

Constructing a Capital Budget

File C5-241

A capital budget can be used to analyze the economic viability of a business project lasting multiple years and involving capital assets. It is divided into three parts. The first part is the initial phase in which capital assets such as machinery and equipment are purchased and a production facility is constructed. The second phase involves estimating a series of operating cash flows that generate annual returns from the project. These operating cash flows extend over the life of the business project. The third phase occurs at the end of the project and involves liquidating the remaining assets and closing the business project.

Estimating Operating Cash Flows

The process for computing operating cash flows is shown in Table 1. Operating cash flows are usually estimated for monthly, quarterly, or annual time periods. First, cash revenues are estimated. This usually involves estimating the number of units sold during each time period and multiplying the number by the selling price of the units.

The next step is to estimate the cash expenses associated with making the product. Cash expenses are categorized as variable and fixed cash expenses.

Variable cash expenses are tied directly to the amount of output produced. For example, if it takes 10 pounds of raw materials to make one unit of output, then the cost of raw materials varies in direct proportion to the amount of output produced. Fixed cash expenses are those that don't vary according to the amount of output produced. For example, administrative expense is often a fixed expense because it is constant regardless of the amount of output produced.

Depreciation of the capital assets is computed next. Depreciation and cash expenses are then subtracted from cash revenues to compute net income before taxes. The income tax rates are applied against the net income before taxes to compute the amount of taxes. The taxes are subtracted from net income before taxes to compute net income after taxes. Because depreciation is a non-cash expense, it is added back to net income after tax to compute cash flow after tax.

The relevant cash flows generated from this process for use in capital budgeting are cash revenues, cash expenses, taxes, and net cash flow after taxes.

Table 1. Example for Computing Operating Cash Flows.

Computing Cash Flow after Taxes			Relevant Cash Flows		
Cash Revenue	+	\$ 10,000	Cash Revenue	+	\$ 10,000
Cash Expenses	-	\$ 5,000	Cash Expenses	-	\$ 5,000
Depreciation	-	\$ 2,000	Net Cash Flow Before Taxes	=	\$ 5,000
Net Income Before Taxes	=	\$ 3,000	Taxes	-	\$ 1,000
Taxes	-	\$ 1,000	Net Cash Flow After Taxes	=	\$ 4,000
Net Income After Taxes	=	\$ 2,000			
Depreciation	+	\$ 2,000			
Cash Flow After Taxes	=	\$ 4,000			

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Table 2. Capital Budgeting Example, Discount Rate = 7%; Tax Rate = 25%.

Year	0	1	2	3	4	5	6	7	8	9	10
Beginning Cash Flows											
Real Estate	(\$200,000)										
Equipment	(\$70,000)										
Working Capital	(\$30,000)										
Total	(\$300,000)										
Operating Cash Flows											
Volume of Sales		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Sale Price		\$2.20	\$2.20	\$2.20	\$2.20	\$2.20	\$2.20	\$2.20	\$2.20	\$2.20	\$2.20
Cash Revenue		\$110,000	\$110,000	\$110,000	\$110,000	\$110,000	\$110,000	\$110,000	\$110,000	\$110,000	\$110,000
Variable Cash Costs		(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)	(\$35,000)
Fixed Cash Costs		(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)	(\$25,000)
Cash Flow (before tax)		\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Building Depreciation (20 years)		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Equipment Depreciation (7 years)		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$0	\$0	\$0
Depreciation Recapture		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$10,000
Taxes		(\$7,500)	(\$7,500)	(\$7,500)	(\$7,500)	(\$7,500)	(\$7,500)	(\$7,500)	(\$10,000)	(\$10,000)	(\$12,500)
Cash Flow (after tax)		\$42,500	\$42,500	\$42,500	\$42,500	\$42,500	\$42,500	\$42,500	\$40,000	\$40,000	\$37,500
Ending Cash Flows											
Cash Value of Buildings											\$100,000
Cash Value of Equipment											\$10,000
Return of Working Capital											\$30,000
Total											\$140,000
Net Cash Flow	(\$300,000)	\$42,500	\$42,500	\$42,500	\$42,500	\$42,500	\$42,500	\$42,500	\$40,000	\$40,000	\$177,500
Present Value Cash Flow	(\$300,000)	\$39,720	\$37,121	\$34,693	\$32,423	\$30,302	\$28,320	\$26,467	\$23,280	\$21,757	\$90,232
Net Present Value	\$64,315										

Capital Budgeting Example

A simplified example of capital budgeting for a business project is shown in Table 2. The initial investment includes outlays for buildings, equipment, and working capital. \$110,000 of cash revenue is projected for each of the 10 years of the project. After variable and fixed cash expenses are subtracted, \$50,000 of net cash flow (before taxes) is generated.

Depreciation on the buildings and equipment used in the project is computed and used to compute the tax liability. For the first seven years, taxes are \$7,500, resulting in net cash flow after taxes of \$42,500 per year. The equipment is completely

depreciated after seven years, resulting in higher taxes and net cash flow after taxes of \$40,000 for years eight and nine.

Although not included in the example, price and cost coefficients can be adjusted for inflation and over the time period.

At the end of 10 years, the project ends. The market value of the buildings and equipment is \$110,000. Adding the return of the \$30,000 of working capital, the cash inflow is \$140,000. Because the equipment has a market value of \$10,000 but is completely depreciated, \$10,000 of depreciation is required to be repaid (recaptured). The recaptured depreciation

increases the taxable income, which increases the amount of tax and reduces the net cash flow after tax to \$37,500. When the net cash flow for all three phases are totaled and discounted, the net present value of the project is \$64,315. So, the business project is expected to provide a net cash return of \$64,315.

Instead of ending the business, the equipment can be replaced at the end of the 10 years and the business continued. But for capital budgeting planning purposes at the beginning of the project, the 10-year period provides a good assessment of economic viability.

Cash Flow, Not Profitability

Capital budgeting is based on the projected cash flows of a project, not its projected profitability. Although closely related, cash flow and profitability are different. Cash flow represents the cash inflows and outflows from the business. Profitability represents the income and expenses of the business.

You may think of cash flow as transactions that affect your business “checkbook” and profitability as items that impact your “income tax return.” For example, the purchase of capital assets results in different transactions. Cash flows include the initial outlay for capital assets and their sale at the end of the project, whereas profitability expresses the cost of capital assets in a series of annual depreciation expenses over the life of the assets.

Discount Rate

The discount rate used in the analysis should reflect the cost of capital. If the project is financed entirely with debt capital, the discount rate will be the interest rate charged by the lender. If the project is financed entirely with equity capital, the discount rate may be the opportunity cost of the funds. For example, the opportunity cost may be the rate of return the funds would have earned invested elsewhere. If both equity and debt are used, the interest charged on the borrowed money and the opportunity cost rate of return may be blended in computing the discount rate.

If the discount rate is designed to represent the cost of capital for the business project, interest expense should not be included as an operating cash flow. If it is, interest (the cost of capital) will be counted twice.

Working Capital

Working capital represents the money required to fund the annual operating cash flow. When creating a capital budget, it is important to allow for funds to provide adequate liquidity for operations. At the beginning of the business project, working capital is a cash outflow just like the purchase of capital assets. At the end of the project, working capital is a cash inflow just like the sale of the capital assets. The amount of working capital remaining at the end of the project may not be the same as the working capital invested at the beginning of the project.

A related issue is the capital needed to get the business project up and running. In many situations, the time period from the initial purchase of equipment until the facility is completed and running at capacity can be long. Funds are needed to bridge this time period.

Another issue is working capital in the form of contingency funds needed to cover any unexpected occurrences. These can include cost overruns, under-performance of the facility, a market downturn, and many other unexpected occurrences.

Lag Time in Converting Inputs to Outputs

In many traditional manufacturing and processing business projects, there is a relatively short time between when inputs are purchased and outputs are produced. For example, corn can be converted into ethanol rather quickly. Once production begins, outputs are produced in the same time period as inputs are utilized.

However, for many agricultural production business projects, there is a considerable lag time from the time the input is utilized until output is produced. For example, it may take several months for a feeder calf to be converted into a finished animal. From the time inputs (feeder calf) are purchased, outputs

(finished animal) may not emerge until the following year. In this situation, the first time period will generate cash outflows (feeder calf purchase) but no cash inflows (finished animal sale). Therefore, additional working capital is needed to finance this lag time. Also, during the last year of the projects, the situation is reversed because no inputs (feeder calf) are purchased but outputs (finished animal) are produced.

Expansion versus Stand-alone Business Project

Business projects are primarily of two types – the expansion of an existing business and the start-up of a new stand-alone business. Expansion examples include an expansion of your main product line, adding a new product line, making a component versus buying the component, and a host of other ways of expanding a business. The other is a standalone business project. This is often a new start-up business that has no direct connection to an existing business.

The purpose of the capital budgeting exercise for a business expansion is to determine if the expansion will generate positive cash returns for the existing business. When computing cash flows for a business expansion, only those cash inflows and outflows associated with the expansion are included. The cash flows of the existing business need not be included. These additional cash flows are sometimes called incremental cash flows because they often represent an increase in an existing cash flow (e.g. more product sales, larger purchase of raw materials, more marketing expense, etc.). An expansion can lead to new and additional cash flows that are difficult to detect. A careful assessment is required to identify all cash flows.

The purpose of the capital budgeting exercise for a stand-alone business is to determine if the business investments will generate a positive net cash return over the life of the project. When preparing a capital budget, all of the cash inflows and outflows over the life of the business project need to be

included. This includes the initial cash outlays at the beginning of the project, the operating cash flows that occur annually over the life of the project, and the remaining cash value of assets at the end of the project.

Assessing Risk

Because capital budgeting involves projecting cash flows several years into the future, there is considerable risk as to the accuracy of these projections, especially for those years farthest into the future. This variability of outcome can have a major impact on the outcome of the analysis and the resulting feasibility of the business project. Several methods have been developed to assess this variability and its impact on the analysis.

Discount Rate

One method for accounting for the risk is to increase the discount rate. This is similar to the way banks account for high-risk loans by increasing the interest rate. Essentially, it means that the bank needs to receive a higher return to offset the higher risk of default on the loan.

Table 3 shows the impact on net present value of the example in Table 2 from raising the discount rate to 10% and 13%. A higher discount rate will generate a smaller net present value.

Table 3. Impact of Risk Adjusted Discount Rate on Net Present Value.

7% (base analysis)	\$64,315
10%	\$10,966
13%	(\$31,388)

Sensitivity Analysis

Sensitivity analysis is another method of assessing business risk. It shows how a change in one of the major operation variables impacts returns. Expressed differently, it shows how sensitive the level of returns is to a change in each of the major variables. Table 4 shows the impact of a positive and negative 20% change in major variables on the net present value of the project described in Table 2.

Table 4. Impact of Sensitivity Analysis on Net Present Value.

	Volume of Sales	Variable Cash Expenses	Fixed Cash Expenses	Discount Rate
20% higher	\$180,204	\$27,441	\$37,976	\$37,845
Base Analysis	\$64,315	\$64,315	\$64,315	\$64,315
20% lower	(\$51,575)	\$101,188	\$90,653	\$93,958

Scenario Analysis

Scenario analysis is similar to sensitivity analysis except that one or more threats to and opportunities for the business project are identified, and how these threats and opportunities might impact returns is estimated. Examples of outside threats include the entry of a competitor into the market, a sudden rise in energy or raw material prices, a new technology breakthrough by a competitor, an economic recession, etc. Examples of inside threats include cost overruns during startup, poor market development, poor quality control, etc. Scenario analysis is often created in “best case” and “worst case” scenarios based on opportunities for and threats to the business. Table 5 shows the net present value of the example in Table 2 using scenario analysis.

Table 5. Impact of Scenario Analysis on Net Present Value.

Best Case	\$132,643
Base Analysis	\$64,315
Worst Case	(\$10,427)

Additional Resources on capital budgeting may be found on the [Ag Decision Maker website](http://www.extension.iastate.edu/agdm/vdoperations.html), www.extension.iastate.edu/agdm/vdoperations.html.

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