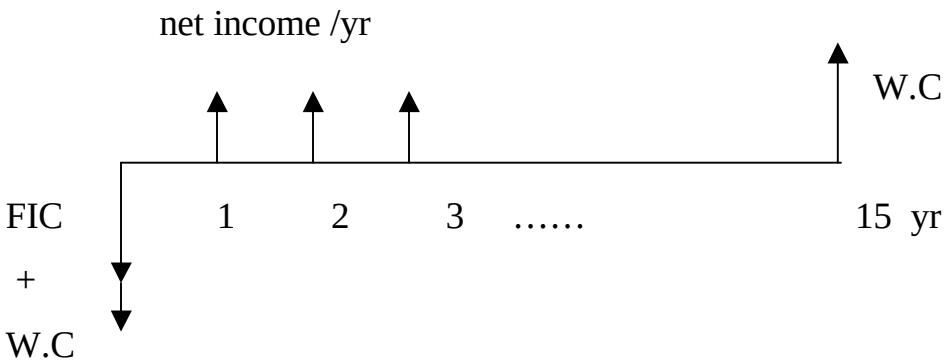
$$\therefore \text{Payout period (without interest)} = \frac{\text{F C I}}{\text{(Average profit + Depreciation)/y}}$$

$$= \frac{682.719}{162.1186 + 38.59}$$

=3.4 yr.

So, Payout period of the estimated project is 4 yr.

#Calculation for IRR (discount cash flow method)



Let IRR = I %

We know,

Present worth = (net income/yr)(P/A, I%, 15) + (Salvage value + W.C)(P/F, I%, 15) - FCI

$$162.1186 \times \frac{(1+I)^{15}-1}{I\times(1+I)^{15}} + 57.6331 \frac{1}{(1+I)^{15}} - 682.719 = 0$$

By trail & error method IRR = 22.7 %

Calculation for NPV with M.A.R.R. = 15 %

Net present worth = (net income/yr)(P/A, I%, 15) + (Salvage value + W.C)(P/F, I%, 15) - FCI

$$= 162.1186 \times \frac{(1+.15)^{15}-1}{I\times(1+.15)^{15}} + 57.6331 \frac{1}{(1+.15)^{15}} - 682.719$$

$$= 272.33$$

Net present worth is positive

So, The investment is economically accepted.