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 techniques 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

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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: Compute Depreciation of each year
Step5: Compute Profit before Depreciation and Tax of each year
Step6: Compute Profit before Tax of each year
Step7: Compute Net Profit of each year
Step8: Compute Cash Inflow of each year
Step9: Compute Sum of Cash Inflow
Step10: Check if Sum of Cash Inflow is less than initial_inv
Step11: If True, Compute pb = c + ((initial_inv - (sum1 - ci[i]))/ci[i]) and break out of the loop
Step12: Print pb
B. Average Rate of Return

Step 1: Start
Step 2: Read initial_inv (initial investment) value from the user
Step 3: Set pbdt (profit before depreciation and tax), pbt (profit before tax), np (net profit), ci (cash inflow) as the empty list
Step 4: Set sum1, avp and avi variable as zero
Step 5: Read sal_value (salvage value), l (expected life) and tax from the user
Step 6: For i=0 to l Do
    Step 7: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
    Step 8: End For
Step 9: Compute Depreciation= (initial_inv-sal_value)/l
Step 10: For i=0 to l Do
    Step 11: Compute pbdt[i]-Depreciation and append each value in pbt list
    Step 12: End For
Step 13: For i=0 to l Do
    Step 14: Compute pbt[i]=(pbt[i]*(tax/100)) and append each value in np list
    Step 15: End For
Step 16: Compute avp=sum1/l
Step 17: Compute avi=(initial_inv+sal_value)/2
Step 18: Compute arr=(avp/avi)*100
Step 19: Print arr
Step 20: Stop

C. Discounted Payback Period

Step 1: Start
Step 2: Import math Library
Step 3: Read initial_inv (initial investment) value from the user
Step 4: Read pbdt (profit before depreciation and tax), pbt (profit before tax), pv (present value), pvf (present value factor), ci (cash inflow) as the empty list
Step 5: Set sum1 variable as zero
Step 6: Read sal_value (salvage value), l (expected life), dr (discount rate) and tax from the user
Step 7: Compute dr=dr/100
Step 8: For i=0 to l Do
    Step 9: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
    Step 10: End For
Step 11: Compute Depreciation= (initial_inv-sal_value)/l
Step 12: For i=0 to l Do
    Step 13: Compute pbdt[i]-Depreciation and append each value in pbt list
    Step 14: End For
Step 15: For i=0 to l Do
    Step 16: Compute pbt[i]=(pbt[i]*(tax/100)) and append each value in np list
    Step 17: End For
Step 18: For i=0 to l+1 Do
    Step 19: Compute np[i]+Depreciation and append each value in ci list
    Step 20: End For
Step 21: For i=0 to l Do
    Step 22: Compute 1/(math.pow((1+dr),i+1)) and append each value in pvf list
    Step 23: End For
Step 24: For i=0 to l Do
    Step 25: Compute ci[i]*pvf[i] and append each value in pv list
    Step 26: End For
Step 27: For i=0 to l Do
    Step 28: Compute sum1=sum1+pv[i]
    Step 29: Check If sum1 is less than initial_inv
Step 30: If True, Compute c=c+1
Step 31: If False, Compute dpb=c+((initial_inv-(sum1-pv[i]))/pv[i])
Step 32: End For
Step 33: Print dpb
Step 34: Stop

D. Net Present Value

Step 1: Start
Step 2: Import math Library
Step 3: Read initial_inv (initial investment) value from the user
Step 4: 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
Step 5: Read sal_value (salvage value), l (expected life), dr (discount rate) and tax from the user
Step 6: For i=0 to l Do
    Step 7: Read Profit Before Depreciation and Tax for each year from the user and append it in pbdt list
    Step 8: End For
Step 9: Compute Depreciation= (initial_inv-sal_value)/l
Step 10: For i=0 to l Do
    Step 11: Compute pbdt[i]-Depreciation and append each value in pbt list
    Step 12: End For
Step 13: For i=0 to l Do
    Step 14: Compute pbt[i]=(pbt[i]*(tax/100)) and append each value in np list
    Step 15: End For
Step 16: For i=0 to l+1 Do
    Step 17: Compute np[i]+Depreciation and append each value in ci list
    Step 18: End For
Step 19: For i=0 to l+1 Do
    Step 20: Compute 1/(math.pow((1+dr),i+1)) and append each value in pvf list
    Step 21: End For
Step 22: Compute np[i]*(1/(math.pow((1+dr),i+1))) and append each value in cv list
Step 23: For i=0 to l+1 Do
    Step 24: Compute np[i]+Depreciation and append each value in np list
    Step 25: End For
Step 26: For i=0 to l+1 Do
    Step 27: Compute np[i]+Depreciation and append each value in cv list
    Step 28: End For
Step 29: Compute sum1=sum1+np[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
Step18: 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)) and append each value in pvf list
Step23: Insert at 0th position of ci list –initial_inv
Step24: For i=0 to l+1 Do
Step25: Compute ci[i]*pvf[i] and append each value in pv list
Step26: End For
Step27: For i=1 to l+1 Do
Step28: Compute sum1=sum1+pv[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
Step33: For i=0 to l+1 Do
Step34: Compute ci[i]*pvf2[i] and append each value in pv2 list
Step35: End For
Step36: For i=1 to l+1 Do
Step37: Compute sum2=sum2+pv2[i]
Step38: End For
Step39: Check If dr1 is less than dr2 and sum1 is greater than dr2
Step40: If True, Compute irr=dr1+((sum1/(sum1-sum2)))*(dr2-dr1)
Step41: Else Check If dr2 is less than dr1 and sum2 is greater than sum1
Step42: If True, Compute irr=dr2+((sum2/(sum2-sum1)))*(dr1-dr2)
Step43: Print irr
Step44: Stop

F. Internal Rate of Return

Step1: Start
Step2: Import math Library
Step3: Read initial_inv (initial investment) value from the user
Step4: Read pbdt (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 pbdt list
Step9: End For
Step10: Compute Depreciation= (initial_inv-sal_value)/l
Step11: For i=0 to l Do
Step12: Compute pbdt[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+1 Do
Step18: Compute 1/(math.pow((1+dr1/100),i)) and append each value in pvf1 list
Step19: Insert at 0th position of ci list –initial_inv
Step20: For i=0 to l+1 Do
Step21: Compute ci[i]*pvf1[i] and append each value in pv1 list
Step22: End For
Step23: For i=1 to l+1 Do
Step24: Compute sum1=sum1+pv1[i]
Step25: End For
Step26: For i=0 to l+1 Do
Step27: Compute 1/(math.pow((1+dr2/100),i)) and append each value in pvf2 list
Step28: For i=0 to l+1 Do
Step29: Compute ci[i]*pvf2[i] and append each value in pv2 list
Step30: End For
Step31: For i=1 to l+1 Do
Step32: Compute sum2=sum2+pv2[i]
Step33: End For
Step34: Check If dr1 is less than dr2 and sum1 is greater than dr2
Step35: If True, Compute irr=dr1+((sum1/(sum1-sum2)))*(dr2-dr1)
Step36: Else Check If dr2 is less than dr1 and sum2 is greater than sum1
Step37: If True, Compute irr=dr2+((sum2/(sum2-sum1)))*(dr1-dr2)
Step38: Print irr
Step39: Stop

Formulas

Payback Period=(Initial Cash Outflow)/(Annual Cash Inflows) (1)
Average Rate of Return=\frac{\text{Average Annual Profit after depreciation and tax}}{\text{Average Investment}} \times 100 (2)
Net Present Value (NPV)=\text{Present Value of Cash Inflow-Present Value of Cash Outflow} (3)
Profitability Index\(=\frac{PV \text{ of cash inflows}}{Initial \text{ investment or cash outflows}}\) (4)
Net profitability index=Profitability Index-1 (5)
IRR=Lower \(\frac{PV \text{ at lower rate}}{PV \text{ at higher rate}}\)\(+\) \(\frac{\text{difference in rates}}{\text{difference in rates}}\) (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 | EARNINGS BEFORE DEPRECIATION & 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=(\(\frac{\text{Initial Investment}-\text{Salvage Value}}{\text{Number of years}}\)) (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\(=2\text{ Yrs} +\text{ }78000 \div 88000\text{ }=2+0.8863=2\text{ years }10\text{ months and }23\text{ days}\)

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 | CASH INFLOWS (EARNINGS AFTER TAX+DEPRECIATION) | CUMULATIVE CASH INFLOWS |
|-------|-----------------------------------|--------------|---------------------|-----|---------------------------------------------|-------------------------|
| 1     | 70000                             | 40000        | 30000               | 12000 | 58000 (58000+64000)                        | 58000                   |
| 2     | 80000                             | 40000        | 40000               | 16000 | 64000 (58000+64000)                        | (122000+88000)          |
| 3     | 120000                            | 40000        | 80000               | 32000 | 88000 (122000+88000)                       | (210000+70000)          |
| 4     | 90000                             | 40000        | 50000               | 20000 | 70000 (210000+70000)                       | (280000+520000)         |
| 5     | 60000                             | 40000        | 20000               | 8000  | 12000 (280000+520000)                      |                         |

Preliminary Investment=200000
Depreciation=(\(\frac{\text{Initial Investment}-\text{Salvage Value}}{\text{Number of years}}\))
Since salvage value is zero, substituting the values we get,
Depreciation\(=\frac{200000}{5}\)=Rs. 40,000/-
Net Profit\(=\frac{(Rs.8,000+Rs.24,000+Rs.48,000+Rs.30,000+Rs.12,000)}{5}\)=Rs.1,32,000/-

Average Annual Profit\(=\frac{132000}{5}\)=Rs. 26,400
Average Investment\(=\frac{200000}{2}\)=Rs. 1,00,000/-
Average rate of return\(=\frac{132000}{100000}\times 100\)=26.4%

6.3 Discounted Pay Back Period
### Table 6.3 Showing the calculation of Discounted Payback Period

| YEARS | EARNINGS BEFORE DEPRECIATION & 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 = Rs. 200,000
Depreciation = (Initial Investment - Salvage Value) / (Number of years)
Since salvage value is zero, substituting the values we get,
Depreciation = 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 = 3 Years + 28,326 / 47,810 = 3 + 0.5924 = 3.5924 = 3 years 7 months and 16 days

### 6.4 Net Present Value Method

| YEARS | EARNINGS BEFORE DEPRECIATION & 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 Inflow - Present Value of Cash Outlay = Rs. 2,51,776 - Rs. 2,00,000 = Rs. 51,776.00

### 6.5 Profitability Index

| YEARS | EARNINGS BEFORE DEPRECIATION & 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 /
Profitability Index = (Present Value of Cash Inflow) / (Present value of Cash Outflow) = 251776 / 200000 = 1.2588

### 6.6 Internal Rate of Return

| YEARS | EARNINGS BEFORE DEPRECIATION & 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                |
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.

Conclusions

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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