Executive Summary

Puchong Plc is evaluating an investment proposal which requires to invest $ 33,00,000 as capital expenditure and additional $40,000 as working capital. Puchong Plc used scientific techniques such as net present value and internal rate of return approach to evaluate the investment proposal. The discount rate of Puchong Plc is 105 however return on capital employed is 30%.

For estimating net present value and internal rate of return, cash flow of the project is estimated. The framework for estimating cash flows are as follows:

Cash flows = Profit after tax + Depreciation – capital expenditure – Change in working capital + recovery of working capital + scrap value

Profit after tax may be estimated as follows:

Profit after tax = Revenue – variable cost – fixed cost – Other fixed losses – taxes

Revenue may be estimated as number of unit sold multiplied with price of units while variable cost may be calculated as sum of direct material and direct labour.

However, it should be noted that a cash flow may not be projected for ten years with certainty. Therefore a factor named certainty equivalent coefficient is multiplied with cash flow of the project. The adjusted cash flow may be used a proxy which accounts for all uncertainty associated with cash flows.

The net present value and internal rate of return is estimated in both cases and it is observed that original as well as adjusted cash flows resulting in positive net present value. Also in both cases internal rate of return is higher than that of reference rate. The base case payback period is approximately 1.83 years and after incorporating certainty equivalent also the payback period is less than three years i.e. 2.25 Years

Also return on capital employed is estimated which is higher than the threshold value of 30%.

Therefore, it is recommended that Puchong Plc should accept the project.

Introduction

Puchong Plc is evaluating an investment proposal to manufacture a new Product ZW300, which has performed well in test marketing trials conducted recently by the company's research and development division.

The details of the project is given below:

Initial investment on Equipment	$ 30,00,000.00
Investment in Additional Buildings	$ 3,00,000.00
Selling price (current price terms) per unit	$ 50.00
Fixed operating costs (Current Price Terms)	$ 1,50,000.00

Raw material	Number of units	Spoilage factor	Price
A	4	7%	$ 1.50
B	3		$ 1.20
C	4	8%	$ 1.30
Additional loss	$ 7,000.00		
Working Capital	$ 40,000.00		

Raw material	Inflation	Comment
A	2%	Inflation to be effective from year 2 onwards
B	3%	Inflation to be effective from year 1 onwards
C	2%	Inflation with effect from year 2
Fixed Cost	2%	Inflation to be effective from year 1 onwards
Labour rate	3.5%	Escalation Every Year
Selling Price	4%	Escalation Every Year

Labour time per unit	25 Minutes
Labour rate	$ 11.00

In addition to above demand projection is also made by the company which is given below:

Year	Demand (units)
1	80,000
2	90,000
3	1,10,000
4	1,15,000
5	1,15,000
6	1,15,000
7	1,15,000

8	1,30,000
9	1,35,000
10	1,35,000

Equipment life in year	10
Building life in years	20
Tax rate	15%
Discount rate	10%
Target ROCE	30%
Revised Discount Rate	20%

Basis inputs mentioned above relevant cash flows are projected and explained in subsequent sections.

Forecasting the relevant cash flows

Project cash flow is estimated using following framework:

FCFF = After tax operating income + Noncash charges (such as D&A) - CAPEX - Working capital expenditures; Where FCFF is free cash flow available for firm.

General Assumptions

Following are the key assumption which is important from the perspective of estimating cash flows:

- All the cash inflows and outflows incurred at the end of year. Therefore capital expenditure incurred at the end of year zero.
- Working capital required from day 1 of the operation, therefore it is assumed that working capital would be infused at the end of year zero
- Working capital would be recovered at the end of operation. Therefore it is assumed that working capital would be recovered at the end of Year ten.
- It is mentioned in the case that the equipment will have scrap value at the end of the project equal to the book value. The realization owing to scrap sale is recognized at the end of year ten.

Capex

There are two major components of capital expenditure namely equipment and buildings. The cost of equipment is $30,00,000 while that of building is $3,00,000. It is assumed that capital expenditure shall be incurred at the end of year 0. It is represented as follows in spread sheet:

Year	Equipment Investment	Additional Building
0	$ 30,00,000	$ 3,00,000
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Revenue Estimation

Revenue is estimated by multiplying number of units sold with price per unit. The initial price of good per unit is $50. However it is further assumed that price will be increase by 4% every year. Further it is assumed that company will meet entire demand of the product. Therefore the revenue estimation in spreadsheet will be shown as below:

Year	Demand in Units	Price	Revenue
0			
1	80,000	$ 50.00	$ 40,00,000
2	90,000	$ 52.00	$ 46,80,000
3	1,10,000	$ 54.08	$ 59,48,800
4	1,15,000	$ 56.24	$ 64,67,968
5	1,15,000	$ 58.49	$ 67,26,687
6	1,15,000	$ 60.83	$ 69,95,754
7	1,15,000	$ 63.27	$ 72,75,584
8	1,30,000	$ 65.80	$ 85,53,557
9	1,35,000	$ 68.43	$ 92,37,841
10	1,35,000	$ 71.17	$ 96,07,355

However, if demand is not same as what company is envisaging, the revenues would be much lower than shown above. Also if some new entrant entered into market with substitute product, then also revenue would be on lower side.

Variable cost estimation

Variable cost comprises of two components namely direct material cost and direct labour cost. It is mentioned that three materials of different quantity is used for producing one unit. Further there are wastage associated with two material. One material (Named B) produced in house. However if ‘B’ is used for production of ZW300, the direct sales of ‘B’ gets reduced

by number of units used in production of ZW300. Therefore market price of 'B' is considered as cost. Therefore cost of per unit material is estimated as follows:

Per unit direct material cost = ((Per unit cost of material A x Number of units of material A used for producing one unit of ZW300)/(1- Wastage percentage of material A)) + ((Per unit cost of material B x Number of units of material B used for producing one unit of ZW300))+ ((Per unit cost of material C x Number of units of material C used for producing one unit of ZW300)/(1- Wastage percentage of material C)). Further total cost of material may be calculated by multiplying total number of goods produced with per unit material cost

Further it is assumed that company will produce as much quantity of ZW300 as it could be sold. The company is not interested to maintain its inventory. Therefore number of goods produced = number of goods sold = market demand

Therefore in spreadsheet cost of material will be shown as follows:

Year	Material A	Material B	Material C	Total Material cost	Total cost of material
0					
1	$ 6.45	$ 3.71	$ 5.65	$ 15.81	$ 12,64,942.95
2	$ 6.58	$ 3.82	$ 5.77	$ 16.17	$ 14,54,859.23
3	$ 6.71	$ 3.93	$ 5.88	$ 16.53	$ 18,17,925.67
4	$ 6.85	$ 4.05	$ 6.00	$ 16.90	$ 19,43,093.72
5	$ 6.98	$ 4.17	$ 6.12	$ 17.27	$ 19,86,615.20
6	$ 7.12	$ 4.30	$ 6.24	$ 17.66	$ 20,31,146.90
7	$ 7.27	$ 4.43	$ 6.37	$ 18.06	$ 20,76,713.21
8	$ 7.41	$ 4.56	$ 6.49	$ 18.46	$ 24,00,296.44
9	$ 7.56	$ 4.70	$ 6.62	$ 18.88	$ 25,48,624.34
10	$ 7.71	$ 4.84	$ 6.75	$ 19.30	$ 26,05,938.03

Labour cost per unit is determined by Total number of goods produced multiplied by amount of time consumed in production of one unit in hour multiplied by hourly wage rate. It should be further noted that hourly wage rate is $11 which would be increased by 3.5 % every year. Therefore labour cost in spreadsheet may be written as follows:

Year	Total Time	labour rate	Labour cost
0			
1	33,333	$ 11.00	$ 3,66,667
2	37,500	$ 11.39	$ 4,26,938
3	45,833	$ 11.78	$ 5,40,076

4	47,917	$	12.20	$	5,84,387
5	47,917	$	12.62	$	6,04,840
6	47,917	$	13.06	$	6,26,010
7	47,917	$	13.52	$	6,47,920
8	54,167	$	14.00	$	7,58,066
9	56,250	$	14.48	$	8,14,776
10	56,250	$	14.99	$	8,43,293

Fixed cost Estimation

There are two fixed component in the cash flow. First is fixed operating cost which is $ 1,50,000. This component would be escalated at the rate of 2% every year. Another component of fixed cost is additional loss of $7,000. This value will remain fixed during the period of estimating cash flows. Therefore fixed cost would be shown as follows in spread sheet.

Year	Fixed operating cost		Additional Loss	
0				
1	$	1,53,000.0	$	7,000.0
2	$	1,56,060.0	$	7,000.0
3	$	1,59,181.2	$	7,000.0
4	$	1,62,364.8	$	7,000.0
5	$	1,65,612.1	$	7,000.0
6	$	1,68,924.4	$	7,000.0
7	$	1,72,302.9	$	7,000.0
8	$	1,75,748.9	$	7,000.0
9	$	1,79,263.9	$	7,000.0
10	$	1,82,849.2	$	7,000.0

Depreciation

Depreciation is estimated by multiplying block of assets by applicable rate of depreciation. In this case straight line method is used for estimating depreciation where equipment would be depreciated in 10 years while building would be depreciated in 20 years. Therefore total depreciation booked in year is given by following formula:

Total depreciation booed per year = (Block of Equipment/10 years) + (Block of building/20 years)

Further, it is assumed that depreciation for reporting and tax purpose would remain the same. Therefore depreciation would be shown as follows in spread sheet.

Year	Equipment Dep	Building Dep

0		
1	$ 3,00,000	$ 15,000
2	$ 3,00,000	$ 15,000
3	$ 3,00,000	$ 15,000
4	$ 3,00,000	$ 15,000
5	$ 3,00,000	$ 15,000
6	$ 3,00,000	$ 15,000
7	$ 3,00,000	$ 15,000
8	$ 3,00,000	$ 15,000
9	$ 3,00,000	$ 15,000
10	$ 3,00,000	$ 15,000

Earnings before Interest and Tax and Profit after Tax

The earnings before interest and taxes may be calculated as follows:

Earnings before interest and tax = Revenue – cost of material – cost of labour – Fixed operating cost – Fixed loss – Depreciation of equipment – Depreciation of building

Profit after tax is estimated by subtracting tax from earnings before interest and tax. Tax obligations is estimated by multiplying applicable tax rate with Earnings before interest and tax.

Year	EBIT	PAT
0		
1	$ 18,93,390.4	$ 16,09,381.8
2	$ 23,20,143.3	$ 19,72,121.8
3	$ 31,09,617.2	$ 26,43,174.6
4	$ 34,56,122.7	$ 29,37,704.3
5	$ 36,47,619.2	$ 31,00,476.3
6	$ 38,47,673.3	$ 32,70,522.3
7	$ 40,56,648.3	$ 34,48,151.1
8	$ 48,97,444.8	$ 41,62,828.1
9	$ 53,73,177.3	$ 45,67,200.7
10	$ 56,53,274.8	$ 48,05,283.6

Working capital and Scrap Value Estimation

Working capital required from day 1 of the operation, therefore it is assumed that working capital would be infused at the end of year zero. The amount of working capital will remain constant i.e. $40,000.Working capital would be recovered at the end of operation. Therefore it is assumed that working capital would be recovered at the end of Year ten.

Scrap value is estimated by subtracting accumulated value of depreciation from gross block of assets. Further if scrap value is equal to book value of asset, then there would be no tax implication.

Estimating Cash flow

Cash flows would be estimated as follows:

Cash flows = Profit after tax + Depreciation – capital expenditure – Change in working capital + recovery of working capital + scrap value (Berk et. al., 2015)

Year	Cash flow	Discount Factor	Discounted Cash Flow
0	$ -33,40,000.0	1.0000	$ -33,40,000.0
1	$ 19,24,381.8	0.9091	$ 17,49,438.0
2	$ 22,87,121.8	0.8264	$ 18,90,183.3
3	$ 29,58,174.6	0.7513	$ 22,22,520.4
4	$ 32,52,704.3	0.6830	$ 22,21,640.8
5	$ 34,15,476.3	0.6209	$ 21,20,742.1
6	$ 35,85,522.3	0.5645	$ 20,23,933.9
7	$ 37,63,151.1	0.5132	$ 19,31,091.5
8	$ 44,77,828.1	0.4665	$ 20,88,939.9
9	$ 48,82,200.7	0.4241	$ 20,70,529.7
10	$ 53,10,283.6	0.3855	$ 20,47,344.2

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The net present value of proposal is $1,70,26,363.7 at discount rate of 10% while internal rate of return is 73.36%. However, if reinvestment rate is considered at 10%, the modified rate of return would be 25.5%. The payback period of proposal is 1.83 years with profitability index of 5.16. However it is argued that current model has not accounted any variability in cash flows which may arise owing to drop in price, reduction in demand and increase in cost. Therefore certainty equivalence is multiplied with cash flows. Therefore modified cash flows and respective net present value and internal rate of return is shown below:

Year	Cash flow	Cash flow adjusted with certainity equivalent	Discount Factor	Discounted Cash Flow
0	$ -33,40,000	$ -33,40,000	1.00	$ -33,40,000
1	$ 19,24,382	$ 18,28,163	0.83	$ 15,23,469
2	$ 22,87,122	$ 20,58,410	0.69	$ 14,29,451

3	$ 29,58,175	$ 25,14,448	0.58	$	14,55,121
4	$ 32,52,704	$ 24,39,528	0.48	$	11,76,470
5	$ 34,15,476	$ 22,20,060	0.40	$	8,92,192
6	$ 35,85,522	$ 19,72,037	0.33	$	6,60,431
7	$ 37,63,151	$ 16,93,418	0.28	$	4,72,602
8	$ 44,77,828	$ 15,67,240	0.23	$	3,64,490
9	$ 48,82,201	$ 12,20,550	0.19	$	2,36,551
10	$ 53,10,284	$ 7,96,543	0.16	$	1,28,646

The net present value of proposal is $49,99,422.8 at discount rate of 10% while internal rate of return is 60.86%. However, if reinvestment rate is considered at 10%, the modified rate of return would be 16.5%. The payback period of proposal is 2.253 years with profitability index of 1.515.

Critical Evaluation of technique

Evaluating investment proposal is a tricky situation as the facility against which investments are required is not in place. Therefore, entire analysis is based on estimation of capital expenditure, capital structure, revenue and cost. Since project yet to start hence there is an uncertainty associated with completion of project, and also with estimation of revenue and cost. Therefore, a set of techniques such as net present value approach, internal rate of return approach, and payback period approach is used for evaluating the project.

Net present value approach involves the sum of project cash flows discounted with appropriate hurdle rate. Hurdle rate is generally cost of capital of the firm which is evaluating the proposal. Alternatively, it is also known as opportunity cost of the firm. In general companies consider a project which has positive NPV. However if the investor is evaluating more than one investment proposals having positive NPV, then investor generally selects the project having highest NPV (Berk et. al., 2015).

Internal rate of return is rate at which the sum of all future cash flows becomes zero. For investment proposal evaluation purpose, internal rate of return should be higher than the threshold rate. Threshold rate is generally weighted average cost of capital or opportunity cost or hurdle rate. Similar to net present value approach, higher the internal rate of project, better it is. However, there are some limitations of internal rate of return approach. If the cash flow of the project under consideration is changing signs in different years under consideration, then internal rate of return might give us multiple values. This is mainly because of the solution of the equation having more than one real root (Magni, 2010). To overcome the situation of multiple roots, the concept of modified internal rate of return or

MIRR is introduced. It discounts all negative cash flows at a specified rate at beginning of the cash flow and sum it together. Further it uses time value of money to project all positive cash flow at the end of the period at specified rate. Then it estimates the rate at which the magnitude of the discounted negative cash flows at time zero to be equivalent to the future value of the positive cash flows at the final time period (Lin, 1976).

Profitability index is yet another capital budgeting measure which is used for prioritizing the project. It is the ratio of payoff to investment. As an investment decision, the projects having Profitability index high than one should be considered. However, it does not give any indication of the total benefit which company may reap from the project (Berk et. al.,2015).

Another tool which is popularly used for evaluating investment proposals is payback period. Unlike two methods mentioned above, payback period does not consider time value of money. For evaluating any investment proposal, the investor need to decide a threshold payback period. If the payback period of the project under consideration, is lower than the threshold value, then project may be selected. Lower the payback period of the project, better it is (Arthur and Steven, 2003).

Another variant of the payback period is discounted payback period. It discount the cash flows of the project with appropriate discount rate. The discounted cash flow in turn will be used for estimating the payback period (Berk et. al., 2015).

However biggest pitfall of payback period is its inability to consider the cash flows after payback is achieved. Further, it does not give any assessment of total value generated for the company if company goes ahead with the project (Berk et. al., 2015).

Recommendation of techniques

With reference to the methodologies discussed above, best methodology which may be used for evaluating the project is net present value approach and internal rate of return approach. However, it should be noted that forecasting a ten year cash flow with certainty is not possible. Though proposal included certainty equivalent coefficient which is multiplied with estimated cash flows to factor the uncertainty associated with the market. The biggest drawback of the approach is the fact that multiplying with certainty equivalent coefficient does not incorporate cases where prices and demand decreases and cost increases. Therefore, proposal should also include sensitivity analysis where impact of each factor affecting the cash flows such as demand, price, cost may be fluctuated independently and simultaneously

to arrive a range of net present value of the project. This would present a right picture in front of decision maker.

Also, it should be noted that cash flow is not changing its sign therefore internal rate of return may also be used along with net present value approach. However sensitivity with respect to each factor must be incorporated in cash flows.

Conclusion and recommendation

The net present value of the project is $1,70,26,363.7 while internal rate of return is 73.36%. The modified internal rate of return is 25.5%. The payback period is 1.83 years while profitability index is 5.16. If certainty equivalent coefficient is multiplied with cash flows then the net present value of the project is $49,99,422.8 while internal rate of return is 60.86%. The modified internal rate of return is 16.5%. The payback period is 2.25 years while profitability index is 1.515. Also, the return on capital employed for every year is more than 30%.

Since the net present value of the investment is positive and internal rate of return is also higher than the discount rate, therefore the project is value accretive for the project. Further it should be noted that return on capital employed is also well above the threshold value set for investment i.e. 30%. Hence Puchong Plc should accept the project.

References

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