

## Capital Budgeting

<http://spreadsheetml.com/finance/capitalbudgeting.shtml>

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## ConnectCode's Financial Modeling Templates

*Have you thought about how many times you use or reuse your financial models? Everyday, day after day, model after model and project after project. We definitely have. That is why we build all our financial templates to be reusable, customizable and easy to understand. We also test our templates with different scenarios vigorously, so that you know you can be assured of their accuracy and quality and that you can save significant amount of time by reusing them. We have also provided comprehensive documentation on the templates so that you do not need to guess or figure out how we implemented the models.*

*All our template models are only in black and white color. We believe this is how a professional financial template should look like and also that this is the easiest way for you to understand and use the templates. All the input fields are marked with the '\*' symbol for you to identify them easily.*

*Whether you are a financial analyst, investment banker or accounting personnel. Or whether you are a student aspiring to join the finance world or an entrepreneur needing to understand finance, we hope that you will find this package useful as we have spent our best effort and a lot of time in developing them.*

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# 1. Capital Budgeting

## 1.1 Background

Capital Budgeting is the process of analyzing a company's investment decisions such as investing in new equipments, machineries, plants, projects and products. This process involves the estimation of the expected cash flows, the calculation of the Net Present Value (NPV) and the calculation of the Internal Rate of Return (IRR) of the investment. Net Present Value is defined as the present value of all cash inflows minus the present value of all cash outflows. If NPV is positive, the investment is making money and is thus viable. Internal Rate of Return is defined as the discount rate that makes the Net Present Value zero. If the IRR is greater than the opportunity cost of capital then the investment is feasible. The greater the value the IRR, the more feasible an investment is.

There are two hurdles in this analyzing process. One involves the correct estimation of the expected cash flow. The other is the use of a correct discount rate (also known as the Project Cost of Capital). In some cases, it is possible to simply use the Company' Weighted Average Cost of Capital (WACC) as the Project Cost of Capital. This is especially the case if the project has similar cost structure as the company. In other cases, a separate estimation or assumption of the Project Cost of Capital is required.

This Capital Budgeting spreadsheet aims to assist investors, managers or analysts in correctly estimating the cash flow in different scenarios and accurately calculating the Net Present Value and Internal Rate of Return. It also allows different investment projects cash flow to be compared and the forecasting of base case, worst case and best case scenario.

## 1.2 Calculating the NPV and IRR of a Project Investment

The CapitalBudgeting-ProjectCashFlow-NPV worksheet in the Capital Budgeting spreadsheet allows you to key in the assumptions and estimates of a project cash flow and will calculate the Net Present Value and Internal Rate of Return of the investment.

### 1.2.1 Assumptions

This worksheet performs capital budgeting analysis by making three basic assumptions. The assumptions are the Discount Rate to use in the investment project, the company's Tax Rate and the estimated percentage of Net Working Capital over Sales.

	A	B	C	D	E	F
1	Capital Budgeting - Project Cash Flow - NPV					
2	<a href="#">Copyright © 2009, ConnectCode. All rights reserved.</a>					
3	Assumptions					
4		Discount Rate*		16.00%		
5		Tax Rate*		34.00%		
6		Net Working Capital over Sales†		16.00%		

### 1.2.2 Projected Income

The net income of the project is calculated by using the following formula:

$$\text{Net income} = \text{Earnings before Interest \& Taxes (EBIT)} - \text{Taxes}$$

where

EBIT = Net Sales - Total Variable Costs - Total Fixed Costs - Depreciation

	A	B	C	D	E	F	G	H	I
7	Projected Income								Year
8				0	1	2	3	4	5
9		Price per Unit*			\$100.00	\$100.00	\$100.00	\$100.00	\$100.00
10		Unit Sales*			2,000.00	3,000.00	4,000.00	5,000.00	6,000.00
11		Net Sales			\$200,000.00	\$300,000.00	\$400,000.00	\$500,000.00	\$600,000.00
12		Variable costs							
13		Material Cost per Unit*			\$10.00	\$10.00	\$10.00	\$10.00	\$10.00
14		Selling Expenses per Unit*			\$10.00	\$10.00	\$10.00	\$10.00	\$10.00
15		Others (per Unit)*			\$10.00	\$10.00	\$10.00	\$10.00	\$10.00
16		Total Costs per Unit			\$30.00	\$30.00	\$30.00	\$30.00	\$30.00
17		Total Variable Costs			\$60,000.00	\$90,000.00	\$120,000.00	\$150,000.00	\$180,000.00
18		Fixed Costs							
19		Lease payments*			\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00
20		Administration*			\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00
21		Others*			\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00
22		Total Fixed Costs			\$15,000.00	\$15,000.00	\$15,000.00	\$15,000.00	\$15,000.00
23		Depreciation*			\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00
24		Earnings before Interest & Taxes (EBIT)			\$25,000.00	\$95,000.00	\$165,000.00	\$235,000.00	\$305,000.00
25		Taxes			\$8,500.00	\$32,300.00	\$56,100.00	\$79,900.00	\$103,700.00
26		Net income			\$16,500.00	\$62,700.00	\$108,900.00	\$155,100.00	\$201,300.00

### 1.2.3 Projected Cash Flows

This section is where the estimated cash flows are calculated. The Operating cash flow is defined as follows:

Operating cash flow = EBIT + Depreciation + Taxes

	A	B	C	D	E	F	G	H	I
27	Projected Cash Flows								Year
28				0	1	2	3	4	5
29		Earnings before Interest & Taxes (EBIT)			\$25,000.00	\$95,000.00	\$165,000.00	\$235,000.00	\$305,000.00
30		Depreciation			\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00
31		Taxes			\$8,500.00	\$32,300.00	\$56,100.00	\$79,900.00	\$103,700.00
32		Operating cash flow			\$116,500.00	\$162,700.00	\$208,900.00	\$255,100.00	\$301,300.00
33	Net Working Capital								Year
34				0	1	2	3	4	5
35		Net Working Capital*		\$20,000.00	\$32,000.00	\$48,000.00	\$64,000.00	\$80,000.00	\$96,000.00
36		NWC Recovery at end*			\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
37		Net Working Capital cash flow		(\$20,000.00)	(\$12,000.00)	(\$16,000.00)	(\$16,000.00)	(\$16,000.00)	(\$16,000.00)
38	Investment (Capital Spending)								Year
39				0	1	2	3	4	5
40		Initial Investment*		(\$1,000,000.00)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
41		Salvage value*			\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
42		Aftertax salvage value			\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
43		Net Capital Spending		(\$1,000,000.00)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
44	Projected Total Cash Flows								Year
45				0	1	2	3	4	5
46		Operating cash flow			\$116,500.00	\$162,700.00	\$208,900.00	\$255,100.00	\$301,300.00
47		Net Working Capital cash flow		(\$20,000.00)	(\$12,000.00)	(\$16,000.00)	(\$16,000.00)	(\$16,000.00)	(\$16,000.00)
48		Net Capital Spending		(\$1,000,000.00)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
49		Total project cash flow		(\$1,020,000.00)	\$104,500.00	\$146,700.00	\$192,900.00	\$239,100.00	\$285,300.00
50		Cumulative cash flow		(\$1,020,000.00)	(\$915,500.00)	(\$768,800.00)	(\$575,900.00)	(\$336,800.00)	(\$51,500.00)
51		Discounted cash flow		(\$1,020,000.00)	\$90,086.21	\$109,022.00	\$123,582.87	\$132,052.80	\$135,835.04
52									
53		Net Present Value		\$141,068.59					
54		Internal Rate of Return		18.84%					

#### **1.2.4 Net Working Capital**

The Net Working Capital at Year 0 can be entered directly into the spreadsheet. From Year 1 onwards, it is calculated as a function over Net Sales as follows:

Net Working Capital = Net Working Capital over Sales \* Net Sales

Net Working Capital cash flow is calculated as follows:

Net Working Capital cash flow = -(Current Year Net Working Capital - Previous Year Net Working Capital) + NWC Recovery at end

#### **1.2.5 Investment (Capital Spending)**

The project investment and salvage value are taken into account in this section.

Aftertax salvage value is calculated as follows:

Aftertax salvage value = Salvage value \* (1 - Tax Rate)

Net Capital Spending is calculated as follows:

Net Capital Spending = Initial Investment + Aftertax salvage value

#### **1.2.6 Project Total Cash Flow**

The Discounted cash flow uses the Time Value of Money to discount the Total project cash flow with the assumed Discount Rate. Total project cash flow is calculated as follows:

Total project cash flow = Operating cash flow + Net Working Capital cash flow + Net Capital Spending

#### **1.2.7 Net Present Value and Internal Rate of Return**

Net Present Value is calculated using Excel's NPV function on the Total project cash flow. Internal Rate of Return is calculated using Excel's IRR function on the Total project cash flow.

### **1.3 Comparing the Cash flow before and after an Investment**

This worksheet expands on the previous worksheet and allows you to estimate and compare the cash flows before and after an investment. In a new investment project that leads to the production of higher value products or lower overall costs, it is the cash flow differences instead of the cash flow of the new project that is important in the decision making process. The Net Present Value and Internal Rate of Return in this worksheet are calculated based on the cash flow difference due to the investment. This will allow decisions to be made on whether to invest in the new project or to stay status quo.

#### **1.3.1 Before Investment**

The worksheet allows the inputs in the Before Investment section and After Investment section to be entered. The different sections are used for calculating the difference in cash flow before and after the investments.

	A	B	C	D	E	F	G
6	<b>Before Investment</b>						
7		<b>Projected Income</b>			<b>Year</b>		
8					0	1	2
9			Price per Unit*			\$100.00	\$100.00
10			Unit Sales*			2,000.00	3,000.00
11			Net Sales			\$200,000.00	\$300,000.00
12			Variable costs				
13				Material Cost per Unit*		\$10.00	\$10.00
14				Selling Expenses per Unit*		\$10.00	\$10.00
15				Others (per Unit)*		\$10.00	\$10.00
16				Total Costs per Unit		\$30.00	\$30.00
17				Total Variable Costs		\$60,000.00	\$90,000.00
18			Fixed Costs				
19				Lease payments*		\$5,000.00	\$5,000.00
20				Administration*		\$5,000.00	\$5,000.00
21				Others*		\$5,000.00	\$5,000.00
22				Total Fixed Costs		\$15,000.00	\$15,000.00
23			Depreciation*			\$100,000.00	\$100,000.00
24			Earnings before Interest & Taxes (EBIT)			\$25,000.00	\$95,000.00
25			Taxes			\$8,500.00	\$32,300.00
26			Net income			\$16,500.00	\$62,700.00
27		<b>Projected Cash Flows</b>			<b>Year</b>		
28					0	1	2
29			Earnings before Interest & Taxes (EBIT)			\$25,000.00	\$95,000.00
30			Depreciation			\$100,000.00	\$100,000.00
31			Taxes			\$8,500.00	\$32,300.00
32			Operating cash flow			\$116,500.00	\$162,700.00

### 1.3.1.1 Projected Income

The net income of the project is calculated by using the following formula:

$$\text{Net income} = \text{Earnings before Interest \& Taxes (EBIT)} - \text{Taxes}$$

where

$$\text{EBIT} = \text{Net Sales} - \text{Total Variable Costs} - \text{Total Fixed Costs} - \text{Depreciation}$$

### 1.3.1.2 Projected Cash Flow

This section is where the estimated cash flows are calculated. The Operating cash flow is defined as follows:

$$\text{Operating cash flow} = \text{EBIT} + \text{Depreciation} + \text{Taxes}$$

### 1.3.2 After Investment

This section is a replicate of the Before Investment section. It is used for keying in the inputs of the cash flow after the investment is made.

	A	B	C	D	E	F	G
34	<b>After Investment</b>						
35		<b>Projected Income</b>			<b>Year</b>		
36					0	1	2
37			Price per Unit*			\$100.00	\$100.00
38			Unit Sales*			2,000.00	3,000.00
39			Net Sales			\$200,000.00	\$300,000.00
40			Variable costs				
41				Material Cost per Unit*		\$3.00	\$3.00
42				Selling Expenses per Unit*		\$10.00	\$10.00
43				Others (per Unit)*		\$10.00	\$10.00
44				Total Costs per Unit		\$23.00	\$23.00
45				Total Variable Costs		\$46,000.00	\$69,000.00
46			Fixed Costs				
47				Lease payments*		\$5,000.00	\$5,000.00
48				Administration*		\$5,000.00	\$5,000.00
49				Others*		\$5,000.00	\$5,000.00
50				Total Fixed Costs		\$15,000.00	\$15,000.00
51			Depreciation*			\$100,000.00	\$100,000.00
52			Earnings before Interest & Taxes (EBIT)			\$39,000.00	\$116,000.00
53			Taxes			\$13,260.00	\$39,440.00
54			Net income			\$25,740.00	\$76,560.00
55		<b>Projected Cash Flows</b>			<b>Year</b>		
56					0	1	2
57			Earnings before Interest & Taxes (EBIT)			\$39,000.00	\$116,000.00
58			Depreciation			\$100,000.00	\$100,000.00
59			Taxes			\$13,260.00	\$39,440.00
60			Operating cash flow			\$125,740.00	\$176,560.00

### 1.3.3 Investment (Capital Spending)

The project investment and salvage value is taken into account in this section.

62	<b>Investment (Capital Spending)</b>			<b>Year</b>			
63				0	1	2	
64		Initial Investment*		(\$200,000.00)	\$0.00	\$0.00	
65		Salvage value*			\$0.00	\$0.00	
66		Aftertax salvage value			\$0.00	\$0.00	
67		Net Capital Spending		(\$200,000.00)	\$0.00	\$0.00	
68	<b>Projected Cash Flows Difference</b>			<b>Year</b>			
69				0	1	2	
70		Cash flow difference due to investment			\$9,240.00	\$13,860.00	
71		Net Capital Spending		(\$200,000.00)	\$0.00	\$0.00	
72		Total project cash flow		(\$200,000.00)	\$9,240.00	\$13,860.00	
73		Cumulative cash flow		(\$200,000.00)	(\$190,760.00)	(\$176,900.00)	
74		Discounted cash flow		(\$200,000.00)	\$8,555.56	\$11,882.72	

Aftertax salvage value is calculated as follows:

$$\text{Aftertax salvage value} = \text{Salvage value} * (1 - \text{Tax Rate})$$

Net Capital Spending is calculated as follows:

Net Capital Spending = Initial Investment + Aftertax salvage value

### **1.3.4 Project Cash Flow Difference**

Cash flow difference due to investment = Operating cash flow after investment - Operating cash flow before investment

Total project cash flow = Cash flow differences due to investmnet + Net Capital Spending

### **1.3.5 Net Present Value and Internal Rate of Return**

Net Present Value is calculated using Excel's NPV function on the Total project cash flow. Internal Rate of Return is calculated using Excel's IRR function on the Total project cash flow.

## **1.4 Scenario Analysis**

Estimating the cash flow of a project is typically very difficult and requires many carefully thought of assumptions. A wrong assumption on the number of units sold or the fixed costs might result in an entirely different decision made. It is thus prudent and useful to perform a Scenario Analysis during Capital Budgeting.

Scenario Analysis basically involves estimating the cash flows on a Base Case, Worst Case and Best Case scenario. The ProjectCashFlowScenarioAnalysis worksheet allows Scenario Analysis to be performed easily. It allows the inputs of the Base Case scenario, Worst Case scenario and Best Case scenario to be entered into the same worksheet. After which, the cash flow is automatically projected based on the scenario selected and the Net Present Value and Internal Rate of Return is calculated for the selected scenario.

### **1.4.1 Assumptions**

This worksheet performs capital budgeting analysis by making three basic assumptions. The assumptions are the Discount Rate to use in the investment project, the company's Tax Rate and the estimated percentage of Net Working Capital over Sales.

### 1.4.2 Forecasting Base Case, Worst Case and Best Case

	A	B	C	D	E	F	G	H	I
7		<b>Forecasting Base Case</b>							
8									Year
9				0	1	2	3	4	5
10		Price per Unit*			\$100.00	\$100.00	\$100.00	\$100.00	\$100.00
11		Unit Sales*			2,000.00	3,000.00	4,000.00	5,000.00	6,000.00
12		Variable costs							
13		Total Costs per Unit*			\$30.00	\$30.00	\$30.00	\$30.00	\$30.00
14		Fixed Costs*			\$15,000.00	\$15,000.00	\$15,000.00	\$15,000.00	\$15,000.00
15		<b>Forecasting Worst Case</b>							
16									Year
17				0	1	2	3	4	5
18		Price per Unit*			\$90.00	\$90.00	\$90.00	\$90.00	\$90.00
19		Unit Sales*			1,500.00	2,000.00	3,000.00	4,000.00	4,500.00
20		Variable costs							
21		Total Costs per Unit*			\$30.00	\$30.00	\$30.00	\$30.00	\$30.00
22		Fixed Costs*			\$14,000.00	\$15,000.00	\$15,000.00	\$15,000.00	\$15,000.00
23		<b>Forecasting Best Case</b>							
24									Year
25				0	1	2	3	4	5
26		Price per Unit*			\$105.00	\$105.00	\$105.00	\$105.00	\$105.00
27		Unit Sales*			4,000.00	6,000.00	8,000.00	100,000.00	120,000.00
28		Variable costs							
29		Total Costs per Unit*			\$30.00	\$30.00	\$30.00	\$30.00	\$30.00
30		Fixed Costs*			\$16,000.00	\$15,000.00	\$15,000.00	\$15,000.00	\$15,000.00

The next three sections of the worksheet allow the inputs of the different scenarios to be entered. The following inputs are required for each of the scenario.

- Price per Unit
- Unit Sales
- Total Costs per Unit
- Fixed Costs

### 1.4.3 Scenario Selection

The worksheet allows the scenario of the cash flow to be selected. Based on the selection, the project income and cash flow of the specified scenario will be generated and calculated.

<b>Forecasting Case Scenario</b>	Worst Case ▼
----------------------------------	--------------

The Forecasting Case Scenario field is defined using a control. The control is set to the following selections.

Base Case
Worst Case
Best Case

When a selection is made, the control will return a number to cell D32. Based on the number returned, the worksheet will generate the project income and cash flow of the selected scenario.

Base Case	1
Worst Case	2
Best Case	3

The following fields in the Projected Income section depend on the number return above to decide which inputs from which scenarios to use.

- Price per Unit
- Unit Sales
- Total Costs per Unit
- Fixed Costs

For example, if the Best Case is selected, Price per Unit in cell E36 (for Projected Income) will be set to E26 (Forecasting Best Case).

34	<b>Projected Income</b>		
35			
36		Price per Unit	
37		Unit Sales	
38		Net Sales	
39		Variable costs	
40			Total Costs per Unit
41			Total Variable Costs
42		Fixed Costs	
43		Depreciation*	
44		Earnings before Interest & Taxes (EBIT)	
45		Taxes	
46		Net income	

The net income of the project is calculated by using the following formula:

$$\text{Net income} = \text{Earnings before Interest \& Taxes (EBIT)} - \text{Taxes}$$

where

$$\text{EBIT} = \text{Net Sales} - \text{Total Variable Costs} - \text{Total Fixed Costs} - \text{Depreciation}$$

The rest of the worksheet is exactly similar to the first worksheet ProjectCashFlow-NPV.