Computing Capital Budgeting for Banking Sector

Sushain Koul\textsuperscript{1}, Dr. Parag Ravikant Kaveri\textsuperscript{2}

\textsuperscript{1}Student, Symbiosis Institute of Computer Studies and Research, Pune, 411016, India
\textsuperscript{2}Department of Computer, Symbiosis Institute of Computer Studies and Research, Pune, 411016, India
\textsuperscript{1}suk1941073@sicsr.ac.in,  \textsuperscript{2}parag.kaveri@sicsr.ac.in

\textbf{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.

\textbf{Index Terms}

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

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\begin{tabular}{l l}
\textbf{Introduction} & \textbf{Algorithm} \\
\end{tabular}

\textbf{A. Payback Period}

Step1: Start
Step2: Read initial\textsubscript{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\textsubscript{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\textsubscript{inv} - sal\textsubscript{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
Step16: 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\textsubscript{inv}
Step22: If True, Compute c=c+1
Step23: If False, Compute pb= (initial\textsubscript{inv}-(sum1-ci[i]))/ci[i] and break out of the loop
Step24: Print pb

\textbf{Methodology}

The information of this research paper has been compiled through Primary and Secondary Sources.
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
Step16: For i=0 to l Do
Step17: Compute np[i]+Depreciation and append each value in ci list
Step18: End For
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+c+1
Step31: If False, Compute dpb=c+((initial_inv-(sum1-pv[i]))/pv[i])
Step32: End For
Step33: Print dpb
Step34: Stop

C. Discounted Payback Period

Step1: Start
Step2: Import math Library
Step3: Read initial_inv (initial investment) value from the user
Step4: Set pbdt (profit before depreciation and tax), pbt (profit before tax), np (net profit), 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: 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
Step16: Compute np[i]+Depreciation and append each value in ci 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+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+1 Do
Step28: Compute sum1=sum1+pv[i]
Step29: Insert at 0th position of ci list –initial_inv
Step30: For i=0 to l+1 Do
Step31: Compute ci[i]*pvf[i] and append each value in pv list
Step32: End For
Step33: Print dpb
Step34: Stop

D. Net Present Value

Step1: Start
Step2: Import math Library
Step3: Read initial_inv (initial investment) value from the user
Step4: 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
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: 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
Step16: Compute np[i]+Depreciation and append each value in ci 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+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+1 Do
Step28: Compute sum1=sum1+pv[i]
E. Profitability Index

Step 1: Start
Step 2: Import math Library
Step 3: Read `initial_inv` (initial investment) value from the user
Step 4: Read `pbd` (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
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 for each year from the user and append it in `pbd` 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 `pbd[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 `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+1` Do
Step 22: Compute `1/(math.pow((1+dr),i+1))` and append each value in `pvf` list
Step 23: Insert at 0th position of `ci` list –`initial_inv`
Step 24: For `i=0` to `l+1` Do
Step 25: Compute `ci[i]*pvf[i]` and append each value in `pv` list
Step 26: End For
Step 27: For `i=1` to `l+1` Do
Step 28: Compute `sum1=sum1+pv[i]`
Step 29: End For
Step 30: For `i=0` to `l+1` Do
Step 31: Compute `1/(math.pow((1+dr2),i))` and append each value in `pvf2` list
Step 32: End For
Step 33: For `i=0` to `l+1` Do
Step 34: Compute `ci[i]*pvf2[i]` and append each value in `pv2` list
Step 35: End For
Step 36: Check If `dr1` is less than `dr2` and `sum1` is greater than `dr2`
Step 37: If True, Compute `irr=dr1+((sum1/(sum1-sum2))*(dr2-dr1))`
Step 38: Else Check If `dr2` is less than `dr1` and `sum2` is greater than `sum1`
Step 39: If True, Compute `irr=dr2+((sum2/(sum2-sum1))*(dr1-dr2))`
Step 40: Print `irr`
Step 41: Stop

F. Internal Rate of Return

Step 1: Start
Step 2: Import math Library
Step 3: Read `initial_inv` (initial investment) value from the user
Step 4: 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
Step 5: Set `sum1, sum2` variable as zero
Step 6: Read `sal_value` (salvage value), `l` (expected life), `dr1` (discount rate1), `dr2` (discount rate2) and `tax` from the user
Step 7: For `i=0` to `1` Do
Step 8: Read Profit Before Depreciation for each year from the user and append it in `pbd` list
Step 9: End For
Step 10: Compute Depreciation=(`initial_inv-sal_value`)/l
Step 11: For `i=0` to `1` Do
Step 12: Compute `pbd[i]-Depreciation` and append each value in `pbt` list
Step 13: End For
Step 14: For `i=0` to `1` Do
Step 15: Compute `pbt[i]-(pbt[i]*(tax/100))` and append each value in `np` list
Step 16: End For
Step 17: For `i=0` to `1` Do
Step 18: Compute `ci[i]+Depreciation` and append each value in `ci` list
Step 19: End For
Step 20: For `i=0` to `1+1` Do
Step 21: Compute `1/(math.pow((1+dr1/100),i))` and append each value in `pvf1` list
Step 22: End For
Step 23: Insert at 0th position of `ci` list –`initial_inv`
Step 24: For `i=0` to `1+1` Do
Step 25: Compute `ci[i]*pvf1[i]` and append each value in `pv1` list
Step 26: End For
Step 27: For `i=1` to `1+1` Do
Step 28: Compute `sum1=sum1+pv1[i]`
Step 29: End For
Step 30: For `i=0` to `1+1` Do
Step 31: Compute `1/(math.pow((1+dr2/100),i))` and append each value in `pvf2` list
Step 32: End For
Step 33: For `i=0` to `1+1` Do
Step 34: Compute `ci[i]*pvf2[i]` and append each value in `pv2` list
Step 35: End For
Step 36: Check If `dr1` is less than `dr2` and `sum1` is greater than `dr2`
Step 37: If True, Compute `irr=dr1+((sum1/(sum1-sum2))*(dr2-dr1))`
Step 38: Else Check If `dr2` is less than `dr1` and `sum2` is greater than `sum1`
Step 39: If True, Compute `irr=dr2+((sum2/(sum2-sum1))*(dr1-dr2))`
Step 40: Print `irr`
Step 41: Stop

Formulas

\[
\text{Payback Period} = \frac{(\text{Initial Cash Outflow})/(\text{Annual Cash Inflows})}{1}
\]
\[
\text{Average Rate of Return} = \frac{\text{Average Annual Profits after depreciation}}{\text{Average Investment}} \times 100
\]
\[
\text{Net Present Value (NPV)} = \text{Present Value of Cash Inflow} - \text{Present Value of Cash Outflow}
\]
Profitability Index= \[ \frac{\text{PV of cash inflows}}{\text{Initial investment or Cash outflows}} \] (4)

Net profitability index=Profitability Index-1 (5)

IRR=\[ \frac{\text{PV at lower rate}}{\text{PV at lower rate} - \text{PV at higher rate}} \cdot \text{difference in rates} \] (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:

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CASH FLOW BEFORE TAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70000</td>
</tr>
<tr>
<td>2</td>
<td>80000</td>
</tr>
<tr>
<td>3</td>
<td>120000</td>
</tr>
<tr>
<td>4</td>
<td>90000</td>
</tr>
<tr>
<td>5</td>
<td>60000</td>
</tr>
</tbody>
</table>

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 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

<table>
<thead>
<tr>
<th>YEARS</th>
<th>EARNINGS BEFORE DEPRECIATION &amp; TAX</th>
<th>DEPRECIATION</th>
<th>EARNINGS BEFORE TAX</th>
<th>TAX</th>
<th>EARNINGS AFTER TAX</th>
<th>CASH INFLOWS (EARNINGS AFTER TAX+DEPRECIATION)</th>
<th>CUMULATIVE CASH INFLOWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70000</td>
<td>40000</td>
<td>30000</td>
<td>12000</td>
<td>18000</td>
<td>58000</td>
<td>58000</td>
</tr>
<tr>
<td>2</td>
<td>80000</td>
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<td>40000</td>
<td>16000</td>
<td>24000</td>
<td>64000</td>
<td>(58000+64000)</td>
</tr>
<tr>
<td>3</td>
<td>120000</td>
<td>40000</td>
<td>80000</td>
<td>32000</td>
<td>48000</td>
<td>88000</td>
<td>(122000+88000)</td>
</tr>
<tr>
<td>4</td>
<td>90000</td>
<td>40000</td>
<td>50000</td>
<td>20000</td>
<td>30000</td>
<td>70000</td>
<td>(210000+70000)</td>
</tr>
<tr>
<td>5</td>
<td>60000</td>
<td>40000</td>
<td>20000</td>
<td>80000</td>
<td>12000</td>
<td>52000</td>
<td>(280000+52000)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Earnings Before Depreciation &amp; Tax</th>
<th>Depreciation</th>
<th>Earnings Before Tax</th>
<th>Tax</th>
<th>Earnings After Tax</th>
<th>Cash Flows (EAT+ Dep.)</th>
<th>PV @ 10%</th>
<th>Discounted Cash Flows</th>
<th>Cumulative Discounted Cash Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70000</td>
<td>40000</td>
<td>30000</td>
<td>12000</td>
<td>18000</td>
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</tr>
<tr>
<td>2</td>
<td>80000</td>
<td>40000</td>
<td>40000</td>
<td>16000</td>
<td>24000</td>
<td>64000</td>
<td>0.826</td>
<td>52864</td>
<td>(52722+52864)</td>
</tr>
<tr>
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<td>32000</td>
<td>48000</td>
<td>88000</td>
<td>0.751</td>
<td>66088</td>
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<tr>
<td>4</td>
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<td>0.683</td>
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<td>(171674+47810)</td>
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<td>12000</td>
<td>52000</td>
<td>0.621</td>
<td>32292</td>
<td>(219484+32292)</td>
</tr>
</tbody>
</table>

Preliminary Investment=2000000
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

<table>
<thead>
<tr>
<th>Years</th>
<th>Earnings Before Depreciation &amp; Tax</th>
<th>Depreciation</th>
<th>Earnings Before Tax</th>
<th>Tax</th>
<th>Earnings After Tax</th>
<th>Cash Flows (EAT+ Dep.)</th>
<th>PV @ 10%</th>
<th>PV of Cash Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70000</td>
<td>40000</td>
<td>30000</td>
<td>12000</td>
<td>18000</td>
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<td>12000</td>
<td>52000</td>
<td>0.621</td>
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</tr>
</tbody>
</table>

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

Table 6.5 Showing the calculation of Profitability Index

<table>
<thead>
<tr>
<th>Years</th>
<th>Earnings Before Depreciation &amp; Tax</th>
<th>Depreciation</th>
<th>Earnings Before Tax</th>
<th>Tax</th>
<th>Earnings After Tax</th>
<th>Cash Flows (EAT+ Dep.)</th>
<th>PV @ 10%</th>
<th>PV of Cash Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70000</td>
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<td>12000</td>
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</tr>
<tr>
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<td>120000</td>
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<td>88000</td>
<td>0.751</td>
<td>66088</td>
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<td>50000</td>
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<td>80000</td>
<td>12000</td>
<td>52000</td>
<td>0.621</td>
<td>32292</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Years</th>
<th>Earnings Before Depreciation &amp; Tax</th>
<th>Depreciation</th>
<th>Earnings Before Tax</th>
<th>Tax</th>
<th>Earnings After Tax</th>
<th>Cash Flows (EAT+ Dep.)</th>
<th>PV @ 20%</th>
<th>DISCOUNTED CASH FLOWS</th>
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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.

References

[1] Capital Budgeting Concept at: https://youtu.be/ZOaGNDmKpzo


Authors Profile

Sushain Koul completed B.E. degree in Electronics and Electrical Engineering from Acharya Institute of Technology, Bengaluru, Karnataka. I am currently pursuing Masters in Business Administration from Symbiosis Institute of Computer Studies and Research, Pune.

Dr. Parag Ravikant Kaveri working as Assistant Professor and Program Head at Symbiosis Institute of Computer Studies and Research, Pune. He has 9 Years of relevant experience and published 25 plus research papers in various national and international Journal and Conferences’