

Extension of budgeting

What is project budgeting?

How to estimate the project budget?

Methods/Techniques for Capital Budgeting



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Project Management

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1. PART

- Recap from the last lecture – Project costs and Project budget

2. PART

- Techniques/Methods of Capital Budgeting, overview of selected methods, their explanation, examples of application

3. PART (20 min.)

- Process of Capital Budgeting, objectives and factor affecting of Capital Budgeting
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Key readings



You can find support in the following sources:

- Book – Kerzner, H. 2013. Project Management. Chapter 14, p. 511 (focused on parts 14.21-14.28)
 - Book – PMBOK Guide. 2017. Chapter 7 (p. 231 Project Cost Management)
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PART 1

Recap – Project budget, Estimating project budget,

- **Project budget** - it's the total amount of money you'll need to finish the project that should be approved by all the stakeholders involved.
- **The project budget** has a **cost side** and a **revenue side**;
- it can be defined as the total amount of funds allocated to a project, usually divided into expenditure categories and phased over time.
- **For profitable projects** - revenues exceed costs. **Revenue > Costs**
- **For non-profit projects** - we should be able to cover our costs. **Revenue = Costs**
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Approaches to estimating a project budget



Bottom-up estimation

- This process starts with zero total costs and adds the cost for each item in the hierarchical structure of work (WBS). The result is the sum of costs for the entire project.

Top-down estimation

- It starts with the project budget total and involves **breaking it down into smaller chunks**.
- Top-down estimation is typically used when you have a **fixed project price** with the budget set in stone.

Analogous estimation

- This process is based on information about past activities, considers the actual costs of previous projects and applies them to the current project.

Expert estimates

- This option is most often used in cases where it is too time consuming or expensive to determine prices from verifiable sources.
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Approaches to estimating a project budget



Three-point estimation

- a **weighted average based on the best, worst, and most likely** case budget scenarios and **encourages you to think from multiple perspectives.**

Parametric estimation

- Parametric modelling uses a mathematical model based on known parameters, which may vary depending on the type of work performed. The parameter can be, for example, the cost per cubic meter, the cost per hour of work of the excavator, etc.
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Approaches to estimating a project budget



Risk budget, tolerance budget, change budget

- **Tolerance budget** is a **range** within which you can spend without having to report back to your sponsor or ask for more money. Tolerance budget is set at the beginning of your project but is particularly useful at the end of a project nearly the delivery date.
 - **Change budget** – changes in projects are very common during the whole project. How well you can adjust your budget to a scope change depends on how well you budgeted the project in the first place. **This budget needs to be approved.**
 - **Risk budget** - Creating a financial reserve to cover unexpected or higher costs. **Risk costs are** one of the most common project risks. It can arise from poor budget planning and inaccurate cost estimation.
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PART 2

Capital budgeting

Techniques/Methods of Capital Budgeting

- **Capital budgeting** is a process that businesses use to evaluate potential major projects or investments. Building a new plant or taking a large stake in an outside venture are examples of initiatives that typically require capital budgeting before they are approved or rejected by management.
- As part of capital budgeting, a company might **assess a prospective project's lifetime cash inflows and outflows** to determine whether the potential returns it generates meet a sufficient target benchmark.
- The capital budgeting process is also known as investment appraisal.





Features of Capital Budgeting

- There is a **long duration** between the initial investments and the expected returns.
 - The organizations usually estimate **large profits**.
 - The process involves **high risks**.
 - It is a **fixed investment** over the long run.
 - All projects require **significant amounts of funding**.
 - The **amount of investment made** in the project determines the **profitability** of a company.
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Understanding Capital Budgeting

- In smaller businesses, a project that has the potential to deliver rapid and sizable cash flow may have to be rejected because the investment required would exceed the company's capabilities.
- The amount of work and time invested in capital budgeting will vary based on the risk associated with a bad decision along with its potential benefits. Therefore, a modest investment could be a wiser option if the company fears the risk of bankruptcy in case the decisions go wrong.
- **Sunk costs** are not considered in capital budgeting.

The sunk cost fallacy

The sunk cost fallacy is the tendency for people to continue something because they've already invested their time, energy, or money, even when abandoning it would be more beneficial.



Techniques/Methods of Capital Budgeting



In addition to the many capital budgeting methods available, the following list outlines a few by which companies can decide which projects to explore:

- Payback Period Method
 - Net Present Value Method (NPV)
 - Internal Rate of Return (IRR)
 - Profitability Index
 - Return on Investment (ROI)
 - Cost Benefit Analysis (CBA)
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Techniques/Methods of Capital Budgeting



Payback Period Method

- It refers to the **time taken by a proposed project to generate enough income to cover the initial investment**. The project with the quickest payback is chosen by the company.
- Formula:

$$\text{Payback Period} = \frac{\text{Initial Cash Investment}}{\text{Annual Cash Flow}}$$

- Despite being an easy and time-efficient method, the Payback Period cannot be called optimum as it **does not consider the time value of money**. The cash flows at the earlier stages are better than the ones coming in at later stages. The company may encounter two projections with the same payback period, where one depicts higher cash flows in the earlier stages/years. In such as case, the Payback Period may not be appropriate.
- A similar consideration is that of a longer period, potentially bringing in greater cash flows during a payback period. In such a case, if the company selects the projects based solely on the payback period and without considering the cash flows, then this could prove detrimental for the financial prospects of the company.

Techniques/Methods of Capital Budgeting



Payback Period Method

Example of Payback Period Method:

An enterprise plans to invest \$100,000 to enhance its manufacturing process. It has two mutually independent options in front: Product A and Product B. Product A brings a contribution of \$25 and Product B of \$15. The expansion plan is projected to increase the output by 500 units for Product A and 1,000 units for Product B.

Here, the incremental cash flow will be calculated as:

$$(25 \times 500) = 12,500 \text{ for Product A } 100,000 / 12,500 = 8$$

$$(15 \times 1000) = 15,000 \text{ for Product B } 100,000 / 15,000 = 6.7$$

The Payback Period for Product A is calculated as:

| | | |
|---|-------------------------------------|-----------|
| 1 | | |
| 2 | Initial Cash Investment | \$100,000 |
| 3 | Incremental Cash Flow | \$12,500 |
| 4 | Payback Period of Product A (Years) | 8 |

| | | |
|---|-------------------------------------|-----------|
| 1 | | |
| 2 | Initial Cash Investment | \$100,000 |
| 3 | Incremental Cash Flow | \$15,000 |
| 4 | Payback Period of Product A (Years) | 6.7 |

This brings the enterprise to conclude that Product B has a shorter payback period and therefore, it will invest in Product B.

Techniques/Methods of Capital Budgeting



Net Present Value Method (NPV)

- **Evaluating capital investment projects** is what the NPV method helps the companies with.
- There may be **inconsistencies in the cash flows** created over time. The cost of capital is used to discount it. An evaluation is done based on the investment made.
- Whether a project is accepted or rejected depends on the value of inflows over current outflows.

- Formula:

| | |
|----------------------------------|-----------|
| <i>Net Present Value (NPV) =</i> | R_t |
| | $(1+i)_t$ |
| <i>t = time of cash flow</i> | |
| <i>i = discount rate</i> | |
| $R_t =$ <i>net cash flow</i> | |

Techniques/Methods of Capital Budgeting



Net Present Value Method (NPV)

Example of Net Present Value (with 9% Discount Rate):

For a company, let's assume the following conditions:

Capital investment = \$10,000

Expected Inflow in First Year = \$1,000

Expected Inflow in Second Year = \$2,500

Expected Inflow in Third Year = \$3,500

Expected Inflow in Fourth Year = \$2,650

Expected Inflow in Fifth Year = \$4,150

Discount Rate = 9%

| Year | Flow | Present Value | Calculation |
|--------------|-----------|-----------------|------------------|
| 0 | -\$10,000 | -\$10,000 | - |
| 1 | 1,000 | 9,174 | $1,000/(1.09)^1$ |
| 2 | 2,500 | 2,104 | $2,500/(1.09)^2$ |
| 3 | 3,500 | 2,692 | $3,500/(1.09)^3$ |
| 4 | 2,650 | 1,892 | $2,600/(1.09)^4$ |
| 5 | 4,150 | 2,767 | $4,000/(1.09)^5$ |
| Total | | \$18,629 | |

Net Present Value achieved at the end of the calculation is: With 9% Discount Rate = \$18,629

This indicates that if the NPV comes out to be positive it indicates the project to be profitable. Therefore, the company shall move ahead with the project.

Internal Rate of Return (IRR)

- IRR refers to the method where the NPV is zero. In such condition, the cash inflow rate equals the cash outflow rate. Although it considers the time value of money, it is one of the complicated methods.
- It follows the rule that if the IRR is more than the average cost of the capital, then the company accepts the project, or else it rejects the project. If the company faces a situation with multiple projects, then the project offering the highest IRR is selected by them.

Formula:

*Internal Rate of Return = Discount rate that makes NPV=0;
implies discounted cash inflows are equal to discounted cash outflows*

Internal Rate of Return Rule = Accept investments if IRR greater than Threshold Rate of Return, else reject.

Techniques/Methods of Capital Budgeting



Internal Rate of Return (IRR)

Example:

We shall assume the possibilities in the table for a company that has 2 projects: Project A with Threshold Rate of Return 7% and Project B with Threshold Rate of Return 10%.

| Year | Project A | Project B |
|-------|-----------|-----------|
| 0 | -\$10,000 | -\$10,000 |
| 1 | \$2,500 | \$3,000 |
| 2 | \$2,500 | \$3,000 |
| 3 | \$2,500 | \$3,000 |
| 4 | \$2,500 | \$3,000 |
| 5 | \$2,500 | \$3,000 |
| Total | \$12,500 | \$15,000 |
| IRR | 7.9% | 15.2% |

Here, The IRR of Project A is 7.9% which is above the Threshold Rate of Return (We assume it is 7% in this case.)

So, the company will accept the project. However, if the Threshold Rate of Return would be 10%, then it would be rejected as the IRR would be lower. In that case, the company will choose Project B which shows a higher IRR as compared to the Threshold Rate of Return.



Profitability Index

- This method provides the ratio of the present value of future cash inflows to the initial investment.
- A Profitability Index that presents a value **lower than 1.0** is indicative of **lower cash inflows** than the initial cost of investment. Aligned with this, a profitability index **great than 1.0** presents **better cash inflows** and therefore, the project will be accepted.

Formula:

$$\text{Profitability Index} = \frac{\text{Present value of Cash Inflows}}{\text{Initial Investment}}$$

Techniques/Methods of Capital Budgeting



Profitability Index

Example:

Assuming the values given in the table, we shall calculate the profitability index for a discount rate of 10%.

| Year | Cash Flows | 10% Discount |
|--------------|------------|-----------------|
| 0 | -\$10,000 | -\$10,000 |
| 1 | \$3,000 | \$2,727 |
| 2 | \$5,000 | \$4,132 |
| 3 | \$2,000 | \$1,538 |
| 4 | \$6,000 | \$4,285 |
| 5 | \$5,000 | \$3,125 |
| Total | | \$15,807 |

So, Profitability Index with 10% discount =
 $\$15,807 / \$10,000 = 1.5807$

As per the rule of the method, the profitability index is positive for the 10% discount rate, and therefore, it will be selected..

$$\text{Profitability Index} = \frac{\text{Present value of Cash Inflows}}{\text{Initial Investment}}$$



Return on investment (ROI)

- Return on investment (ROI) is a financial planning strategy for **determining the value of a project to predict how it may perform.**

How you can use ROI at work:

- In an **entry-level position**: You can use ROI to help persuade management to approve a project under consideration.
 - In a **management position**: You can consider using ROI to monitor and measure your team's performance. This data can help you ensure you're offering constructive criticism and encouragement when necessary.
 - In an **executive position**: You can consult ROI data to determine whether a project is a positive financial investment for the organization, as well as decide which projects to approve and which to overturn.
 - Proving a project's ROI can also help executives and management understand the types of projects that are successful, which can improve the company's long-term investment strategy.
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Return on investment (ROI)

To calculate a project's ROI, consider the formula below:

$$\text{ROI} = (\text{Net profit} / \text{cost of investment}) \times 100$$

- To determine your net profit, subtract the predicted expenses for the project from your expected revenue: **Net profit = expected revenue - total expenses**
 - To determine a project's total expenses, financial planners often divide a project into simplified tasks to ensure they've accounted for every step of the process. Then they factor in the cost of materials, how many hours it may take to complete the project, the amount of staff necessary and their hourly wages. They also consider costs for buying or leasing equipment, software and buildings.
 - Total expenses = material costs + (hours to complete the project x number of people working on the project x hourly wage) + equipment costs + software costs + building costs + additional costs.
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Return on investment (ROI)

Erica is responsible for inventory sourcing at a local used bookstore. She has an opportunity to purchase 1,000 books from a competing bookshop that is downsizing. The books cost one dollar each, and Erica plans to price them at four dollars each. She doesn't have a car, so she plans to pay for a \$50 book delivery service. She estimates that selecting the inventory, arranging the delivery service, cataloging the new books and ensuring they're stored properly may take her about four hours, or about \$50 in wages.

To determine the anticipated ROI for this project, Erica does the following calculations:

- Expected revenue = 1,000 books x \$4 per book = \$4,000
 - Total expenses = (1,000 books x \$1 per book) + \$50 delivery fee + \$50 wages = \$1,100
 - Then, she subtracts the expected revenue from the total expenses, or cost of investment, to find her potential net profit:
 - Potential net profit = \$4,000 - \$1,100 = \$3,900
 - Finally, she divides the net profit by the total expenses, or cost of investment, and multiplies that figure by 100 to find the ROI: $ROI = (\$3,900 / \$1,100) \times 100 = 354\%$
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Techniques/Methods of Capital Budgeting



Cost-Benefit Analysis

A cost-benefit analysis is a systematic process that businesses use to analyze which decisions to make and which to forgo. The cost-benefit analyst sums the potential rewards expected from a situation or action and then subtracts the total costs associated with taking that action.



Cost Benefit Analysis Formula

$$\text{Net Present Value (NPV)} = \sum \text{Present Value of Future Benefits} - \sum \text{Present Value of Future Costs}$$

$$\text{Benefit Cost Ratio} = \frac{\sum \text{Present Value of Future Benefits}}{\sum \text{Present Value of Future Costs}}$$

Techniques/Methods of Capital Budgeting



Cost-Benefit Analysis

Costs may include the following.

- Direct costs would be direct labor involved in manufacturing, inventory, raw materials, manufacturing expenses.
- Indirect costs might include electricity, overhead costs from management, rent, utilities.
- Intangible costs of a decision, such as the impact on customers, employees, or delivery times.
- Opportunity costs such as alternative investments, or buying a plant versus building one.
- Cost of potential risks such as regulatory risks, competition, and environmental impacts.

| Cost Benefit Analysis Example | | | | | | | |
|---------------------------------|---------|-------------------|------------------|------------------|------------------|------------------|------------------|
| Year | | 0 | 1 | 2 | 3 | 4 | 5 |
| Benefits | | \$0 | \$200,000 | \$250,000 | \$312,500 | \$390,625 | \$488,281 |
| Costs | | | | | | | |
| | Upfront | \$75,200 | \$0 | \$0 | \$0 | \$0 | \$0 |
| | Ongoing | \$0 | \$29,000 | \$29,000 | \$29,000 | \$29,000 | \$29,000 |
| Total Costs | | \$75,200 | \$29,000 | \$29,000 | \$29,000 | \$29,000 | \$29,000 |
| Net Cash Flow | | (\$75,200) | \$171,000 | \$221,000 | \$283,500 | \$361,625 | \$459,281 |
| Discount Rate | | 11% | | | | | |
| Discount Factor | | 100% | 89% | 78% | 67% | 56% | 45% |
| Discounted Net Cash Flow | | (\$75,200) | \$152,190 | \$172,380 | \$189,945 | \$202,510 | \$206,677 |
| NPV | | \$848,502 | | | | | |
| IRR | | 213% | | | | | |

Cost-Benefit Analysis

Every project will have different underlying principles; benefits might include the following:

- Higher revenue and sales from increased production or new product.
- Intangible benefits, such as improved employee safety and morale, as well as customer satisfaction due to enhanced product offerings or faster delivery.
- Competitive advantage or market share gained as a result of the decision.

- An analyst or project manager should apply a monetary measurement to all of the items on the cost-benefit list, taking special care not to underestimate costs or overestimate benefits.

Pros

Requires data-driven analysis
Limits analysis to only the purpose determined in the initial step of the process
Results in deeper, potentially more reliable findings
Delivers insights to financial and non-financial outcomes

Cons

May be unnecessary for smaller projects
Requires capital and resources to gather data and make analysis
Relies heavily on forecasted figures; if any single critical forecast is off, estimated findings will likely be wrong.

PART 3

Proces of Capital Budgeting



1. Identifying and generating projects

- Investment proposals are the first step in capital budgeting. Taking up investments in a business can be motivated by a number of reasons. There could be the addition or expansion of a product line. An increase in production or a decrease in production costs could also be suggested.

2. Evaluating the project

- It mainly consists of selecting all criteria necessary for judging the need for a proposal. In order to maximize market value, it has to match the company's mission. It is crucial to consider the time value of money here.
 - In addition to estimating the benefits and costs, you should weigh the pros and cons associated with the process. There could be a lot of risks involved with the total cash inflows and outflows. This needs to be scrutinized thoroughly before moving ahead.
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3. Selecting a Project

- Since there is no ‘one-size-fits-all’ factor, there is no defined technique for selecting a project. Every business has diverse requirements and therefore, the approval over a project comes based on the objectives of the organization. The companies need to explore all the options before concluding and approving the project. Besides, the factors like viability, profitability, and market conditions also play a vital role in the selection of the project.

4. Implementation

- Once the project is implemented, now come the other critical elements such as completing it in the stipulated time frame or reduction of costs. Hereafter, the management takes charge of monitoring the impact of implementing the project.

5. Performance Review

- This involves the process of analyzing and assessing the actual results over the estimated outcomes. This step helps the management identify the flaws and eliminate them for future proposals. |

Proces of Capital Budgeting



Factors Affecting Capital Budgeting

- Capital Return
 - Accounting Methods
 - Structure of Capital
 - Availability of Funds
 - Management decisions
 - Government Policies
 - Working Capital
 - Need of the project
 - Lending terms of financial institutions
 - Earnings
 - Taxation Policies
 - The economic value of the project
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Objectives of Capital Budgeting

The following points present the objectives of the capital budgeting:

- **Capital Expenditure Control:** Organizations need to estimate the cost of investment as it allows them to control and manage the required capital expenditures.
 - **Selecting Profitable Projects:** The company will have to select the most appropriate project from the multiple possibilities in front of it.
 - **Identification of Source of funds:** The businesses need to locate and select the most viable and apt source of funds for long-term capital investment. It needs to compare the various costs like the costs of borrowing and the cost of expected profits. |
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Proces of Capital Budgeting – Key Takeaways



- The capital budgeting process is the planning process utilized to calculate the potential investments or expenditures whose amount is significant.
 - It helps estimate the company's investment in long-term fixed assets like the plant and machinery addition or replacement, new equipment, research, development, etc.
 - This capital budgeting process is the decision regarding the sources of finance and then calculating the return earned from the investment.
 - It starts with identifying different investment opportunities. Then, after collecting and calculating other investment proposals and choosing the best profitable investment, the decision for capital budgeting and apportionment is to be taken.
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