Computing Capital Budgeting for Banking Sector

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ABSTRACT

Perhaps the most difficult hurdle which companies come across is the selection of the project which is beneficial to the organization in the long-run and also increases the present value of the shareholders. This is where Capital Budgeting comes into play. Capital Budgeting is one of the most important areas of financial management. This paper gives an overview of what capital budgeting is, what different types of techniques comes under capital budgeting and how to represent capital budgeting technique algorithmically. In this paper we also throw some light on what the results of various capital budgeting techniques will be if any banking organization follows these techniques and compare those results. These techniques namely as Payback Period (PP), Average Rate of Return (ARR), Net Present Value (NPV), Profitability Index (PI) and Internal Rate of Return (IRR) are used to evaluate projects.

Index Terms

Capital Budgeting, Cash Flow, Discount Rate, Time Value of Money

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

An organizaton's success or failure depends on capital budgeting decisions. Capital budgeting decisions among several costly long-term investments play a profound impact on the organization and long-term performance. A capital budgeting decision can be stated as the process that companies use for making decisions on long-term projects. Such type of decisions are generally taken in line with the goal of maximizing shareholders value. A firm's investment decisions would generally include expansion, acquisition, modernisation and replacement of long-term assets. The decisions to invest in fixed assets are made by the managers as these are one of the major judgements. Capital budgeting involves various techniques which give a clear picture about which project is profitable. When a project is finalized, initial investment is made and then it is expected that future cash flows are calculated and discounted to the present value. If all the expected future discounted cash flows when combined together is greater than initial investment the project is said to be profitable.

Objective

To understand the practical use of capital budgeting methods in a banking organization for decision- making.
To learn the significance of capital budgeting in valuing the project for financing.

Methodology

The information of this research paper has been compiled through Primary and Secondary Sources.

Algorithm

A. Payback Period

Step1: Start
Step2: Read initial_inv (initial investment) value from the user
Step3: Set pbdt (profit before depreciation and tax), pbt (profit before tax), np (net profit), ci (cash inflow) as the empty list
Step4: Set sum1 and c variable as zero
Step5: Read sal_value (salvage value), l (expected life) and tax from the user
Step6: For i=0 to l Do
Step7: Read Profit Before Depreciation and Tax for each year
from the user and append it in pbdt list
Step8: End For
Step9: Compute Depreciation= (initial_inv-sal_value)/l
Step10: For i=0 to l Do
Step11: Compute pbdt[i]-Depreciation and append each value in pbt list
Step12: End For
Step13: For i=0 to l Do
Step14: Compute pbt[i]-(pbt[i]*(tax/100)) and append each value in np list
Step15: End For
Step 16: For i=0 to l Do
Step17: Compute np[i]+Depreciation and append each value in ci list
Step18: End For
Step19: For i=0 to l Do
Step20: Compute sum1=sum1+ci[i]
Step21: Check If sum1 is less than initial_inv
Step22: If True, Compute c=c+1
Step23: If False, Compute pb=c+((initial_inv-(sum1-ci[i]))/ci[i]) and break out of the loop
Step25: Print pb

Step26: Stop

B. Average Rate of Return

Step1: Start
Step2: Read initial_inv (initial investment) value from the user
Step3: Set pbdt (profit before depreciation and tax), pbt (profit before tax), np (net profit), ci (cash inflow) as the empty list
Step4: Set sum1, avp and avi variable as zero
Step5: Read sal_value (salvage value), l (expected life) and tax from the user
Step6: For i=0 to l Do
Step7: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
Step8: End For
Step9: Compute Depreciation= (initial_inv-sal_value)/l
Step10: For i=0 to l Do
Step11: Compute pbdt[i]-Depreciation and append each value in pbt list
Step12: End For
Step13: For i=0 to l Do
Step14: Compute pbt[i]-(pbt[i]*(tax/100)) and append each value in np list
Step15: End For
Step 16: For i=0 to l Do
Step17: Compute sum1=sum1+np[i]
Step18: End For
Step19: Compute avp=sum1/l
Step20: Compute avi= (initial_inv+sal_value)/2
Step21: Compute arr= (avp/avi)*100
Step22: Print arr
Step23: Stop

C. Discounted Payback Period

Step1: Start
Step2: Import math Library
Step3: Read initial_inv (initial investment) value from the user
Step4: Read pbdt (profit before depreciation and tax), pbt (profit before tax), pvf (present value factor), pv (present value), np (net profit) and ci (cash inflow) as the empty list
Step5: Set sum1, dpb and c variable as zero
Step6: Read sal_value (salvage value), l (expected life), dr (discount rate) and tax from the user
Step7: Compute dr=dr/100
Step8: For i=0 to l Do
Step9: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
Step10: End For
Step11: Compute Depreciation= (initial_inv-sal_value)/l
Step12: For i=0 to l Do
Step13: Compute pbdt[i]-Depreciation and append each value in pbt list
Step14: End For
Step15: For i=0 to l Do
Step16: Compute pbt[i]-(pbt[i]*(tax/100)) and append each value in np list
Step17: End For
Step 18: For i=0 to l Do
Step19: Compute np[i]+Depreciation and append each value in ci list
Step20: End For
Step21: For i=0 to l Do
Step22: Compute 1/(math.pow((1+dr),i+1)) and append each value in pvf list
Step23: End For
Step24: For i=0 to l Do
Step25: Compute ci[i]*pvf[i] and append each value in pv list
Step26: End For
Step27: For i=0 to l Do
Step28: Compute sum1=sum1+pv[i]
Step29: Check If sum1 is less than initial _inv
Step30: If True, Compute c=c+1
Step31: If False, Compute dpb=c+((initial_inv-(sum1-pv[i]))/pv[i])
Step32: End For
Step33: Print dpb
Step34: Stop

D. Net Present Value

Step1: Start
Step2: Import math Library
Step2: Read initial_inv (initial investment) value from the user
Step3: Set pbdt (profit before depreciation and tax), pbt (profit before tax), np (net profit), pv (present value), pvf (present value factor), ci (cash inflow) as the empty list
Step4: Set sum1 variable as zero
Step5: Read sal_value (salvage value), l (expected life), dr (discount rate) and tax from the user
Step7: Compute dr=dr/100
Step6: For i=0 to l Do
Step7: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
Step8: End For
Step9: Compute Depreciation= (initial_inv-sal_value)/l
Step10: For i=0 to l Do
Step11: Compute pbdt[i]-Depreciation and append each value in pbt list
Step12: End For
Step13: For i=0 to l Do
Step14: Compute pbt[i]-(pbt[i]*(tax/100)) and append each value in np list
Step15: End For
Step 16: For i=0 to l Do
Step17: Compute np[i]+Depreciation and append each value in ci list
Step18: End For
Step19: For i=0 to l+1 Do
Step20: Compute 1/(math.pow((1+dr),i+1)) and append each value in pvf list
Ste21: End For
Step22: Insert at 0th position of ci list –initial_inv
Step19: For i=0 to l+1 Do
Step20: Compute ci[i]*pvf[i] and append each value in pv list
Step22: End For
Step21: For i=0 to l+1 Do
Step22: Compute sum1=sum1+pv[i]

Step23: End For
Step25: Print sum1
Step26: Stop

E. Profitability Index

Step1: Start
Step2: Import math Library
Step3: Read initial_inv (initial investment) value from the user
Step4: Read pbdt (profit before depreciation and tax), pbt (profit before tax), pvf (present value factor), pv (present value), np (net profit) and ci (cash inflow) as the empty list
Step5: Set sum1 variable as zero
Step6: Read sal_value (salvage value), l (expected life), dr (discount rate) and tax from the user
Step7: Compute dr=dr/100
Step8: For i=0 to l Do
Step9: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
Step10: End For
Step11: Compute Depreciation= (initial_inv-sal_value)/l
Step12: For i=0 to l Do
Step13: Compute pbdt[i]-Depreciation and append each value in pbt list
Step14: End For
Step15: For i=0 to l Do
Step16: Compute pbt[i]-(pbt[i]*(tax/100)) and append each value in np list
Step17: End For
Step 18: For i=0 to l Do
Step19: Compute np[i]+Depreciation and append each value in ci list
Step20: End For
Step21: For i=0 to l+1 Do
Step22: Compute 1/(math.pow((1+dr),i+1)) and append each value in pvf list
Step23: End For
Step24: Insert at 0th position of ci list –initial_inv
Step25: For i=0 to l+1 Do
Step26 Compute ci[i]*pvf[i] and append each value in pv list
Step27: End For
Step28: For i=1 to l+1 Do
Step29: Compute sum1=sum1+pv[i]
Step30: End For
Step31: Compute pi=sum1/initial_inv
Step32: Print pi
Step33: Stop

F. Internal Rate of Return

Step1: Start
Step2: Import math Library
Step3: Read initial_inv (initial investment) value from the user
Step4: Read pbd (profit before depreciation), pbt (profit before tax), pvf1 (present value factor1), pvf2 (present value factor2), pv (present value), np (net profit), pv1 (present value1), pv2 (present value2) and ci (cash inflow) as the empty list
Step5: Set sum1, sum2 variable as zero
Step6: Read sal_value (salvage value), l (expected life), dr1 (discount rate1), dr2 (discount rate2) and tax from the user
Step7: For i=0 to l Do
Step8: Read Profit Before Depreciation for each year from the user and append it in pbd list
Step9: End For
Step10: Compute Depreciation= (initial_inv-sal_value)/l
Step11: For i=0 to l Do
Step12: Compute pbd[i]-Depreciation and append each value in pbt list
Step13: End For
Step14: For i=0 to l Do
Step15: Compute pbt[i]-(pbt[i]*(tax/100)) and append each value in np list
Step16: End For
Step17: For i=0 to l Do
Step18: Compute np[i]+Depreciation and append each value in ci list
Step19: End For
Step20: For i=0 to l+1 Do
Step21: Compute 1/(math.pow((1+dr1/100),i)) and append each value in pvf1 list
Step22: End For
Step23: Insert at 0th position of ci list –initial_inv
Step24: For i=0 to l+1 Do
Step25: Compute ci[i]*pvf1[i] and append each value in pv1 list
Step26: End For
Step27: For i=1 to l+1 Do
Step28: Compute sum1=sum1+pv1[i]
Step29: End For
Step30: For i=0 to l+1 Do
Step31: Compute 1/(math.pow((1+dr2/100),i)) and append each value in pvf2 list
Step32: End For
Step30: For i=0 to l+1 Do
Step33: Compute ci[i]*pvf2[i] and append each value in pv2 list
Step34: End For
Step35: For i=1 to l+1 Do
Step36: Compute sum2=sum2+pv2[i]
Step37: End For
Step38: Check If dr1 is less than dr2 and sum1 is greater than dr2
Step39: If True, Compute irr=dr1+((sum1/(sum1-sum2))*(dr2-dr1)
Step40: Else Check If dr2 is less than dr1 and sum2 is greater than sum1
Step41: If True, Compute irr=dr2+((sum2/(sum2-sum1))*(dr1-dr2)
Step42: Print irr
Step43: Stop

Formulas

Payback Period=(Initial Cash Outflow)/(Annual Cash Inflows) (1)

Average Rate of Return= $\frac{Average\ Annual\ Profits\ (after\ dep\ \&\ tax)}{Average\ Investment} * 100$ (2)

Net Present Value(NPV)=Present Value of Cash Inflow-Present Value of Cash Outflow (3)

Profitability Index=$\frac{PV\ of\ cash\ inflows}{Initial\ investment\ or\ Cash\ Outflows}$ (4)
Net profitability index=Profitability Index-1 (5)
IRR=Lower Rate+$\frac{PV\ at\ lower\ rate}{PV\ at\ lower\ rate - PV\ at\ higher\ rate} * difference\ in\ rates$ (6)

Calculations

The bank is making an allowance for investment in a project that costs Rs. 2,00,000. The project's expected life is 5 years and has zero salvage value. The company practices straight line technique of depreciation. The company's tax rate is 40% and the interest rate is 10%. The expected earnings before depreciation and before tax from the business are as follows:

YEAR	1	2	3	4	5
CASH FLOW BEFORE TAX	70000	80000	120000	90000	60000

6.1 Pay Back Period

Table 6.1 Showing the Calculation of Payback Period

YEARS	EARNINGS BEFORE DEPRICIATION & TAX	DEPRECIATION	EARNINGS BEFORE TAX	TAX	EARNINGS AFTER TAX	NET PROFIT
1	70000	40000	30000	12000	18000	18000
2	80000	40000	40000	16000	24000	24000
3	120000	40000	80000	32000	48000	48000
4	90000	40000	50000	20000	30000	30000
5	60000	40000	20000	8000	12000	12000

Preliminary Investment=200000
Depreciation=$\frac{Initial\ Investment - Salvage\ Value}{Number\ of\ years}$ (6)
Since salvage value is zero, substituting the values we get,
Depreciation=$\frac{200000}{5}$ =Rs. 40,000/-
Amount received till 2nd year=Rs. 1,22,000/-
Amount expected in 3rd year (Rs. 2,00,000 - Rs. 1,22,000) =Rs. 78,000/-
Cash Inflows after tax in 3rd year= Rs. 88,000/-
PBP=2 Yrs+$\frac{78000}{88000}$
=2+0.8863=2 years 10 months and 23 days

6.2 Average Rate of Return

Table 6.2 Showing the calculation of Average Rate Of Return

YEARS	EARNINGS BEFORE DEPRECIATION & TAX	DEPRECIATION	EARNINGS BEFORE TAX	TAX	EARNINGS AFTER TAX	CASH INFLOWS (EARNINGS AFTER TAX+DEPRECIATION)	CUMULATIVE CASH INFLOWS
1	70000	40000	30000	12000	18000	58000	58000
2	80000	40000	40000	16000	24000	64000	(58000+64000)
3	120000	40000	80000	32000	48000	88000	(122000+88000)
4	90000	40000	50000	20000	30000	70000	(210000+70000)
5	60000	40000	20000	8000	12000	52000	(280000+52000)

Preliminary Investment=200000
Depreciation=(Initial Investment-Salvage Value)/(Number of years)
Since salvage value is zero, substituting the values we get,
Depreciation=200000/5 =Rs. 40,000/-
Net Profit= (Rs.8,000 + Rs.24,000 + Rs.48,000 + Rs.30,000 + Rs.12,000)= Rs.1,32,000/-
Average Annual Profit=132000/5 =Rs. 26,400
Average Investment= (Initial Investment+Scrap Value)/2 =200000/2 =Rs. 1,00,000/-
Average rate of return=(Average Annual Profit)/(Average Investment)*100 =26400/100000*100 =26.4%

6.3 Discounted Pay Back Period

Table 6.3 Showing the calculation of Discounted Payback Period

YEARS	EARNINGS BEFORE DEPRICIATION & TAX	DEPRECIATION	EARNINGS BEFORE TAX	TAX	EARNINGS AFTER TAX	CASH FLOWS (EAT+ DEP.)	PV @ 10%	DISCOUNTED CASH FLOWS	CUMULATIVE DISCOUNTED CASH FLOWS
1	70000	40000	30000	12000	18000	58000	0.909	52722	52722
2	80000	40000	40000	16000	24000	64000	0.826	52864	(52722+52864)
3	120000	40000	80000	32000	48000	88000	0.751	66088	(105586+66088)
4	90000	40000	50000	20000	30000	70000	0.683	47810	(171674+47810)
5	60000	40000	20000	8000	12000	52000	0.621	32292	(219484+32292)

Preliminary Investment=200000
Depreciation=(Initial Investment-Salvage Value)/(Number of years)
Since salvage value is zero, substituting the values we get,
Depreciation=200000/5 =Rs. 40,000/-
Amount received till 3rd year = Rs. 1,71,674/-
Amount expected in 4th year = (Rs.2,00,000 - Rs.1,71,674) = Rs.28,326/-
Cumulative Discounted Cash Inflows after tax in 4th year = Rs.47,810/-
PBP=3Yrs+28326/48710 =3+0.5924 =3.5924 =3 years 7 months and
16 days

6.4 Net Present Value Method

Table 6.4 Showing the calculation of Net Present Value

YEARS	EARNINGS BEFORE DEPRICIATION & TAX	DEPRECIATION	EARNINGS BEFORE TAX	TAX	EARNINGS AFTER TAX	CASH FLOWS (EAT+ DEP.)	PV @ 10%	PV of CASH FLOWS
1	70000	40000	30000	12000	18000	58000	0.909	52722
2	80000	40000	40000	16000	24000	64000	0.826	52864
3	120000	40000	80000	32000	48000	88000	0.751	66088
4	90000	40000	50000	20000	30000	70000	0.683	47810
5	60000	40000	20000	8000	12000	52000	0.621	32292

Total Present Value of Cash Inflow = Rs.2,51,776.00
Present Value of Cash Outflow=Rs.2,00,000.00
NPV =Present Value of Cash Influx-Present Value of Cash Outlay = Rs.2,51,776 - Rs.2,00,000 = Rs.51,776.00

6.5 Profitability Index

Table 6.5 Showing the calculation of Profitability Index

YEARS	EARNINGS BEFORE DEPRICIATION & TAX	DEPRECIATION	EARNINGS BEFORE TAX	TAX	EARNINGS AFTER TAX	CASH FLOWS (EAT+ DEP.)	PV @ 10%	PV of CASH FLOWS
1	70000	40000	30000	12000	18000	58000	0.909	52722
2	80000	40000	40000	16000	24000	64000	0.826	52864
3	120000	40000	80000	32000	48000	88000	0.751	66088
4	90000	40000	50000	20000	30000	70000	0.683	47810
5	60000	40000	20000	8000	12000	52000	0.621	32292

Net Present Value of Cash Inflows = Rs.2,51,776/-
Present Value of Cash Outflow = Rs.2,00,000/-
Profitability Index= (Present value of Cash Inflow)/(Present value of Cash Outflow) =251776/200000 =1.2588

6.6 Internal Rate of Return

Table 6.6 Showing the calculation of Internal Rate of Return

YEARS	EARNINGS BEFORE DEPRICIATION & TAX	DEPRECIATION	EARNINGS BEFORE TAX	TAX	EARNINGS AFTER TAX	CASH FLOWS(EAT+DEP.)	PV @ 10%	DISCOUNTED CASH FLOWS	PV @ 20%	DISCOUNTED CASH FLOWS
1	70000	40000	30000	12000	18000	58000	0.909	52722	0.833	48314
2	80000	40000	40000	16000	24000	64000	0.826	52864	0.694	44416

3	120000	40000	80000	32000	48000	88000	0.751	66088	0.578	50864
4	90000	40000	50000	20000	30000	70000	0.683	47810	0.482	33740
5	60000	40000	20000	8000	12000	52000	0.621	32292	0.401	20852

Net Discounted Cash Flows @ 10%=Rs. 2,51,776/-
Net Discounted Cash Flows @ 20 %=Rs. 1,98,186/-
IRR=Lower Rate + (Present Value at lower rate)/(Present Value at lower rate-Present Value at higher rate)*Difference in Rates
=10% + 251776/(251776-198186)*(20-10)%
=56.98%

Results & Discussions

The Payback Period is 2 years 10 months and 23 days i.e. the initial investment can be recovered in the calculated time.
The Average Rate of Return is 22.40%.
The Net Present Value i.e. NPV =Rs. 51,776 is satisfactory.
The Internal Rate of Return i.e. IRR =56.98% is good to an extent.
The Profitability Index is fairly good. As PI (i.e 1.2588) is greater than 1, hence the project can be accepted.
The above calculations can be performed for different techniques and get results for the same techniques for any project where the banking organization would like to invest in and foresee whether the project they are going to invest in reaps benefits to them in future. This helps in taking the call as to choose and go with the project that is most profitable.
Generally, the calculations are done manually but the same steps can be done through automation or programmatically using python language. The above given algorithm steps when written and compiled using python language can ease the tedious task of manually updating cash flows for different successive years and computing the results for different techniques.
Most of the large organizations consider all the measures because each one provides somewhat different piece of relevant information to the decision makers and yet an impression has been created that the firms should use NPV method for decision making.
The reason why NPV is considered as superior method because it helps the organization to decide as to which project is the most profitable by ranking projects of different sizes over varying period of time.

Conclusion

All the methodologies of capital budgeting postulate that several investment offers under concern are mutually exclusive which may not essentially be accurate in certain situations. Ambiguity and threat pose major restrictions to the methods of capital budgeting. Urgency is another check in the valuation of capital investment judgements. The method of capital budgeting involves valuation of future cash inflows and outflows. The future is always undefined and the data collected may not be precise. Clearly the outcomes based upon incorrect data may not be respectable.

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