

## Capital Budgeting: A brief overview

### 1.1 Introduction

In competitive business environment in order to sustain in the competition organization continuously needs to expand its business to new dimensions. For this it has to go for expansion, replacement and renewal of its capital assets. For this organization needs to deploy long term capital and it has to decide in which of the alternative they should fund. This initiates the concept of capital Budgeting.

One of the most important decision for a financial manager is investment decision. Investment decision are of two type- **1. Short term investment decision** **2. Long term investment decision**. Capital budgeting is primarily concerned with *sizable* investments in *long-term* assets. These assets may be tangible items such as property, plant or equipment or intangible ones such as new technology, patents or trademarks. Investments in processes such as research, design, development and testing – through which new technology and new products are created – may also be viewed as investments in intangible assets.

Irrespective of whether the investments are in tangible or intangible assets, a capital investment project can be distinguished from recurrent expenditures by two features. One is that such projects are significantly *large*. The other is that they are generally *long-lived* projects with their benefits or cash flows spreading over many years. *Sizable, long-term* investments in tangible or intangible assets have long-term consequences. An investment today will determine the firm's strategic position many years hence. These investments also have a considerable impact on the organization's future cash flows and the risk associated with those cash flows. Capital budgeting decisions thus have a long range impact on the firm's performance and they are critical to the firm's success or failure.

Capital is the financial resources available for use. In some literature **Capital** is the firm's total assets. It includes all tangible and intangible assets. These assets include physical assets (such as land, buildings, equipment, and machinery), as well as assets that represent property rights (such as accounts receivable, securities, patents, copyrights). On the other hand, Budgeting is the estimation of revenue and expenditure over a specified future period of time.

In short capital budgeting is the process of evaluating and selecting long-term investment consistent with the firm's goal of owner's wealth maximization.

### 1.2 Motives of Capital Budgeting

1. **Expansion:** To extend the existing facility there is the need of capital expenditure decision either new or existing areas.

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2. **Replacement:** When a firm think of replacing the older facility with new equipment's with new equipment's capital budgeting is prominent.

3. **Renewal:** It is the alternative of replacement decision. In case of renewal two very important matter needs to be considered. Repair and maintained is revenue expenditure but overhauling or rebuilding is capital expenditure.

4. **Other Purpose:** Sometimes firms have to expand its capital for long term non tangible assets. But to be considered those as capital expenditure those must have long term commitment to the firm. Such as

- Advertisement Expenditure
- Management Consultant
- Research and Development
- Installation of pollution Control devise

### 1.3 Some Important Concept of Capital Budgeting

#### Projects

The endeavor to transform financial asset into capital asset is called project.

#### Independent vs Mutually exclusive projects

If the acceptance of one project does not affect the acceptance of another projects are said to be independent. In contrast if two project fight for funds where only one will get those projects are said to be mutually exclusive.

#### Unlimited funds vs Capital Rationing

If it is possible for the firms to get funds needed to select all the projects at or a lower rate from the prevailing market the situation is called the firm having unlimited funds. In contrast when resource is limited the resource is allocated according to the priority of needs. If there is fund celling in case of capital budgeting the situation is called capital rationing.

#### Conventional and Non-conventional cash flows:

One cash out flow followed by a series of cash inflows and reverse is called the conventional cash flow. '-+++++' If there is multiple change in cash flow pattern then it is called non-conventional cash flow. '- + + + - - +'

### Mixed Stream Vs Annuity

If the projects cash inflows occur at an equal amount per annum then the cash flow is considered as annuity and if it is of different amount then it is known as mixed stream of cash flows

### Contingent Projects and Substitute Project

A contingent project is one the acceptance or rejection of which is dependent on the decision to accept or reject one or more other projects. In contrast, substitute projects are ones where the degree of success (or even the success or failure) of one project is increased by the decision to reject the other project.

## 1.4 Steps in Capital Budgeting

The **capital budgeting process** consists of five steps:

1. **Proposal generation.** Proposals for new investment projects are made at all levels within a business organization and are reviewed by finance personnel.
2. **Review and analysis.** Financial managers perform formal review and analysis to assess the merits of investment proposals
3. **Decision making.** Firms typically delegate capital expenditure decision making on the basis of dollar limits.
4. **Implementation.** Following approval, expenditures are made and projects implemented. Expenditures for a large project often occur in phases.
5. **Follow-up.** Results are monitored and actual costs and benefits are compared with those that were expected. Action may be required if actual outcomes differ from projected ones.

## 1.5 Working capital in capital Budgeting

There are mainly two types of operating capital one is temporary working capital and the other is permanent working capital. According to different author the permanent working capital is invested from long term sources. Such as the permanent working capital for a machine which have validity of more than one-year use must invested form long term sources. That is why we considered working capital in capital budgeting.

## Cash flow estimation in Capital Budgeting

An important part of the capital budgeting process is the estimation of the cash flows associated with the proposed project. Any new project will cause a change in the firm's cash flows. In evaluating an investment proposal, we must consider these expected changes in the firm's cash flows and decide whether or not they add value to the firm. Successful investment decisions will increase the shareholders' wealth through increased cash flows. The tools and techniques in capital budgeting are all based on the expected cash flow. In order to evaluate a project, the cash flows *relevant* to the project have to be identified. In simple terms, a *relevant cash flow* is one which will change (decrease or increase) the firm's overall cash flow as a direct result of the decision to accept the project. Relevant cash flows thus deal with *changes or increments* to the firm's existing cash flows. These flows are also known as *incremental or marginal* cash flows. Project evaluation rests upon *incremental cash flows*. Incremental cash flows are the cash inflows and outflows traceable to a given project, which would disappear if the project disappeared. The incremental cash flows can be measured by comparing the cash flows of the firm 'with' the project and the cash flows of the firm 'without' the project. It is a marginal, or incremental, analysis comparing two situations. Erroneous comparisons such as 'before versus after' should be avoided.

### 2.1 Principles of Estimating Cash Flows

While estimation of the cash flow financial manager has to consider some principles-

- Incremental Cash Flows
- After-Tax Cash Flows
- Ignore Sunk Costs

Another key concept used in identifying relevant cash flows is the notion of sunk costs. A sunk cost is an amount spent in the past in relation to the project, but which cannot now be recovered or offset by the current decision. Sunk costs are past and irreversible. They are not contingent upon the decision to accept (or reject) a proposed project. Therefore, they should not be included in the cash flows.

- Include the Opportunity Cost

When a firm undertakes a project, various resources will be used and not be available for other projects. The cost to the firm of not being able to use these resources for other projects is referred to as an 'opportunity cost'. The value of these resources should be measured in terms of their opportunity cost. The opportunity cost, in the context of capital budgeting, is the value of the most valuable alternative that is given up if the proposed investment project is

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undertaken. This opportunity cost should be included in the project's cash flows.

- Include Externalities

## 2.2 Types of Cash Flows

Cash flows used in capital budgeting are of different types. They are

### Initial Investment Outlay

Cash flow occurring at time "0" that means the cash flows relevant with acquisition of the projects.

#### Formula

Cost of asset + Shipping cost + Installation cost + Increase/decrease in Working Capital

### Operating Cash Flows

Cash flow occurring over the period of life of the projects from its operation.

#### Method 1

$\Delta \text{ Operating Cash Flow} = (\Delta \text{ Revenue} - \Delta \text{ Expenditure} - \Delta \text{ Depreciation}) (1 - \text{Tax rate}) + \Delta \text{ Depreciation}$

#### Method 2

$\Delta \text{ Operating Cash Flow} = (\Delta \text{ Revenue} - \Delta \text{ Expenditure}) (1 - \text{Tax rate}) + \Delta \text{ Depreciation} \times \text{Tax rate}$

### Terminal Cash Flows

Cash flow occurring at time of the termination of the project that means when the projects elements are discarded the amount of cash flows occur.

#### Formula

Funds Realized from Sale of New Asset + Tax Consequences from the Sale of the Asset + Recovery of Net Working Capital

### Net Cash Flows

Sum up all the cash flows we get net cash flows

## 2.3 Real vs. Nominal Cash Flows

- In DCF analysis,  $k$  includes an estimate of inflation.
- If cash flow estimates are not adjusted for inflation (i.e., are in today's dollars), this will bias the NPV downward.
- This bias may offset the optimistic bias of management.

## Evaluation Tools and Decision Criteria

The most important stage of capital budgeting is the evaluation stage. Here the cash flows are evaluated with different tools. To evaluate investment projects and select the one that maximizes wealth, we must determine the cash flows from each investment and then assess the uncertainty of all the cash flows.

### 3.1 Characteristics of an ideal tool

An evaluation technique should consider all the following elements of a capital project:

- All the future incremental cash flows from the project;
- The time value of money; and
- The uncertainty associated with future cash flows.

Projects selected using a technique that satisfies all three criteria will, under most general conditions, maximize owners' wealth. Such a technique should include objective rules to determine which project or projects to select.

### 3.2 Different evaluation techniques

➤ Conventional or non-discounting techniques

1. Payback period technique

- Regular payback period
- Discounted payback period
- Payback Period Reciprocal

2. Accounting rate of return / Return on investment / Average rate of return

➤ Non-Conventional of discounting techniques

1. Net Present value (NPV)

2. Internal Rate of return (IRR)

3. Profitability Index (PI)

4. Modified Internal Rate of Return (MIRR)

#### 3.2.1 Payback Period

The length of time required to recover initial investment. In other word Payback Period is the period of time required for the cumulative expected cash flows from an investment project to equal the initial cash outflow.

## ▪ Regular Payback Period

For annuity cash flows

$$\text{Payback Period} = \frac{\text{Initial Investment}}{\text{Periodic payment/cashinflows}}$$

For mixed Stream cash flows

$$\text{Payback Period} = \text{year before full recovery} + \frac{\text{Unrecovered cost at start of year}}{\text{Cash flows during year}}$$

### DECISION CRITERIA

When the payback period is used to make accept–reject decisions, the following decision criteria apply:

- If the payback period is less than the maximum acceptable payback period, accept the project.
- If the payback period is greater than the maximum acceptable payback period, reject the project.

The length of the maximum acceptable payback period is determined by management.

This value is set subjectively on the basis of a number of factors, including the type of project (expansion, replacement or renewal, other), the perceived risk of the project, and the perceived relationship between the payback period and the share value. It is simply a value that management feels, on average, will result in value-creating investment decisions.

### Evaluation of Payback Period

- Strengths
  - Provides an indication of a project's risk and liquidity.
  - Easy to calculate and understand.
- Weaknesses
  - Ignores the TVM.
  - Ignores CFs occurring after the payback period.

## ▪ Discounted Payback Period

The length of time it takes to recover the project's investment in terms of discounted cash flows, where the discount rate is the cost of capital.

### Evaluation of Discounted Payback Period

- Strengths
  - Considers the time value of money.
  - Considers the riskiness of the cash flows involved in the payback.
- Weaknesses
  - Requires estimate of cost of capital.
  - Ignores cash flows beyond the payback.

### ▪ Payback Period Reciprocal

Using payback period, we can know the time within which we can recover our initial investment but cannot compare with the rate of return. To remove these difficulties this technique can be used.

If cash flow is even formula is

$$\text{PBR} = \frac{\text{Annual Cash Inflow}}{\text{Initial Investment}} \times 100$$

If the cash flow is uneven the formula is

$$\text{PBR} = \frac{1}{\text{Payback Period}} \times 100$$

#### DECISION CRITERIA

Which project shows highest of this return shall be accepted

### 3.2.3 Accounting rate of return / Return on investment / Average rate of return

It is calculated by dividing average annual after tax profit by average investments. That is

$$\text{ARR} = \frac{\text{Average annual after tax profit}}{\text{Average Investment}}$$

$$\text{ARR} = \frac{\frac{\Sigma \text{Profit over the life of the project}}{N}}{\text{Net working Capital} + \frac{\text{Initial Investment} + \text{Salvage Values}}{2}}$$

#### Decision Criteria

Target profit level is determined by the management of the company and the ARR is compared with that.

ARR > PR then accept the project

And ARR < PR do not accept the project

Pros and Con of ARR

It's very simple to calculate, a good measure to inform the investors about the return on investment. On the other hand, it considers the projects profit rather than cash flow and it also ignores projects life



### 3.2.4. Net Present Value (NPV)

Modern capital budgeting technique found by subtracting a projects initial investment from the present values of cash inflows discounted at a rate equal to the cost of capital.

NPV = Present value of cash flow – Initial Investment

$$= \frac{CF_1}{(1+i)} + \frac{CF_1}{(1+i)^2} + \frac{CF_1}{(1+i)^3} + \dots \dots \dots + \frac{CF_n}{(1+i)^n}$$

#### DECISION CRITERIA

When NPV is used to make accept–reject decisions, the decision criteria are as follows:

- If the NPV is greater than \$0, accept the project.
- If the NPV is less than \$0, reject the project.

If the NPV is greater than \$0, the firm will earn a return greater than its cost of capital. Such action should increase the market value of the firm, and therefore the wealth of its owners by an amount equal to the NPV.

#### Evaluation of NPV

- **Strengths**
  - Tells whether firm value is increased.
  - Considers all cash flows.
  - Considers the time value of money.
  - Considers the riskiness of future cash flows.
- **Weaknesses**
  - Requires estimate of cost of capital.
  - Expressed in terms of dollars, not as a percentage

#### NPV profile

It's the graphical representation of NPV as we know present value is a decreasing function of discount rate. NPV profile shows relationship between NPV and discount rate. Characteristics of NPV Profile are.

- Downward sloping
- Slightly curved
- Crossover discount rate

#### THE INVESTMENT PROFILE

The net present value technique also allows you to determine the effect of changes in cost of capital on a project's profitability. A project's investment profile, also referred to as the net present value profile, shows how NPV changes as the discount rate changes. The investment profile is a graphical depiction of the relation between the net present value of a project and the discount rate. It shows the net present value of a project for a range of discount rates.

### 3.2.5 Internal Rate of return(IRR)

IRR is the rate of return that a project generates. Algebraically, IRR can be determined by setting up an NPV equation and solving for a discount rate that makes the NPV = 0. In simple word IRR is the rate at which the present value of cash inflow of any project equates the initial cash outlay.

$$\text{Initial Cash outflow} = \frac{CF_1}{(1+k)} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n}$$

Here “k” is the internal rate of return(IRR). But the sign “k” is an unknown variable. To find this unknown variable value we use two different techniques.

- **Computer Programing:** Here we use sophisticated computer program to calculate the IRR
- **Trial and error Method:** In case of trial and error method we try and find an arbitrary rate at which NPV equates to zero or close to zero

We try to find a lower discount rate at which the NPV is positive and a higher discount rate at which NPV is negative then we go for interpolation. Then we use the interpolation technique.

$$\text{IRR} = \text{LDR} + \frac{\text{PV @ LDR} - \text{ICO}}{\text{PV@LDR} - \text{PV @HDR}} \times (\text{HDR} - \text{LDR})$$

Alternatively we can solve this with another way

<u>Rate</u>	<u>PV</u>
LDR%	<u>Xxx</u>
IRR( $\alpha$ )	<u>Xxx</u>
HDR	<u>xxx</u>

$$X = \text{PV @ LDR\%} - \text{PV @ IRR} \qquad \frac{\alpha}{z} = \frac{x}{y}$$

$$Y = \text{PV @ LDR\%} - \text{PV @ HDR\%} \qquad \alpha = xxx$$

$$Z = \text{HDR\%} - \text{LDR\%}$$

$$\text{Now IRR} = \text{LDR\%} + \alpha$$

#### DECISION CRITERIA

When IRR is used to make accept–reject decisions, the decision criteria are as follows:

- If the IRR is greater than the cost of capital, accept the project.
- If the IRR is less than the cost of capital, reject the project.

These criteria guarantee that the firm will earn at least its required return. Such an outcome should increase the market value of the firm and, therefore, the wealth of its owners.

### Evaluation of IRR method

- **Strengths**
  - Tells whether firm value is increased.
  - Considers all cash flows.
  - Considers the time value of money.
  - Considers the riskiness of future cash flows.
- **Weaknesses**
  - Requires estimate of cost of capital.
  - May not give value-maximizing decisions for mutually exclusive projects.
  - May not give value-maximizing decisions under capital rationing.
  - May produce multiple IRRs.

### 3.2.6 Modified internal rate of return (MIRR)

It's a financial measure of an investments attractiveness. It is used in capital budgeting to rank alternative investments of equal size. It is originated to solve some problems with IRR. While there are several problems with IRR MIRR resolves two of them. Firstly, IRR is sometimes misapplied under an assumption that interim positive cash flows are reinvested at the same rate of return as that of the projects that generated them. And MIRR only provide one rate no confusion regarding multiple IRR.

MIRR is the internal rate of return on a project assuming that cash inflows are reinvested at some specified rate.

$$\text{MIRR} = \sqrt[n]{\frac{\text{Present value of cashflows reinvested at cost of capital}}{\text{Initial Investment}}}$$

### Evaluation of MIRR Method

- **Strengths**
  - Tells whether firm value is increased.
  - Considers all cash flows.
  - Considers the time value of money.
  - Considers the riskiness of future cash flows.
- **Weaknesses**
  - May not give value-maximizing decisions for mutually exclusive projects.
  - May not give value-maximizing decisions under capital rationing.

### 3.2.7 Profitability Index / Benefit cost ratio

The profitability index (PI) is the ratio of the present value of change in operating cash inflows to the present value of investment cash outflows:

$$\text{PI} = \frac{\text{Present value of cashinflow/NPV}}{\text{Initial cash outlay}}$$

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### Decision Rule

If for calculation present value is taken, then the results shall be compared with 1.

- PI greater than or equal 1 accept the project
- PI less than 1 do not accept the project.

If for calculation Net present value is taken, then the result shall be compared with "0"

- PI greater than or equal "0" accept the project
- PI less than "0" do not accept the project

### Evaluation of PI Method

- Strengths
  - Tells whether firm value is increased.
  - Considers all cash flows.
  - Considers the time value of money.
  - Considers the riskiness of future cash flows.
- Weaknesses
  - Requires estimate of cost of capital.
  - May not give correct decision for mutually exclusive projects.

## 3.3 Conflict between NPV, IRR and PI

When the projects are single, conventional and independent then all the above technique provide the same result no question of conflict but conflict arises when two or more projects are mutually exclusive and consist of nonconventional cash flows we may denote three condition for those conflicts

1.Differences in investment size. If different projects are mutually exclusive and consist of different size it may cause the conflicts

2.Differences in cash flow pattern. The timing of cash flow and the nature of cash flow may be different in different mutually exclusive projects

3.Differences in projects life. Different mutually exclusive projects may have different projects life which might be called another reason of conflict between above measures

## 3.4 Annualized Net Present Value (ANPV)

Annualized net Present value is an approach to evaluate unequal lived projects that converts the NPV of unequal lived mutually exclusive projects into an equivalent annual amount in NPV terms to select the best project.

Step 1: Calculate NPV

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Step 2: Divide NPV of each project by the present value interest factor of annuity at the given cost of capital and the project life

$$ANPV = \frac{NPV}{PVIFA_{kn}}$$

Step 3: Select the Project having highest ANPV

## Capital Rationing in capital Budgeting

It's a financial situation in which a firm has limited money or budget ceiling for capital expenditure and numerous projects compete for this budget. In other word capital rationing is a financial situation where the firm does not have sufficient fund either on hand or in terms of access to accept all the projects that are acceptable.

### 4.1 Types of capital Rationing

There are two types of capital rationing

- Voluntary/ self- Imposed/ Soft rationing
- Non- Voluntary / Capital Market imposed / Hard Rationing

#### 4.1.1 Soft Rationing

When the firm voluntarily stays reluctant to collect fund for capital expenditure to have financial control is called soft rationing. Rationale behind this are

- **Deal with overstated cash flow**

Some ambitious divisional managers habitually overstate their investment opportunities rather than trying to distinguish which projects really are worthwhile. Headquarter may find it simpler to impose an upper limit on divisional expenditure and thereby force the division to set their own priorities. In such instances budget limit are rough but effective way to deal with biased cash flow forecast.

- **To force work within the capacity**

Sometimes the firm have many acceptable project even though the firm have limited capacity to raise fund from investors. Capital rationing helps in that case to complete the work within the capacity of the firm.

- **Finance Policy**

If the firm have investment policy to be financed in internally this will tent to limit capital and results in capital rationing.

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- **Rapid growth vs control and comfort of top Management**

In some case management may believe that very rapid corporate growth could impose intolerable strain on management and organization since it is difficult to quantify those constrain explicitly, capital rationing is used as a proxy to give the top level management some sorts of relief.

### 4.1.2 Hard Rationing

In some situation firm have different projects having positive NPV yet cannot accept them as they have no fund to support them neither on hand nor on market. Rationale are

- **Transaction cost**

When any firm have access to capital market and try to gather new capital from market to accept the project available in market. But we know for every new issue of shares include flotation cost which increase the marginal cost of capital and makes the collection of new capital harder resulting in forced capital rationing.

- **Information Asymmetry**

Sometimes the managers get more optimistic and select riskier projects which shall yield handsomely but the investor might not agree with those information of the management. This might cause the increase of cost of capital besides the investors are absolutely refusing to invest in their projects. This will tend to the hard rationing.

- **Legal Complication**

Legal complication may give verdict to the hard rationing by imposing restriction of collecting fund from capital market or other financial institution.