Project Finance

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Contents

Detailed Curriculum

Project Finance: The Life Cycle of a Project – Project Manager vs Line Managers – Project Management in India – Ethics in Project Management – Management of International Projects – Characteristics of Project Finance – Parties in Project Finance – Project Financing Options in India – Financial Appraisal of Projects – The Cost of a Project – The Means of Finance – Detailed Project Report

Term Finance: Appraisal of Term Loans – Key Financial Indicators – Procedure for Sanction of a Term-loan – Financing International Projects – Project Exports – Working Group – Role of Exim Bank in Project Exports – Role of ECGC in Project Exports

Project Initiation and Resource Allocation: Identification of Opportunities – Process of Resource Allocation at the Corporate Level – Process of Resource Allocation at the Business Unit Level – Generation of Project Ideas and Creativity

Market and Demand Analysis: Identification of the Target Market – Choice of the Market Strategy – Projection of Demand using Primary Data and Secondary Data – Projection of Demand using Qualitative Models

Technical Analysis: Project Procurement Management – Solicition – Vendor Selection – Contract Administration – Purchasing Equipment and Materials – Plant Location – Project Design – Work Schedule

Time Value of Money: Why Money has Time Value? – Process of Compounding – Process of Discounting – Future Value of a Single Flow – Future Value of Multiple Flows – Future Value of Annuity – Present Value of a Single Flow – Present Value of Uneven Multiple Flows

Cost of Capital: The Meaning of Cost of Capital – Costs of Different Sources of Finance – Weighted Average Cost of Capital – Weighted Marginal Cost of Capital Schedule

Appraisal Criteria: Define the Cash Flows from Long-Term Equity and Total Funds Point of View – Appraise a Project by Discounting and Non-Discounting Criteria – Appraise Projects with Special Features

Risk Analysis in Capital Investment Decisions: Definition of Risk? – Project Risk Management – Types of Risk Measurement of Risk – Methods of Risk Adjusted Investment Appraisal – Advanced Techniques of Risk Analysis – Decision Tree Analysis

Application of Portfolio Theories in Investment Risk Appraisal: Portfolio Theory of Markowitz – Single Index Model of Portfolio Analysis – Capital Asset Pricing Model of Portfolio Analysis – Application of Portfolio Theories to Capital Budgeting

Environmental Appraisal of Projects: Meaning of Environment and Pollution – Pollution Created by Different Industries – Methods of Preventing Pollution – Environmental Regulations in India – Environmental Impact Assessment for Projects

Social Cost Benefit Analysis: The Rationale for SCBA – UNIDO Approaches for SCBA – Little-Mirrlees Approach – SCBA Methods Followed by Financial Institutions – Public Sector Investment in India

Multiple Projects and Constraints: Conflicts in Ranking of Projects by Different Criteria – Resolution of the Conflict in Ranking – Techniques for Selection of more than One Project from a Group

Options in Investment Appraisal: The Basics of Options – Valuation of Options – Application of Option Valuation Models to Project Appraisal

<u>**Chapter I**</u>

Project Finance

After reading this chapter, you will be conversant with:

- The Life Cycle of a Project
- Project Manager vs Line Managers
- Project Management in India
- Ethics in Project Management
- Management of International Projects
- Characteristics of Project Finance
- Parties in Project Finance
- Project Financing Options in India
- Financial Appraisal of Projects
- The Cost of a Project
- The Means of Finance
- Detailed Project Report

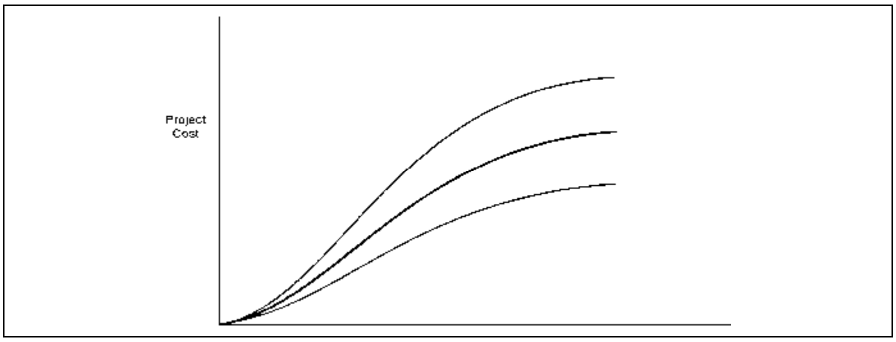
THE LIFE CYCLE OF A PROJECT

The life of a project, like that of any organization can be divided into phases. These phases correspond with changes in the levels of activity or effort put into the project and the uncertainty regarding the final outcome of the project and is not just of academic interest. Studying them and the actions to be performed by the managers in each of the phases will help in managing the life cycle of a project better. There are broadly, four phases in the life of a project:

- Phase I : Conception and Selection.
- Phase II : Planning and Scheduling.
- Phase III : Implementation, Monitoring and Control.
- Phase IV : Evaluation and Termination.

The level of activity, in any project, starts at a low level and then rises slowly. At the conception and selection phase, before it is decided whether or not something is a worthwhile idea or which of the several alternative ideas should be proceeded with, the activity is naturally low and is confined to conducting feasibility studies, estimating revenues and costs, etc. In this phase the amount spent is also low, as also the number of people working on it (we can also say the time spent on the project).

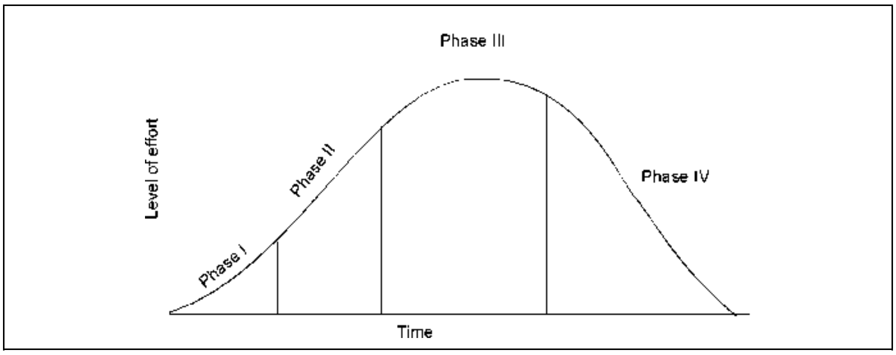
Figure 1: Estimate of Project Cost: Estimate made at Project Start



Generally, until this phase is complete the firm does not stop bothering about the cost, though there may be pressures to complete the appraisals quickly, so that the firm can get ahead of its rivals in implementing the project. The functions to be performed by the project manager (if one is appointed by the time) or the team working on the project are:

- Identifying a need for a project.
- Establishing goals to be achieved by the project.
- Estimating the amount that the firm will have to commit for the project.
- Presenting the project idea or various alternative ideas to the management and get their approval.

Figure 2: Effort Spent on a Project: The Level of Effort Increases until Phase III and then Decreases



Once selection of the project and its approval by the management are through, the project enters the second phase. This phase is preparatory to the actual implementation of the project. Planning how to implement the project and scheduling how the implementation should be carried out are done in this phase. Planning includes deciding on what are the activities to be undertaken for implementing the project, while scheduling is fixing time frames for the activities. The level of activity and also the project cost rise rapidly during this phase. The number of people assigned to the project also increases manifold. The functions to be carried out in this phase are:

- Set up a technical team to decide on how the project can be implemented.
- Plan for the requirements of personnel, finance, materials, etc.
- Prepare a schedule keeping in view the date given by the client (if the project is being undertaken for a client), or the management (if it is as in-house project), and the required buffer time to meet unexpected events or mishaps.

At this time, generally, the project staff tend to be more concerned with the performance than with the schedule or costs.

The next phase is the actual implementation of the project, and monitoring and controlling the implementation. The project cost reaches its peak during this stage, as also the level of activity (or the man-hours spent on the project). The project manager is highly concerned about the costs and does not bother much about the schedule at the beginning. Concentration on the performance also continues. The major functions that are to be carried out in this phase are:

- Procuring materials.
- Building and testing the tools.
- Developing support systems.
- Producing the system that is aimed at.
- Verifying whether its performance is up to the laid down standard.
- Making modifications to either bring the performance to the required level or to suit the changes suggested by the client or the management.

Towards the end of this phase, the focus of the project manager generally changes to meeting the schedule than cost and/or performance.

The fourth, and the final phase is to evaluate what has been done, and hand it over to either the client or the in-house operational staff. This marks the end of the project, from the project management angle. In this phase, the activity levels decline steeply, and reach zero. The additional inputs of other resources are also small. This phase is often completed in a hurry, as the deadline will be nearing. The entire concentration of all the staff and the managers will be focused on handing over on time than on costs or performance. The functions that are carried out in this stage are:

- Training operational staff.
- Transfer of materials.
- Transferring the responsibilities.
- Releasing surplus resources, that remain after use.
- Releasing the project staff for the next assignment.

Managing the Life Cycle:

- As we have already discussed, the focus of the manager is on performance initially, then shifts to costs and finally settles on meeting the deadline. Conventionally, this is accepted practice. But, modern project management suggests that the focus should be on performance and the schedule right from the beginning.

- The uncertainty regarding the estimates made is always high for the activities at the later stages of the life cycle. The later on activity scheduled is in the life cycle, the higher the uncertainty of the estimates related to it. Estimates should, therefore, be revised periodically and adjusted upwards or downwards depending on what lessons can be learnt from the work already done.

PROJECT MANAGER VS LINE MANAGERS

In any organization where a separate project management department is set up, there is always a constant tussle between the line managers and the project manager. This tussle arises because both compete with each other to share the organization's:

- Money,
- Manpower,
- Equipment,
- Facilities,
- Materials, and
- Information/Technology.

The conflict of interest that arises in sharing these common resources is further compounded by the fact that one of the important resources, manpower, is controlled by the line manager. The project manager informs line managers of his requirement of staff, and the allocation is made by the line manager. This also applies to resources that are controlled by specific departments. The project manager is generally not allowed to choose the staff or equipment he wants. He has to take whoever or whatever is given to him and can complain only if what is provided is substandard.

The employees provided to a project manager continue to report to their line manager. Their appraisals are also done by the line manager and it is only natural that they give preference to the commands of the line manager over the project manager. In such a situation, the success of a project depends on:

1. Presence of a good working relationship between the project manager and the line manager.
2. Effective handling of the cross reporting by the functional employees (the employees sent to work on the project).

The Project Manager

The project manager's duty is to co-ordinate and integrate activities being carried out across various functional departments. He should, therefore, possess strong communicational and interpersonal skills to succeed, apart from a general knowledge of the technology being used. He need not be a technical specialist. Communicative and interpersonal skills are supposed to be his forte.

The project manager's job is very tricky. He has tremendous responsibility for getting things done, but little authority. Often project managers negotiate for the resources they need from the superiors and also the line managers. Though the entire project appears to revolve around the project manager, in reality, he has to do nothing short of tightrope walking for managing the superiors (executive), and the line staff effectively.

Managing the line staff is often referred to as interface management. It involves:

1. Managing human relationships in the organization with respect to all those connected with the project.
2. Balancing the managerial and technical functions.
3. Coping with risks associated with project management.
4. Handling organizational restraints such as capital rationing effectively.

An ideal project manager should have both managerial and technical skills. This is one point that cannot be overemphasized. Project managers should generally be between thirty and forty years. People older than forty are generally considered to be more conservative while those in the twenties are termed 'over aggressive'. And, this age range is considered to be the time when a man is not only willing, but also able to work very hard to make some money.

The Line Manager

Once the task to be done is specified by the project manager, it is the responsibility of the line manager to get it executed. He decides who does it with what resources and when, within the constraints laid down by the project manager. While the project manager is a generalist, the line manager is almost always a technical specialist. He has the knowledge and also the duty to point out to the authorities the lacunae and inconsistencies, if any in the specifications and constraints laid down by the project manager.

Because of his tough bargaining in allocation of resources to the projects, the line manager is generally considered to be a villainous character by project managers. But on the other side of the coin, the line manager has his own problems:

1. Limited availability of resources.
2. Having to cater to many work orders.
3. Deadlines to be met.
4. Unscheduled changes in the tasks to be done.
5. Technical breakdowns.
6. Employee turnover, etc.

And, it is not as if the entire responsibility lies with the project manager. If a task fails, the line manager is also accountable.

In any case, resolving the differences between the line and project managers is the job of the senior executives. Apart from holding line managers responsible for the success of the project, the senior management should ensure that it is not only committed very seriously to the success of the project, but its commitment and seriousness are visible to all. Only then will all those involved try to get the things moving than enter into conflicts with each other over demarcation of their territories and responsibilities.

PROJECT MANAGEMENT IN INDIA

As already mentioned, project management has been adopted in India after independence. Right from the inception, it should be said, that it has been a failure in India. Severe time and cost overruns have been the characteristic features of projects, particularly in the public sector. The commonly quoted reasons for the overruns are:

Internal Reasons

1. Disputes with local people on acquisition of land and compensation.
2. Bad choice of technology.
3. Non-availability of skilled personnel.
4. Lack of proper planning.
5. Non-availability of the equipment of required quality at the required time.
6. Poor quality of the inputs purchased.
7. Labor disputes.
8. Lack of proper handling of organizational issues such as appointment of the project manager.

9. Absence of proper co-ordination between different departments involved, such as customs, sales tax, etc.
10. Lack of proper monitoring and follow up.

External Reasons

1. Funds not being released by the concerned department on time.
2. Changes in foreign exchange rates.
3. Inflation.
4. Political instability and lack of political will to implement projects quickly and efficiently.
5. Budget deficits.
6. Diversion of funds to other unforeseen uses like meeting a natural calamity.

As a consequence of all these factors, there are few public sector projects in India that have not faced time or cost overrun or both.

The situation of the private sector, however, is very different. Since overruns rob the profit off the project and defeat the very purpose of their being set up, private sector projects do not face so many problems as the public sector.

ETHICS IN PROJECT MANAGEMENT

Many philosophers define ethics as the science of conduct. Doug Wallace and John Pekel define ethics as the basic ground rules by which humans live. These ground rules differ from society to society and individual to individual, and similarly from a project executed in one country to one executed in another.

The term "ethics" is commonly used to refer to the moral principles that are accepted by the majority of the members of society. Ethics play a significant role in the context of project management. Though projects are completed within a limited period of time, they deliver products or systems that may have a significant long-term impact on stakeholders and the environment. Therefore, project managers must exercise care when dealing with ethical issues that arise during the development and implementation of a project.

Ethics and Project Management

The decisions taken by project management professionals will have an impact on the quality of life of various stakeholders of the project. Project management professionals should therefore work in an ethical manner to win the confidence and trust of stakeholders such as employee, clients and the public.

It is important to consider ethical issues when implementing a project because its success or failure affects various stakeholder groups. Nixon in his article "Legal Lights: Business Ethics" (*Project Management Journal*, September 1987), identified some common ethical mistakes committed by businesses:

- "Wired" bids and contracts – the winner is predetermined.
- "Buy-in" contracts.
- Kickbacks.
- Protecting team members – group cohesiveness.
- Taking shortcuts in order to meet the schedule or budget.
- Using inferior quality materials.
- Compromising on safety measures.
- Violation of standards.

A project manager, especially in a public sector organization will be faced with ethical issues concerning pollution, public safety, industry locations, utilizing public property and so on. A code of ethics for the project management profession was developed in 1982 by PMI at a symposium on project management. This code of ethics was revised in 1989 and again in 1995.

Ethics Obligation Matrix

The Ethics Obligation Matrix was first developed by Schrock, Pike and Ireland. This matrix tries to map the different obligations of the project manager towards the stakeholders of the project, such as the employer, client, project team members, student trainees, professional societies, general public and the government. The ethical obligations to be considered are, support the code of ethics, support the professional project management societies, protect privileged information, take responsibility for actions, use authority properly, preserve state of the art expertise, win the confidence of public, support and follow the laws of the region, avoid accepting gifts, conserve resources and increase productivity, prevent conflict of interest, provide equal employment opportunity, promote safety and health, develop the profession of project management, deal honestly with the employer and the client and interact in a professional manner.

MANAGEMENT OF INTERNATIONAL PROJECTS

Globalization can be defined and viewed from various perspectives. The word globalization has both positive and negative connotations. Globalization is a movement towards capitalism that intensified with the disintegration of the USSR and demolition of the Berlin wall. According to Ruud Lubbers, globalization is a process of minimizing the significance of geographical distance in developing and maintaining international economic, political and socio-cultural relations. It is mostly perceived as an economic pattern containing a greater interaction and integration of all the economic models of countries by an enhancement in the international business, investments in other nations through FDI's and FII's and capital flows through foreign exchange.

Globalization has a significant impact on the way projects are managed. One can identify three basic models of project management based on the project management styles in different geographic locations. The European model, The North American model and The Japanese model.

In Europe, there is a formally structured and systematic procedure for handling technical issues. Particular national organizations are given the responsibility of conducting research under the guidelines of the local government.

In North America, the system is not as formal and rigid as it is in Europe. In Japan, development of technology is given primary importance. The Japanese believe that superior technology brings in superior core competency. Japanese firms seek competitive advantage through technology.

The shrinking of global distances, communication revolutions like Internet, satellite communications, cellular telephony act as a backbone for organizations to set up units in foreign lands, thus giving rise to international project management. And these projects could be anything from setting up a joint venture to setting up a production facility. In today's business environment, where the competitive dynamics of the market are strong, there are highly complex products, faster changes and a diverse set of individuals (both, functionally, and culturally) who are spread across the globe. Managing people and resources remotely is a tough task. Therefore, the role of project management gains significance in handling international projects effectively. There are certain unique challenges faced by the project manager in managing international projects such as political disturbances, cultural barriers and so on.

Impact of the Business Environment on International Projects

Project managers today face complex problems in the wake of the increase in the number of international projects being handled across the globe. The difficulty lies in exploring, segregating and responding to all the visible requirements. The project manager therefore has to adapt his expertise in project management, as per international requirements. The fundamental difference between an international project and a domestic project is that international projects require an in-depth analysis of the various constituents of the macro and micro environments. The major constituents are language, culture, political environment, economic conditions, government regulations, availability of infrastructure and human capital. The success or failure of an international project is based on the pre-analysis of the micro and macro environments of the country where the project is to be implemented.

The opportunities and benefits offered by international projects are equally balanced by uncertainties and threats. The major challenges faced in international projects are Political disturbances, Economic instability, and sudden changes in tax laws, Time consuming government procedures, Cultural barriers, Patent laws, Improper pre-analysis, and Dispute settlements.

Impact of Socioeconomic Environment on International Projects

If the differences in culture, tradition and language between the partners of the project are not managed effectively, the project is bound to fail. For instance, the perception of time in two different cultures could be totally different. While the Americans look at time as money, Arabs have a more relaxed attitude towards time. Bridging the gap between these two perceptions is difficult. In a similar manner, in the US, information required by the project manager is generated from outside i.e., the job is delegated and Americans respect taking initiatives. But in Europe, it is the project manager who initiates the process of seeking information. So before starting a project in foreign nation, it is essential to have the knowledge of the information flow in specific cultures. Americans encourage delegation and a participative management styles, but this may not be the case with other cultures. In the US, mostly it is job security and social security that motivates the employees to work, but motivation differs from culture to culture, especially in developing economies. In these countries, career and personal growth are the key motivators.

India is just next to the US when it comes to English-speaking and technically trained manpower. The workforce in India is strong and growing. The work culture of many Indian companies is going through a transition phase – rewarding employees with high salaries is no more a valid retention strategy, but providing an intellectually stimulating environment is the challenge now. Employees have begun demanding work environments that match international standards. Organizations are maintaining themselves above these international standards. The business culture of Indian companies has evolved over a period of time, and is now on par with the world’s best. Indian companies have now begun introducing the following changes into their work culture:

Flat organization structures: Many organizations have decided to avoid overly hierarchial organizational structures, so as to facilitate communication between engineers, project team members, project managers, and other employees.

Flexibility in timing: Understanding the brain work involved in developing software projects, many project managers have become flexible so as to accommodate the late working hours and late start in the morning. Companies have also started managing the work schedule of the employees by providing transportation service to their staff.

Many organizations also organize special events to develop an emotional bonding between employees. Organizations are also beginning to look at soft skills as tools for managing project teams.

Impact of Legal Environment on International Projects

Legal systems are different in different countries and hence the variance in the judgment methods, punishments and penalty structures. The legal systems of developing countries are often characterized by inconsistency and bureaucracy. The decision making process is very long because the decision makers have a very limited authority. And even if the decision maker is given the authority and power, his judgment is often crippled by a lack of factual knowledge.

The legal system in India is one of the most complex and convoluted in the world, resulting in prolonged trials. Because of the loopholes in the system and its power to harass the common man mentally, physically and financially, most avoid recourse to the legal system. Cases take years before they come to a final hearing. Such a tedious and ineffective legal system can hinder the flow of foreign investments into the country. An example is the recent problems between Enron Corporation and the Maharashtra State Electricity Board (MSEB).

Impact of Technological Environment on International Projects

Establishing effective project management methodology and procedures is a challenging task, particularly in countries that are not well-developed technologically. Project management techniques such as scheduling, costing and programming differ from country to country because no two countries have the same kind of quality in education and in infrastructure like software, hardware and communication facilities. The project management systems should be modified to suit the environment.

In the US, technology is treated as a tool to improve the lifestyle of the individual. Although new technology is known to eliminate some jobs, a majority of Americans believe that it helps in creating new and better jobs. Further, the people of USA believe that the liberal attitude of the government coupled with their freedom and risk-taking attitude is responsible for the growth of technology. Americans generally support any creativity that can lead to a technological revolution. India offers a contrast to the USA in this area. Infrastructural problems are common in Indian industries. Infrastructural facilities remain underdeveloped owing to a lack of funds. The fast growing demands of Indian economy are not satisfied due to the bureaucratic structure of the government. In addition to this, matters become worse with the poor quality of work in the industry. Politicization of environmental issues has also led to delays in the project approval process, ultimately resulting in cost overruns.

Impact of Cultural Diversity on Projects

In the mid 1990's, Peugeot, the French automobile giant launched its 309 GLD model car in India, in the mid-size segment. It didn't take long for the car to fail in the market. One of the reasons for this failure could have been a lack of understanding of the Indian consumer's tastes and preferences.

Tastes and preferences are behavioral characteristics and form a part of culture. So, understanding the culture of a country is a major determinant of the success or failure of any international project. Before jumping headlong into a project in a country with a different culture, the project manager should spend some time exploring the customs and beliefs of that culture. Each and every country in this world has its own cultural peculiarities that influence the business environment. Culture is the result of interaction between the humans and the environment. It is passed down through the generations, aided by the family structure and schools. Defining culture is no simple task, because it involves many complex sub-topics.

These need to be defined first, in order to get a complete picture of culture and its possible implications on the business environment. Therefore, the key to the success of any international project is in understanding cultural differences and attempting to bridge the cultural gap as much as possible. People from different cultures differ in their appearances, perceptions and even in their personalities, attitudes and presentation.

Managerial Behavior in International Projects

Today, a firm's management expects more from project managers than before. Generally, projects that succeed are the ones that are efficiently managed. The significance of soft skills in the success of a project is often overlooked in most management development programs. Therefore, a good project manager is expected to have the right blend of technical and interpersonal skills. The behavioral pattern of an individual is mainly influenced by his cultural and socioeconomic backgrounds. It can be said that the behavior of the project manager is the key to success of any project, but since this behavior is strongly related to the individual's psychology it can never be the same in two persons.

There are a few countries in the world that can match India's ancient and rich culture. Its geographical, religious and racial diversity is as strong as its diversity in language. The diversity in India has led to several behavioral problems among people, because people from different regions may behave differently.

The manager's rank is considered to be a top position in Indian organizations and few subordinates would dare to question the manager. Business meetings are usually formal and there is little informality. The concept of respecting elders and seniors in the Hindu customs is practiced by many Indians while addressing their seniors in the office.

Most of the Indian project managers have strong technical and analytical skills. They are usually tough while negotiating. However, they are very flexible while working i.e., they can stretch their work timings as per the requirements. They can stay back late and even work on holidays to complete their work. Work pressure and competition are so intense that most Indian project managers are perfectionists. The one drawback is that Indian managers cannot delegate effectively. Fear of the subordinate not delivering the goods usually makes him take up the job himself. Further, Indian managers are less technology-driven when compared to their western counterparts. This may be due to the lack of funds and exposure to the latest developments in those disciplines.

In spite of the gaps in culture, language, behavior and business environment between countries, many projects have been successful in international markets and organizations were able to establish themselves in foreign markets.

CHARECTERISTICS OF PROJECT FINANCE

Project finance refers to large and long term financing of infrastructure and industrial projects like power plants, oil pipelines, integrated oil refineries etc. In project finance, loans are granted for investment projects which are technically feasible and profitable, economically viable, financially feasible and generate their own income. Debt and equity are source of financing the project. Equity contributes about 30 to 40 percent of the funds and the remaining is through debt. Repayment on loan in project finance is solely based on generation of the cash flow.

Project finance gathered momentum in 1990's. Project financing is sometimes called off-balance sheet financing or non-recourse or limited-recourse finance. Project finance is the most preferred and mode of long term finance differs from other financing methods (A comparison of project finance with other financing vehicles is given in box 1). Projects are of two types – Greenfield and Brownfield.

Greenfield projects are those that are built from scratch. New projects such as airports, factories and ports come under this category. Under brown field projects, modifications or improvements are carried out for existing projects.

Box 1: Comparison of project finance with other financing vehicles
Secured Debt is collateralized by a specific asset or assets. To that extent it is similar to project finance. However, secured debt almost always has recourse to other assets of the firm as well. Herein lies the dissimilarity with project finance. **Asset-backed Securities** can often be mistaken for project finance, since they appear to have all the features of the latter – collateralized by asset cash flows and non-recourse to the originator. However, the major difference lies in the fact that asset backed securities hold single purpose 'financial' assets – not single purpose 'industrial' assets, the latter being mostly illiquid. One of the latest developments in project finance is the 'securitization' of project finance loans. **Leveraged Buy Outs/Management Buy Outs** may seem similar to project finance due to their high debt levels. However, LBOs/MBOs are dissimilar in that they do not have separate corporate/government sponsors and may not consist of single purpose industrial assets. **Privatizations** Those that involve single purpose, industrial assets could be categorized as project finance provided the debt is non-recourse to the private sponsors. Privatization of airports or large telecom facilities could fall under this category. However, privatization of banks or administrative bodies would not be termed project finance, since they do not satisfy the 'single purpose industrial asset' criterion. **Venture-backed Companies** display concentrated equity ownership like project companies. However, debt levels are much lower than project companies, and in most cases, the managers themselves are equity holders.

Source: ICFAI University Press.

Traditionally, the public sector has played a major role in project finance. To increase the flow of funds for developmental projects and reduce public borrowings by the government as well as to create confidence among investors, private sector participation in project finance was encouraged. Earlier, banks were not involved in providing finance for long term projects, but with increasing competitive business environment, banks became an important source in providing finance to the projects. Commercial banks in particular played an important role in project financing. They are the important sources of project finance. Project financing in the past, was not a service of commercial banks, but in recent time's project financing transactions became part of commercial banking operations. Role of commercial banks in financing project exports is discussed in detail in chapter titled "Financing International Projects". Apart from commercial banks, insurance companies, international financing agencies, private lenders etc., are sources of project finance.

Every Project whether big or small faces certain risk. In project finance, risk allocation and identification are the most important components. The different kinds of project risks are operating risk, environmental risk, infrastructure risk, completion risk, political risk, participation risk, interest rate risk, legal risk etc. Detailed description on project risks and risk mitigation process is discussed in the chapter titled "Risk in Project Finance".

Characteristics of Successful Project Financing

- Project itself is recognized as a separate company.
- It is limited or non-recourse in nature.
- Predictability of future cash flow is one of the most important characteristics.
- Financial and technical expertise of the sponsors to operate the project over the project life.
- Economic and financial viability of the project.
- Compulsory government approval wherever required.
- Insurance of the project's assets both during construction and operation.
- Strong discipline of project finance.

Project Finance: Advantages

- As large projects face high risk, project finance involves sharing or allocating of risk among those who are set to handle them efficiently.
- Project finance gives investors control over free cash flow which is redistributed to shareholders.
- Project finance reduces information asymmetry especially in large scale, high risk projects. It also solves underinvestment problem.
- Project finance reduces the cost of financial distress or bankruptcy. The Project and Sponsor being two different entities isolates project from sponsor's bankruptcy. Creditors cannot claim dues from unrelated projects.
- In project finance, lenders look at the project's cash flows and to assets for collateral. Project financing has the ability to expand sponsor's debt capacity by being 'off-balance sheet'. The project sponsors having low credit ratings can also handle project-related contracts. It provides sponsors with valuable tax shields and higher firm value.
- In project finance, closer control and monitoring is possible with separation of assets and cash flows which facilitates greater accountability to investors.
- Project financing involves providing clear information to investors about the project.
- The impact of the project's economic failure on the share price of the parent company may be less.
- Performance of the management can be assessed accurately in project finance.

Project Finance: Disadvantages

- As project finance is related to large projects, it takes longer to structure.
- Complexity of transactions leading to high transaction costs in project finance.
- Project debts are more expensive due to its non-recourse nature.
- Transparent disclosure of information leads to high cost.
- Increasing lenders risk.
- High interest rates on project financing.
- Frequent monitoring of financial performance.

PARTIES IN PROJECT FINANCE

Typical project finance structure involves active participants in financing the projects. It involves the agreements that are entered by the project company with the participants. Participants along with the agreements are shown in figure 3. The most important participants in project finance include equity investors called project sponsors and a syndicate of banks that generally provide loans to risky projects. Others involved in project finance are Special Purpose Vehicle (Project Company), operator, financial advisor and technical expert. We will now discuss them in brief:

Project Sponsors: They contribute equity and own the project. They are the shareholders of the project company. Project sponsors play an important role in the success and failure of the project. They are the key stakeholders of the project. They provide financial resources to the project. A project may have one or more sponsors. The key responsibilities of the project sponsor include:

- Managing the overall project.
- Authorizing the budget.
- Ensuring about the expertise of the project manager and other team members in managing projects.
- Removing obstacles or roadblocks if any.
- Reviewing the project's progress.
- Ensuring adequate availability of resources when needed.
- Ensuring proper and required benefits are realized from the project.

Project sponsors may come across social and environmental issues with respect to projects. A yardstick was developed with a set of guidelines by private sector banks on 4th June 2003, for managing social and environmental issues related to project financing called Equator Principles. These principles apply to projects costing over 10 million in US dollars and to all sectors. These principles were again revised in July 2006. Banks implementing the equator principles undertake to provide loans to projects whose sponsors can ensure that the projects are developed in socially responsible manner and as per sound environmental management practices. The principles are given in box 2.

Box 2: Equator Principles of Lenders

Principle 1: Review and Categorization

When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorize such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). Project categories are: Category A (significant impacts), Category B (limited impacts) and Category C (minimal or no impacts).

Principle 2: Social and Environmental Assessment

Sponsors conduct a Social and Environmental Assessment, to address relevant key environmental and social issues and risks of the proposed project. Assessment should also propose mitigation and management measures that are relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Social and Environmental Standards

For projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the Assessment will establish to a participating EPFI's satisfaction the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines. Consequently, to avoid duplication and streamline EPFI's review of these projects, successful completion of an Assessment (or its equivalent) process under and in compliance with local or national law in High-Income OECD Countries is considered to be an acceptable substitute for the IFC Performance Standards, EHS Guidelines and further requirements as detailed in Principles 4, 5 and 6 below:

Principle 4: Action Plan and Management System

The borrower prepares an Action Plan (AP)3 which addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritize the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment. Borrowers will build on, maintain or establish a Social and Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP.

Principle 5: Consultation and Disclosure

For all category projects, the government, borrower or third party expert has consulted with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities' concerns. In order to accomplish this, the Assessment documentation and AP, or non-technical summaries thereof, will be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner. The borrower will take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation. For projects with adverse social or environmental impacts, disclosure should occur early in the Assessment process and in any event before the project construction commences, and on an ongoing basis.

Principle 6: Grievance Mechanism

For all categories of projects to ensure that consultation, disclosure and community engagement continues throughout construction and operation of the project, the borrower will, scaled to the risks and adverse impacts of the project, establish a grievance mechanism as part of the management system. This will allow the borrower to receive and facilitate resolution of concerns and grievances about the project's social and environmental performance raised by individuals or groups from among project-affected communities. The borrower will inform the affected communities about the mechanism in the course of its community engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible to all segments of the affected communities.

Principle 7: Independent Review

For all category projects, borrower will review the Assessment, AP and Consultation process documentation to assist EPFI's due diligence, and assess equator principles compliance.

Principle 8: Covenants

An important strength of the Principles is the incorporation of covenants linked to compliance.

Principle 9: Independent Monitoring and Reporting

To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all category projects require appointment of an independent environmental and/or social expert, to verify its monitoring information which would be shared with EPFIs.

Source: www.equtor-prinicples.com

Other Equity Investors: Government, Suppliers, Customers, Contractors.

Syndicate of Banks (Lender): Large projects require syndication of financing. Lenders are generally banks or financial institutions. A group of lenders provides loans to a project company to develop a project. These loans are non-recourse loans secured by assets and are repaid from the project's cash flows.

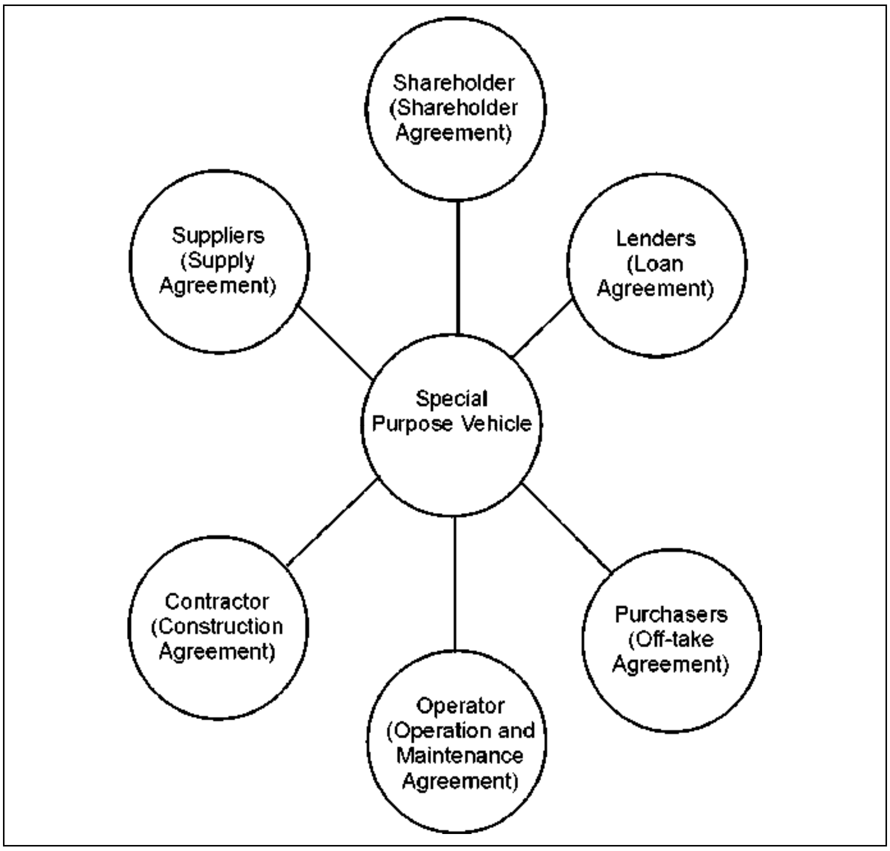
Special Purpose Vehicle or Entity: SPVs are used to finance large projects. They are also called as Project Company. They are used for isolating the firm from financial risk. They are created only for legal purposes. They are created for channeling funds from the borrowers to lenders and meet the regulatory requirements.

Operator: An entity appointed by the SPV responsible for the operation and maintenance of the project.

Financial Advisor: The financial advisor is appointed to give advices on the financial affairs of the project.

Technical Experts: To advise sponsors and lenders on technical viability of the project. They prepare feasibility reports and monitor progress of the project.

Figure 3



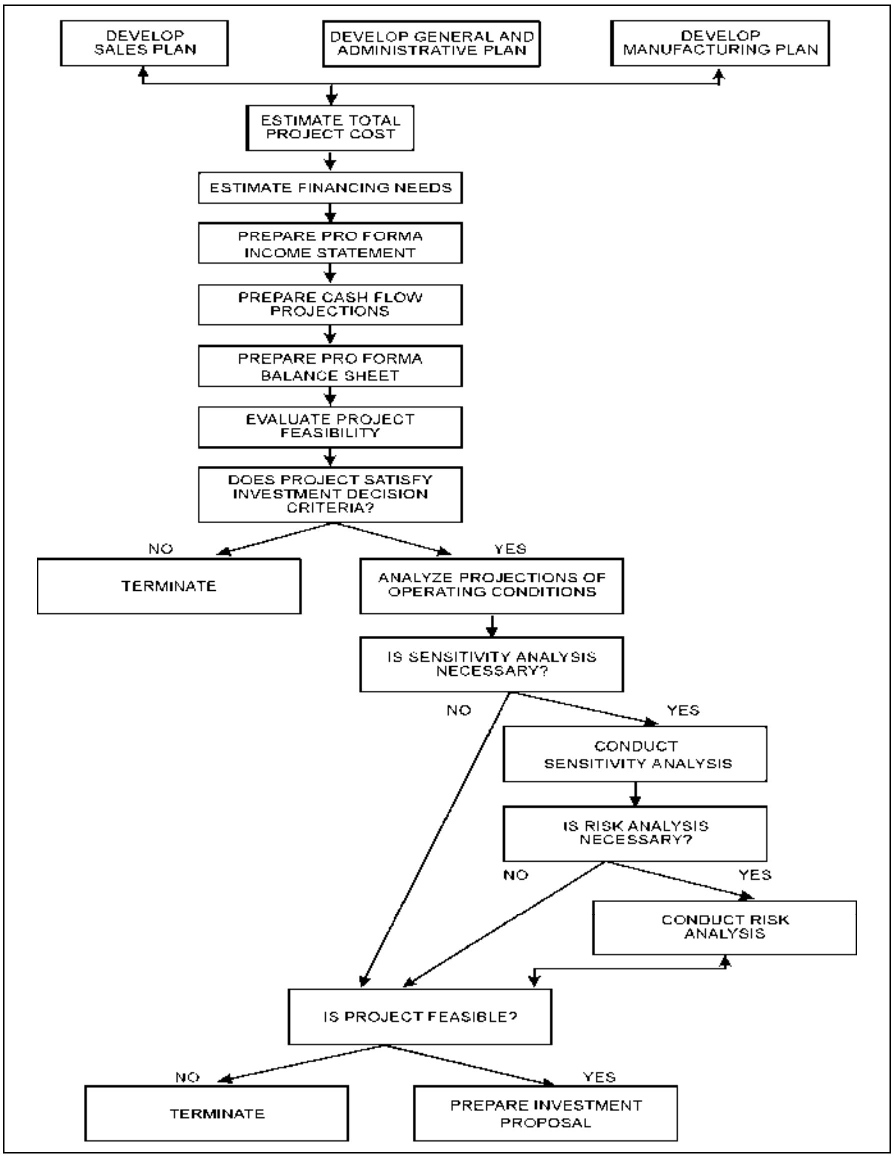
PROJECT FINANCING OPTIONS IN INDIA

Traditionally, project financing requirements were met by financial institutions such as ADB, IDBI, IFCI, IDFC and others. Detailed descriptions about these financial institutions are given in Annexure I. ADB and IDBI lend to infrastructure projects with strong sponsors. IDFC is set up for the purpose of financing commercially viable infrastructure projects. Syndicate credit market is also another important option of project finance. Syndicate credit is where two or more banks together arrange for loan and share the risk jointly. It is also known as syndicate loan. With increased competition and liberalization new options have emerged for financing projects which include equity markets, preferential capital, term loans, debentures, deferred credit, seed capital assistance, government subsidies, sales tax deferment and exemption, unsecured loans and deposits and lease and hire purchase finance. To assess the financial appraisal of the project it is important to understand the cost of project, means of finance and other financial statements which are discussed in the later part of this chapter.

FINANCIAL APPRAISAL OF PROJECTS

In this chapter we will now discuss each component of cost of a project and means of finance along with illustration of Mini Garments Ltd. First, let us look at the various steps indicated in financial analysis in figure 4 given below.

Figure 4: Financial Analysis Flow Chart



THE COST OF A PROJECT

It is one of the important steps in planning a project and first step in conducting financial analysis. The cost specifies the funds required for starting the project and bringing it into reality. All the concerned items that are required for the project should be included in the cost. The actual cost and the estimated cost of the project may differ. It is essential to get the real figures of the project as project overruns are also difficult to avoid. Time schedule also plays an important part in planning the project. The longer the time schedules the higher the cost, which in turn affects profitability of the project. To get an idea of what is meant by cost of the project. Let us examine each of these items of the project cost by studying the illustrative project on Mini Garments Ltd.

Mini Garments has set up an Export Oriented Garment Unit with an installed capacity of 1.2/1.125/1.35 lakh pieces per annum of pants/shirts/kids wear at an estimated cost of Rs.200 lakh.

Table

(Rs. in lakh)

Project Cost details:		
Land		4.00
Site Development		6.00
Buildings		50.00
Machinery:		
Imported – CIF	46	
Duties	6	
Others	1	53.00
Indigenous: FOB	26	
Duties	3	
Others	1	30.00
Preliminary Expenses		2.00
Pre-operative Expenses		18.00
Provision for contingencies		15.00
Margin money for working capital		22.12
		200.12

The cost of a project comprises of –

a. Land and Site development.

b. Building and Civil works.

c. Plant and Machinery.

d. Miscellaneous fixed assets.

e. Pre-operative Expenses.

f. Provision for Contingencies.

g. Preliminary expenses.

h. Technical know-how fees.

i. Estimation of Bank Finance and Margin money.

Each of these items is discussed elaborately below:

Land and Site Development

The elements of cost which go in for determining the cost of land and the site development are –

i. Basic cost of land.

ii. Conveyancing charges and other allied charges.

iii. Levelling of the plot.

iv. Laying of the internal roads.

v. Laying of the approach roads.

vi. Construction of the boundary walls.

vii. Construction of the main gate.

viii. Tube-well digging cost.

The total cost of land and site development for Mini Garments Limited estimated to be Rs.10 lakh as under:

Table

(Rs. in lakh)

Land (10,000 sq.m)	4.00
Site development	6.00
	10.00

Building and Civil Works

The costs under this head can be segregated into (i) main factory building, and (ii) allied civil work like administrative block, storage space for raw materials and civil work for utilities, security gates and structures, and miscellaneous civil works not included in the above heads.

The areas of the building for factory and other purposes are worked out depending upon the plant layout and manpower requirement. These areas are then multiplied with the construction cost per unit area for that respective type of building. The sum of these will give the cost of building and civil works.

Generally, current cost of building materials and construction charges are used for projects with a relatively shorter implementation period, say up to one year. In the case of projects with a longer implementation schedule, an allowance is added to the current cost estimates equal to the latest available annual inflation rate for civil works multiplied by number of the years of implementation period.

The cost of buildings and civil works in case of Mini Garments Limited was estimated to be Rs.50 lakh.

Plant and Machinery

The calculation of the cost of plant and machinery needs segregation of the entire plant, machinery and equipment into imported and indigeneous categories and also into those in respect of which firm orders have been placed and are yet to be placed. Quotations are examined to analyze the cost estimates and if the quotations are old and latest estimates is not available, suitable escalation in the cost estimates, based on the validity of the quotations, and are provided. In case of large projects, provision for escalation is made by adding the latest figures of annual inflation for machinery multiplied by the length of the delivery period.

Thus, the cost of the plant and machinery is done by adding cost of all items of plant and machinery. In case of imported equipment, the price is converted into rupee equivalent. The component of custom duty at the prevailing rate should be taken into consideration while assessing the final cost of the plant and machinery. The total cost of plant and machinery is calculated as follows:

i. Basic cost of indigenous machines (a)

ii. Basic cost of imported plant and machinery (b)

iii. Custom duty on the imported plant and machinery (c)

BASIC COST: (a) + (b) + (c) – A

iv. Excise (normally 15 percent of basic cost) – B

v. Sales tax – C

vi. Octroi, freight, transportation, loading, unloading, clearing and forwarding charges (say 4 percent of basic cost) – D

vii. Erection charges (generally 5-10 percent of basic cost) – E

TOTAL COST = A + B + C + D + E

In the case of Mini Garments Limited, the cost of plant and machinery is calculated as follows:

Table

(Rs. in lakh)

Basic cost of indigenous machinery	26
Basic cost of imported machinery	46
Duties on imported machinery	6
Duties on indigenous machinery	3
Other expenses	2
Total Cost	83

Miscellaneous Fixed Assets

There are other items of machinery which do not form part of the direct manufacturing process and are called miscellaneous fixed assets or utilities. These may differ from project to project. Common to most projects are DG set, boiler, piping, meters, etc, laboratory equipment, testing equipment, transformer, furniture, office equipment, cables, etc. Sometimes expenses incurred for patents, licences, payments in respect of trade marks, etc., are also included under this head.

The provision of these assets is determined depending upon their need and justification. Adequate provision for escalation charges are made in the light of escalation clauses, if any, in the quotations or by adding an allowance at the latest rate of annual inflation on various equipment multiplied by the delivery period.

Pre-Operative Expenses

The expenses incurred till the date of commencement of commercial production are included under this head. Broadly speaking pre-operative expenses comprise the following:

i. Promotional expenses

ii. Organizational and training costs

iii. Rent, rates and taxes

iv. Travelling expenses

v. Postage, telegrams and telephone expenses

vi. Printing and stationery expenses

vii. Advertisement expenses

viii. Guarantee Commission

ix. Insurance during construction

x. Interest during construction period, etc.

Pre-operative expenses incurred up to the point of time the plant and machinery are ready for use are capitalized by apportioning them to depreciable fixed assets in proportion to their book values.

The pre-operative expenses for Mini Garments Limited was estimated to be Rs.18 lakh including interest on term loan (of Rs.100 lakh, as shown in means of financing) during construction period of 6 months. The interest on term loan for those 6 months at the rate of 18% was calculated as

$$100 \text{ x } \frac{18}{100} \text{ x } \frac{6}{12} = \text{Rs.9 lakh}$$

Provision for Contingencies

Over and above the escalation under various items of cost on the basis of latest available rate of inflation, contingency provision is made on the basis of project implementation schedule. Escalation may arise due to minor changes in the specifications of the buildings, plant and machinery which result in the increase of costs.

Contingency for price escalation can be provided by analyzing each and every item of the cost of the project. For this purpose, costs can be divided into firm and non-firm costs, where firm costs are those which are already procured, or there is reasonable possibility of the items being procured within the provisions made at the time of appraisal. Firm costs have less possibility of variation as compared to non-firm costs. So, it does not call for provisions for escalation. However, it would be in the interest of the project to provide contingencies as per the following rates –

i. Firm Costs – 5%

ii. Non-firm costs – 10%

Thus, if the basic costs are as follows:

Table

(Rs. in lakh)

1.	Land	5.00
2.	Building	25.00
3.	Site Development	12.00
4.	Plant and Machinery	50.00
5.	Miscellaneous Fixed Assets	5.00
6.	Preliminary and Pre-operative (Excluding interest)	3.00
		100.00

The provision is made as follows: (Escalation provision is usually not made for land.)

Table

(Rs. in lakh)

	Firm Costs	Escalation @5%	Non-Firm Costs	Escalation 10%	Total
Building	–	–	25	2.50	2.50
Site development	–	–	12	1.20	1.20
Plant & Machinery	20	1.00	30	3.00	4.00
M. Fixed Assets	–	–	5	0.50	0.50
Preliminary & Pre-operative	–	–	3	0.30	0.30
					8.50

Thus, the total provision of the contingencies would be Rs.8.5 lakh on the basic cost of Rs.100 lakh, i.e. 8.5%. As a rule of thumb basis the provision for the escalation of contingencies may vary from 7.5 percent to 10 percent of the total cost of the project excluding the margin money for working capital and interest during construction period. If there is a possibility of delay or change in the implementation schedule, contingency provision can also be made for the interest during construction period. This provision for escalation is apportioned to the depreciable assets in proportion to their values.

The contingency provision for Mini Garments Limited was estimated at Rs.15 lakh, 8.9 percent of the basic cost of the project of Rs.169 lakh (i.e. 200.12 – 22.12 – 9), as follows:

Table

		Firm costs	Non-firm costs	Escalation @10%
1.	Site development	–	6.00	0.60
2.	Buildings	–	50.00	5.00
3.	Plant and Machinery	–	83.00	8.30
4.	Preliminary Expenses	–	2.00	0.20
5.	Pre-operative Expenses (excluding interest)	–	9.00	0.90
				15.00

Preliminary Expenses

Preliminary and capital issue expenses include cost of preparation of feasibility report, project reports conducting market survey or any other survey necessary for the project, legal charges for drafting agreements, memorandum and articles of association, capital issue, underwriting commission, brokerage, charges for drafting, printing and issue of prospectus, share certificates, etc.

For Mini Garments Limited, preliminary expenses are estimated to be Rs.2 lakh. The expenditure is lesser than 2.5% of the total cost of the project and therefore, can be written-off over ten years entirely.

Technical Know-how Fees

The technical know-how and engineering fees include know-how fees, expenses on foreign technicians, training of Indian technicians within the country and abroad as also any royalty and compensation if payable. A thorough scrutiny should be done with regard to the precise scope and cost of know-how and consultancy services. To avoid overcharging by the consultant, three or four consultants are approached, their experience is examined and the relative fees are compared. While estimating know-how and consultancy fees, government guidelines, range of services rendered by the consultants, guarantees offered, risks shared, etc., are examined. If the royalty or fees for know-how is payable in lump sum at the beginning of the project, it is considered to be a part of the cost of the project. On the other hand, if it is payable periodically, whether or not based on sales, it is considered an operating cost.

Estimation of Bank Finance and Margin Money

The estimation of bank finance involves the following steps:

1. **Estimation of the current assets required to be held by the company:**

   The estimate is generally based on the experience of similar units. Raw material stocks are estimated in terms of number of months' consumption while finished goods and work-in-process are estimated in terms of so many months cost of production. The estimate of debtors is based on the sales estimate and the credit period proposed to be allowed by the unit.

2. **Reduce the margin money required to be brought in by the promoter from the current assets:**

   Banks normally insist that at least 25% of the current assets have to be financed by units through long-term funds. Therefore, 25% of the current assets have to be included in the project cost. The margin money included in the cost of capital for Mini Garments is Rs.22.12 lakh. The margin money included in the cost of capital is generally based on the estimate of working capital for the second year of operations.

Reduce the current liabilities other than bank finance presently sought from the remaining amount:

The current liabilities such as trade credit, wages and salaries payable and other outstanding expenses have to be reduced from the current assets after netting out for margin money. This is because these liabilities are short-term funds which can be used by the unit to finance its current assets. The same cannot again be funded by the bank.

The current liabilities of Mini Garments Ltd. Are as follows:

	Year 1	Year 2	Year 3 onwards
Trade Creditors	1.45	2.56	3.75
Wages Payable	0.29	0.45	0.86
Total	1.74	3.01	4.61

Margin money for working capital for Mini Garments was calculated to be Rs.22.12 lakh in the second year, the computation of which is shown in Table.

Table

(Rs. in lakh)

Particulars	Consumption at 100% capacity utilization	Requirements (Months)	Bank Finance (%)	I Year 50% operating capacity			II Year 60% operating capacity			III Year 80% operating capacity		
				Working Capital	Working Capital Gap	Margin Money	Working Capital	Working Capital Gap	Margin Money	Working Capital	Working Capital Gap	Margin Money
Raw materials & Consumables	271.88	1.50	75	16.99	12.74	4.25	20.39	15.29	5.10	27.19	20.39	6.80
Packing materials	67.14	1.50	75	0.42	0.32	0.10	0.50	0.38	0.12	0.67	0.50	0.17
Work-in-progress	234.77	0.06	60	1.17	0.70	0.47	1.41	0.85	0.56	1.87	1.12	0.75
Finished goods	258.35	0.50	75	10.76	8.07	2.69	13.08	9.81	3.27	17.37	13.02	4.34
Receivables	335.86	0.10	75	2.80	2.10	0.70	3.36	2.52	0.84	4.48	3.36	1.12
Cash requirement	119.03	1.00	0	9.92	0.00	9.92	12.23	0.00	12.23	16.16	0.00	16.16
Total				42.06	23.93	18.13	50.97	28.85	22.12	67.74	38.40	29.34
Current Liabilities					1.74			3.01			4.61	
Bank Finance					22.19			25.84			33.79	

Notes:

Working capital required during I year (i.e. 50% capacity utilization) is calculated as –

i. Raw Materials and Consumables: $271.88 \text{ x } 0.5 \text{ x } \frac{1.5}{12} = 16.99$ lakh

ii. Packing materials: $0.01 \text{ x } 671.4 \text{ x } 0.5 \text{ x } \frac{1.5}{12} = 0.42$ lakh

iii. Work-in-progress (i.e., Total operating cost – Depreciation):

$$234.77 \text{ x } \frac{0.06}{12} \text{ lakh } = 1.17 \text{ lakh}$$

iv. Finished goods

(i.e., Total operating cost + Salaries + Admn. Overheads – depreciation):

$$258.35 \text{ x } \frac{6.5}{12} = 139.51 \text{ lakh.}$$

v. Receivables (Sales): $335.86 \text{ x} \frac{0.1}{12} = 2.80$ lakh

vi. Cash requirement, i.e. the amount of cash required to be held by the unit for day to day expenses is estimated as so many months' working expenses, which in the present case is one month. The calculation is:

(Total operating cost – Raw material – Rent + Salaries + Admn. Overheads – Packing Materials – Depreciation)

$$119.03 \text{ x } \frac{1}{12} = 9.92 \text{ lakh}$$

THE MEANS OF FINANCE

Once the cost of project is estimated, the next step is to find out the means of financing the project. Therefore, all the available avenues should be evaluated and the means and pattern of financing should be fixed carefully. The financing pattern of the companies mentioned in the previous section is given below.

Table: Mini Garments Limited Means of Finance:

(Rs. in lakh)

Share Capital		
Promoters	90.12	
Public Issue	0	90.12
Term Loan		100.00
Subsidy		10.00
		200.12

This section gives an overview of the various sources of finance.

Equity Capital

Equity capital is the capital contributed by the owners of a company. A part of the equity capital is brought in by the promoters while the rest is issued to the public.

Equity may also be raised through the issue of Global Depository Receipts (GDRs). GDRs are negotiable instruments issued by a depository bank which entitles the holder to the number of equity shares specified in the receipt. The shares are denominated in the currency of the country to which the issuing company belongs and can be subscribed through the currency of the investor or the US dollar. The company issues the shares to the depository bank which in turn issues the GDRs to the investors against the shares held by it. The issuing company receives funds in foreign currency.

The advantages of equity capital are:

i. Payment of dividend is not obligatory and may be skipped when profits are low.

ii. It is permanent capital and does not carry any repayment obligation until the liquidation of the company.

The disadvantages are:

i. Dividend on equity capital is not a tax deductible expense.

ii. Issue of equity results in dilution of control of the promoters if they too do not subscribe to the issue in the required proportion.

Sometimes financial institutions may subscribe to a part of the equity capital through firm allotments. In addition, reservations may also be made to the employees of the company and the promoter companies as also to mutual funds and NRIs.

Preference Capital

Preference capital is a hybrid between the equity capital and debt capital. While the claim of the preference shareholders is just above the equity holders, it is subordinate to the claims of all other stakeholders of the company. The dividend on preference shares, which is paid at a fixed percentage of the face value of the shares, is not a tax deductible expense. However, the Companies Act requires that the preference shares have to be redeemed within a maximum time period of 20 years, which along with the fixed nature of the dividend gives them the character of debt. These shares are issued when the promoters want to raise the net worth of the company without diluting their stake to meet the requirements of the financial institutions as the institutions consider preference shares as a part of the net worth.

There are many variations of the preference shares such as the cumulating of the dividend payable when the profits are inadequate, participation in profits if the equity dividends exceed a certain percentage, etc.

Debenture Capital

Debenture capital is debt raised through the issue of debentures. Based on whether they are convertible into equity shares or not, debentures may be fully convertible (FCDs), partly convertible (PCDs), or non-convertible (NCDs). Debentures may be secured by a charge on the assets of the company or may be unsecured. There is no restriction on the period of maturity for which debentures can be issued, though generally the period of maturity varies between five and ten years. Interest on debentures, like on any other debt, is tax deductible. The amount to be raised through debentures should be decided keeping in view the amount of finance available from the institutions and the security available. When convertible debentures are issued in Euromarkets to raise debt in foreign currency, they are called Euro Convertible Bonds (ECBs). The ECBs carry an option to the holder to get them converted into equity shares at a ratio specified at the time of issue.

Term Loans

Financial institutions and commercial banks extend term loans with a repayment period ranging generally between eight and fifteen years. The loans are available for setting up new projects and also for expansion and renovation. The loans are secured by a first charge on the assets financed and a second charge on all other assets of the firm. Term loans are allowed in both rupees and foreign currency. Foreign currency loans are availed of to meet the cost of imported equipment, cost of technology and know-how, etc., for which payments may have to be made in foreign currency. The loan account is maintained in foreign currency and the interest and installments are converted into rupees at the time of repayment at the rates then prevailing. Term loans, both in rupees and foreign currencies are available from non-banking financial companies also. But generally, the limitation is that the NBFCs do not finance the entire project, but limit themselves to the items they believe are relatively safe to finance and also charge a rate higher than the financial institutions. Foreign currency term loans may also be obtained directly from overseas lenders if the borrower has a high credit rating.

Deferred Credit

Suppliers of equipment often allow the buyer to pay in installments. The period over which the installments are spread over and the finance charges depend on the credit standing of the buyer, the value of the equipment and the demand for the equipment in the market.

Bill Rediscounting Scheme

This scheme has been introduced by the IDBI to encourage the sale of indigenous capital equipments on a deferred payment basis. The mechanism of this scheme has been explained in detail in Annexure – I.

Seed Capital Assistance

Seed capital assistance is provided to small and medium ventures made generally by first generation entrepreneurs who are technically qualified, but do not have sufficient resources to augment the resources brought in by them at very low rates of interest. For more details on seed capital assistance see Annexure – I.

Unsecured Loans

When promoters are unwilling or unable to bring in equity to the extent wanted by the financial institutions, they extend unsecured loans to the venture. Such unsecured loans, which do not carry any interest, may also be extended by friends and relatives of the promoters and cannot be withdrawn without the permission of the lending institutions.

Deposits

Public deposits are also unsecured, and can be raised by the firm subject to the rules made by the Central government and the RBI in this regard.

Leasing and Hire Purchase

Non-banking financial companies finance only a part of the project, and rarely the entire project, unlike the FIs. Therefore, the willingness of the financial institutions to let a third company finance a part of the project should be kept in mind while deciding on the financing mix. Comparison of:

- The finance charges demanded by the hire purchase company (or the finance charge implicit in the lease) with the cost of funds from other sources.
- The outflow on hire payments or lease rentals with the expected cash inflows should be done to decide on which source of finance to choose.

Estimation of Profits

It is the projected financial statements that reveal the desirability or otherwise of the project. In the statements, the crux is the estimation of the revenue and the corresponding costs. In estimating the cost of production, assessment is made of various inputs and also the production capacity build-up. The aspects which have to be considered while estimating the cost of production, and sales revenue are:

Product Mix: Depending upon the demand projections, product mix is selected. Given adequate demand for each of the product, product mix is determined depending upon the contribution of each product towards profitability and the adequacy of the plant and utilities.

Installed Capacity: First, the installed capacity of the entire plant is assessed based upon the capacity guaranteed by the supplier for each equipment/section of the plant, direct inputs, product mix etc. The installed capacity is indicated in terms of physical quantities per unit of time. As installed capacity is based upon the product mix, inputs, etc. it may vary during the project life. Determining the capacity of the unit with four different alternatives is discussed in box given below:

Box: 3 How to Determine Capacity of the Unit

If there is only one product and one Machine/Assembly Unit:

$$\text{Capacity} = \frac{\text{Total time available}}{\text{Time taken to manufacture one unit of product}}$$

For assessing total time available take 400–440 minutes per shift for 250-300 working days in a year for a continuous non-seasonal activity (thus providing timing for break-downs, maintenance, holidays, etc.).

In case of seasonal activities, consider total time available based on actual data, and likely activity levels during off-season.

Determine time taken to manufacture one unit of the product from process details, discussion with borrower and actual observation (if possible)

If there is one Product and two or more Machines Assembly Units:

$$\text{Capacity} = \frac{\text{Total time available}}{\text{Time taken in manufacturing process at the bottleneck machine}}$$

The bottleneck machine is the one on which the product spends the maximum time in the process.

If there are two or more Products and one or more Machinery/Assembly Units:

Determine the product-mix e.g., if there are two products A & B the product may be 75% of A and 25% of B (in numbers or quantity).

Find out the time taken by one unit of each product for manufacture, e.g., A may take 5 minutes and B 10 minutes.

Determine the following: 5 x 0.75 + 10 x 0.25 – 6.25 minutes.

If the total time available is 300 days x 440 minutes per shift per day = 1, 32000 minutes, capacity is given by the figure = 1,32,000/6.25 = 21,120 units of A & B. This will be made of 75% of A and 25% pf B i.e. 15,840 units of A and 5,280 units of B.

This can be expressed in total Rupee value by multiplying with relative selling prices.

If there are two or more Products and two or more Machinery/Assembly Units:

Suppose there are three product A,B & C and three machines/assembly units, XY & Z.

Determine the time required in the process for each product at each machine/assembly and make a matrix as below for the time spent.

Machine/Assembly Unit:

Product	X	Y	Z
A	5 minutes	2 minutes	10 minutes
B	1 minutes	8 minutes	4 minutes
C	3 minutes	4 minutes	3 minutes

This illustration indicates that A spends 5 minutes X, 2 minutes at Y and 10 minutes at Z to be processed.

B 1 minute at X, 5 minutes at Y and 6 minutes at Z and so on.

– now find out past/projected product-mix (in numbers of quantity). This may be say 20% A, 50% B, and 30% C.

Multiply the row against A in the above matrix by 0.20, the B row by 0.50, and the C row by 0.30 and the result to get the following:

Product	X	Y	Z
A	1.0 (i.e. 5 x 0.20)	1.0 (i.e. 2 x 0.20)	2.0 (10 x 0.20)
B	0.5	4.0	2.0
C	0.9	1.2	0.9

The machine/assessment where the above total is the highest is the bottleneck machine. In the above illustration Y (5.60 minutes) is the bottleneck machine.

$$\text{Capacity} = \frac{\text{Total time available (say 3300 x 400}}{\text{Manufacturing time at bottleneck machine (Y)}}$$

$$= \frac{1,32,000}{5.60} = 23,572 \text{ numbers}$$

This is made up 4714 numbers of A, 11786 nos. of B (50%) and 7072 numbers C (30%). This is the capacity in numbers.

– Multiply these numbers by the selling prices to get capacity expressed in Rupee value of sales.

– A change in the product mix with change capacity and may even shift the bottleneck to X or Z.

Capacity Utilization: It may not be possible to fully utilize the installed capacity of the plant due to several factors like teething problems in the plant and machinery, technological/process constraints, frequent changes in product-mix, inherent characteristics of the industry, etc. In some industries, 100 percent capacity utilization is not possible during the entire life of the project.

The production capacity over a period is decided based upon the average capacity utilization of the industry over the past few years and the capacity build up achieved by similar units during the early stages of their operations. Generally, only 80% capacity is utilized even during the third or fourth year of operation.

SALES ESTIMATION

For products which are manufactured in the country, the basis of assuming a selling price is the pricing pattern laid down by the government, if the products' price is controlled by the governments or the current market price and price trends in the past. For products which are not manufactured in the country and are being imported, the landed cost of a similar imported product is assumed to be the selling price.

The selling price for Mini Garments was estimated to be Rs.250, Rs.190 and Rs.130 per piece of pant, shirt and kids wear. At 100% capacity utilization, the project is estimated (as shown in table below) to produce 1,14,000 pieces of pants, 1,06,875 pieces of shirts and 1,28,250 pieces of kids wear (excluding 5% rejected material). Rejected material is expected to be sold at Rs.125, Rs.85, and Rs.65 per piece of Pants, Shirts and Kids wear respectively. The sales realization at 50%, 60%, and 80% capacity per pieces of pants, shirts and kids wear levels is given in the table below:

The following points have to be borne in mind while estimating working results or profits:

i. The unit is assumed to sell all that it produces. That is, production is considered to be equal to sales and hence no adjustment is necessary for opening or closing stock.

ii. Adjustments are not made for inflation. That is, projections of revenues and costs are made at today's prices. It is assumed that the impact of inflation on revenues will be offset by that on costs.

iii. Sales are generally estimated net of excise duty while commission paid to salesmen is shown as an expense in the income statement.

The capacity of Mini Garments Limited at 100% levels was estimated to be 1,14,000, 1,06,875 and 1,28,250 pieces per annum of pants, shirts, and kidswear respectively determined as follows:

Table: Capacities at 100% Levels

Product Mix	No. of Machines Used	Pieces/ Machine	Pieces/ Day (2 shifts)	Pcs/ Annum (300 days)	Reject @5%	Pcs/ Annum
Pants	40	5.00	400	1,20,000	6,000	1,14,000
Shirts	30	6.25	375	1,12,500	5,625	1,06,875
Kids Wear	30	7.50	450	1,35,000	6,750	1,28,250
Its capacity utilization was estimated to be 50%, and 60% during 1st and 2nd years and 80% from 3rd year onwards.						

The production capacity of the project is determined as follows:

Table: Production Capacity (Pcs/annum)

Product Mix	Capacity at 100% Levels	I Year @ 50% Capacity	II Year @ 60% Capacity	III Year Onwards @ 80% Capacity
Pants	1,14,000	57,000	68,400	91,200
Shirts	1,06,875	53,438	64,125	85,500
Kids Wear	1,28,250	64,125	76,950	1,02,600

Revenue from Sales for Mini Garments is calculated as below:

Table

Product Mix	Prod. at 100% Capacity (Pieces)	I Year		II Year		III Year Onwards	
		No. of Pieces	Amount	No. of Pieces	Amount	No. of Pieces	Amount
Pants	1,14,000	57,000	142.50	68,400	171.00	91,200	228.00
Shirts	1,06,875	53,438	101.53	64,125	121.84	85,500	162.45
K.Wear	1,28,250	64,125	83.36	76,950	100.03	1,02,600	133.38
'A'			327.39		392.87		523.83

(Rs. in lakh)

Sale of Rejects							
Product	S.P (Rs.)	Reject (Pieces)	Sales (Rs.)	Reject (Pieces)	Sales (Rs.)	Reject (Pieces)	Sales (Rs.)
Pants	125	3,000	3.75	3,600	4.50	4,800	6.00
Shirts	85	2,813	2.39	3,375	2.87	4,500	3.82
K.Wear	65	3,375	2.20	4,050	2.63	5,400	3.51
'B'			8.34		10.00		13.33
Total Sales Realization		(A + B)	= 335		402.87		537.16

COST OF PRODUCTION

The cost of production includes the cost of raw materials, components, consumables and utilities comprising power, fuel, water, etc. The initial theoretical calculations are adjusted taking into account the actual consumption pattern in the industry. The cost of inputs, besides the basic cost, includes loading, transportation and unloading expenses. Suitable provisions are also made for seasonal fluctuation in prices.

The various elements of total cost of production are –

a. Raw materials
b. Chemicals
c. Components
d. Consumables.
   I. Total Raw Material Cost (a) + (b) + (c) + (d)
e. Utilities
f. Power
g. Water
h. Fuel
   II. Total utilities (e) + (f) + (g) + (h)
i. Wages
j. Factory supervision salaries
k. Bonus and Provident Fund
   III. Total Labor (i) + (j) + (k)
l. Repairs and maintenance
m. light
n. Rent and taxes on factory assets
o. Insurance on factory assets
p. Packing material
q. Miscellaneous factory overheads
r. Contingency at 5%
   IV. Total Factory Overheads (l to r)
   V. Cost of Manufacture/Operating Cost I + II + III + IV
   VI. Total Administration Expenses
   VII. Total Sales Expenses
   VIII. Royalty and Know-how Payable
   IX. Total Cost of Production (V) + (VI) + (VII) + (VIII)

Mini Garments estimates its unit cost and total cost of raw materials and consumables to be:

Table: Unit Cost

Product Mix	Cloth/Piece (mts), Cloth/Piece (mt) (Rs.)	Cloth Cost (Rs.)	Consumables/ Piece	Unit Cost of RMs	
Pants	1.20	75	90	10.00	100.00
Shirts	1.80	40	72	3.00	75.00
K. Wear	1.00	45	45	5.00	50.00

Table: Total Cost

(Rs. in lakh)

Product Mix	Cost of RMs at 100% Level	Cost during I Year at 50% Level	Cost during II Year at 60% Level	Cost from III Year Onwards at 80% Level
Pants	1,20,000 x 100 = 120.00	60.00	72.00	96.00
Shirts	1,12,500 x 75 = 84.38	42.19	50.63	67.50
K. Wear	1,35,000 x 50 = 67.50	33.75	40.50	54.00
Total	271.88	135.94	163.13	217.50

The cost of power includes demand and energy charges. The requirements of utilities are calculated on the basis of actual need and also on the experience of similar units in the industry. If the project contemplates generation of power internally, then the cost of power generated is to be segregated from power obtained from the Electricity Board. The cost of generating power internally will be added to other expenses such as fuel, salaries, depreciation, etc.

Table: Power Estimates of Mini Garments

Maximum demand	350 KVA
Average demand	275 KVA
Power factor	0.9
Units/hour	250
Units/year	250 x 12 x 300 = 9 lakh units at 100% capacity utilization (assuming 12 hours/day working)
Demurrage Charges	Ist year Rs.3.00 lakh, II year onwards Rs.4.00 lakh

The total cost of power is determined as follows:

Table

(Rs. in lakh)

		I Year at 50% utilization	II year at 60% utilization	III year onwards at 80% utilization
i.	Units Consumption (in lakh)	04.50	05.40	07.20
ii.	Average cost/unit (Rs.)	02.25	02.25	02.25
iii.	Energy cost (i) x (ii)	10.13	12.15	16.20
iv.	Dem. charges	3.00	04.00	04.00
v.	Total cost (iii) + (iv)	13.13	16.15	20.20
Water and infrastructural facilities required for the project were expected to be available easily without any further cost.				

The other items of cost forming part of operating cost are labor and supervision, repairs and maintenance, packing materials and other miscellaneous factory overheads. Under labor and supervision, the size of the labor force, skills required of them and wage rate determines the total wage bill. The wage rate is taken either as per the statutory provisions or the rates prevailing in similar units and the location of the plant. A provision is added for allowances, provident fund etc. Every year it is estimated to escalate by 5%. Unless the plant and machinery has some special characteristics, for profit projections, repairs and maintenance are taken at 2 to 3 percent of the value of fixed assets and subsequently increased during later years. In case of those industries where wear and tear is high, a higher provision may be made.

The total labor and factory overheads of Mini Garments Limited was estimated to be – Wages (during 3rd year at 80% capacity)

Table

(Rs. in lakh)

Category	Nos.	Rs./Year/Person	Annual Salary
Finishers	225	24,000	54.00
Roughers	100	18,000	18.00
Cutters	16	18,000	2.88
Eyelet stichers	60	14,400	8.64
Chief designer	1	90,000	0.90
Asst. designers	3	50,000	1.50
Works Manager	1	1,00,000	1.00
Purchase Manager	1	1,00,000	1.00
Purchase Staff	4	36,000	1.44
			89.36
Other Perks @ 33%			29.49
			118.85
Henceforth, wages are estimated to escalate by 5%. Wages during the I and II year is calculated based on the capacity utilization. Cost of packing materials for Mini Garments was estimated to be 1% of sales value.			

Table

Repairs and Maintenance was estimated to be –
I year – Rs.3.52 lakh
II year – Rs.4.07 lakh
III year – Rs.5.22 lakh

Apart from raw materials, consumables and utilities cost, overall cost of production also includes administrative expenses comprising of salaries, electricity, postage and other office supplies, insurance and taxes, etc. sales expenses and royalty know-how. Depending on the project, administrative and sales expenses can be taken at 3 to 5 percent and 5 to 10 percent of the sales respectively.

The estimates may be based on the average of the expenses incurred by similar units, if any.

Salaries for Mini Garments were estimated to be Rs.18.49 lakh as follows:

Table

Category	Nos.	Rs./Yr./ Person	Annual Salary
Admn. Manager	1	60,000	60,000
Sales Manager	1	1,00,000	1,00,000
General Manager	1	1,50,000	1,50,000
Admn. Staff	5	36,000	1,80,000
Sales Staff	5	36,000	1,80,000
Supervisors	5	36,000	1,80,000
Maint. Staff	5	36,000	1,80,000
Watch/Ward	12	18,000	2,16,000
Other Subord. Staff	10	14,400	1,44,000
			13,90,000
Other perks @ 33%			4,58,700
			18,48,700
			= Rs.18.49 lakh

Salaries are expected to increase by 5% every year.

Salaries during I and II years are calculated on the basis of capacity utilization.

Administrative Expenses, of Mini Garments Limited were estimated to be Rs.12 lakh, Rs.18 lakh and 24 lakh during I, II and III year onwards respectively.

Selling Expenses were estimated to be 5% of sales value.

Other Expenses

For profit projections, interest charges, depreciation and taxes payable should also, be estimated. The provision for financial charges should be made on the basis of actual taking into account interest rates, guarantee, commission, etc.

Mini Garments Limited has estimated term loan to be Rs.100 lakh and working capital loan (as calculated in the table-Margin Money for Working Capital) to be Rs.23.93 lakh and Rs.28.84 lakh during I and II year respectively and Rs.38.39 lakh from III year onwards. It has been assumed that interest on term loan and on bank borrowings is to be 18% p.a. Term Loan is assumed to be repaid in 20 equal quarterly installments starting from beginning of the III year of operation. Based on the above estimates and assumptions Mini Garments interest schedule will be:

Table: Repayment and Interest Schedule of Term Loan

(Rs. in lakh)

Year	Opening Balance	Amount Repaid	Closing Balance	Interest @18.00%	Total Repayment
I	100.00	0.00	100.00	18.00	18.00
II	100.00	0.00	100.00	18.00	18.00
III	100.00	20.00	80.00	15.75*	35.75
IV	80.00	20.00	60.00	12.15	32.15
V	60.00	20.00	40.00	8.55	28.55
VI	40.00	20.00	20.00	4.95	24.95
VII	20.00	20.00	0.00	1.35	21.35

* Interest is calculated as follows:

Rs.95 lakh for 3 months @ 18% p.a –	4.275
Rs.90 lakh for 3 months @ 18% p.a. –	4.050
Rs.85 lakh for 3 months @ 18% p.a. –	3.825
Rs.80 lakh for 3 months @ 18% p.a. –	3.600
	15.750

Table: Interest on Bank Borrowings

	Const - ruction Period	I	II	III	IV	V	VI	VII
Opening Balance*	–	0	22.19	25.84	33.79	33.79	33.79	33.79
Repayment	–	–	–	–	–	–	–	–
Increase	–	22.19	3.65	7.95	–	–	–	–
Closing Balance	–	22.19	25.84	33.79	33.79	33.79	33.79	33.79
Interest at the rate of 18% p.a (approx.)	–	3.99	4.65	6.08	6.08	6.08	6.08	6.08

* The amount of bank borrowings is obtained from the computation of margin money for working capital.

Provision for Depreciation

Provision for depreciation is made either by SLM or WDV method. But, for tax purposes, depreciation should be provided on WDV method as per the rates provided in the Income Tax Act.

Pre-operative expenses including interest during construction period and contingencies are allocated to the fixed assets (generally to depreciable assets) in proportion to their values before providing depreciation.

Provision for Taxation

Certain deductions under Sec. 80HHC (in respect of export turnover), 80IA (in respect of new industrial undertakings) etc., are allowed from total income to arrive at the taxable income and tax is computed as per the rates given in the Act.

Regarding Mini Garments Ltd. a deduction of 30% of profits, after deducting carry forward losses is allowed for ten assessment years under section 80IA as it is located in a backward district. The tax rate applicable for the project is 40%. It may be noted that the tax on income is calculated at the time of making the projections at the tax rates prevailing at the time unless it is known definitely that a different tax rate would be applicable in future.

Depreciation is calculated for Mini Garments in the following manner:

Table

Assets	Value before Capitalization	Pre-operative Expenses	Contingencies	Value after Capitalization
Land	4.00	–	–	4.0
Site development	56.00	7.25	6.04	69.29
Plant & Machinery	83.00	10.75	8.96	102.71

Depreciation was assumed to be 3% and 11% on buildings, plant and machinery respectively on SLM basis. However, for tax purposes, depreciation was computed at 10% and 25% on buildings and plant and machinery respectively.

Computation of Depreciation

(Rs. in lakh)

	Year									
	I	II	III	IV	V	VI	VII	VIII	IX	X
A. Straight Line Method:										
Land	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Building										
Opening balance	69.29	67.21	65.13	63.05	60.97	58.89	56.81	54.73	52.65	50.57
Less: Depreciation	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
Closing balance	67.21	65.13	63.05	60.97	58.89	56.81	54.73	52.65	50.57	48.49
Plant & Machinery										
Opening balance	102.71	91.41	80.11	68.81	57.51	46.21	34.91	23.61	12.31	1.01
Less: Depreciation	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	1.01
Closing balance	91.41	80.11	68.81	57.51	46.21	34.91	23.61	12.31	1.01	–
Summary:										
Opening balance	176.00	162.62	149.24	135.86	122.48	109.10	95.72	82.34	68.96	55.58
Less: Depreciation	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	3.09
Closing balance	162.62	149.24	135.86	122.48	109.10	95.72	82.34	68.96	55.58	52.49

B. Written Down Value Method:										
Land and Building	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Opening balance	69.29	62.36	56.12	50.51	45.46	40.91	36.82	33.14	29.83	26.85
Less: Depreciation	6.93	6.24	5.61	5.05	4.55	4.09	3.68	3.31	2.98	2.69
Closing balance	62.36	56.12	50.51	45.46	40.91	36.82	33.14	29.83	26.85	24.16
Plant & Machinery:										
Opening balance	102.71	77.03	57.77	43.33	32.50	24.37	18.28	13.71	10.28	7.71
Less: Depreciation	25.68	19.26	14.44	10.83	8.13	6.09	4.57	3.43	2.57	1.93
Closing balance	77.03	57.77	43.33	32.50	24.37	18.28	13.71	10.28	7.71	5.78
Summary:										
Opening balance	176.00	143.39	117.89	97.84	81.96	69.28	59.10	50.85	44.11	38.56
Less: Depreciation	32.61	25.50	20.05	15.88	12.68	10.18	8.25	6.74	5.55	4.62
Closing balance	143.39	117.89	97.84	81.96	69.28	59.10	50.85	44.11	38.56	33.94

Table: Computation of Income Tax

(Rs. in lakh)

	Year									
	I	II	III	IV	V	VI	VII	VIII	IX	X
A. Gross Taxable Profit										
1. Profit as per profitability statement	25.23	32.84	58.35	54.29	51.13	47.65	44.02	38.31	31.05	34.19
2. Add: Depreciation under SL method	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	3.09
3. Less: Depreciation under WDV method	32.61	25.50	20.05	15.88	12.68	10.18	8.25	6.74	5.55	4.62
4. Less: Preliminary expenses written-off	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
5. Less: Unabsorbed depreciation & losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (A)	5.80	20.52	51.48	51.59	51.63	50.65	48.95	44.75	38.68	32.46
B. Deductions	1.74	6.16	15.44	15.48	15.49	15.20	14.69	13.43	11.60	9.74
C. Taxable profit (A – B)	4.06	14.36	36.04	36.11	36.14	35.46	34.27	31.33	27.08	22.72
D. Income Tax (@ 40%)	1.62	5.75	14.41	14.45	14.46	14.18	13.71	12.53	10.83	9.09

PROJECTION OF FINANCIAL STATEMENTS

For projecting the financial condition of a project, forecasts of the income, assets and liabilities and the cash flows are necessary. Based on the assumptions and estimates made the following statements are prepared:

- Projected Income Statement.
- Projected Sources and Uses of funds statement.
- Projected Balance Sheet.

Table: Projected Income Statement of Mini Garments Ltd.

(Rs. in lakh)

	Year									
	I	II	III	IV	V	VI	VII	VIII	IX	X
No. of working days	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
No. of shifts	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Capacity utilization	50.00	60.00	86.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
A. INCOME										
Sales (A)	335.73	402.87	537.16	537.16	537.16	537.16	537.16	537.16	537.16	537.16
B. OPERATING COST										
Raw materials & Consumables	135.94	163.13	217.50	217.50	217.50	217.50	217.50	217.50	217.50	217.50
Packing materials	3.36	4.03	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37
Utilities (i.e. power, water & fuel)	13.13	16.15	20.20	20.20	20.20	20.20	20.20	20.20	20.20	20.20
Employee remuneration including benefits	74.28	89.14	118.85	124.79	130.73	136.67	142.61	148.55	154.49	160.43
Repairs, maintenance & insurance	3.52	4.07	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Contingency*	4.55	5.47	7.21	7.51	7.81	8.10	8.40	8.70	9.00	9.29
Depreciation	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	3.09
Total (B)	248.16	295.37	387.73	393.97	400.21	406.44	412.68	418.92	425.16	421.10
C. ADMINISTRATIVE EXPENSES										
Salary including benefits	11.56	13.87	18.49	19.41	20.33	21.25	22.17	23.09	24.01	24.93
Administrative overheads	12.00	18.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Marketing expenses	16.79	20.14	26.86	26.86	26.86	26.86	26.86	26.86	26.86	26.86
Excise duty	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (C)	40.35	52.01	69.35	70.27	71.19	72.11	73.03	73.95	74.87	75.79
D. FINANCIAL EXPENSES										
Interest:Term Loan	18.00	18.00	15.75	12.15	8.55	4.95	1.35	0.00	0.00	0.00
Interest on working capital loan	3.99	4.65	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08
Total (D)	21.99	22.65	21.83	18.23	14.63	11.03	7.43	6.08	6.08	6.08
E. Total expesnes (B+C+D)	310.50	370.03	478.81	482.87	486.03	489.51	493.14	498.85	506.11	502.97
F. Profit (A-E)	25.23	32.84	58.35	54.29	51.13	47.65	44.02	38.31	31.05	34.19
G. Preliminary expenses Written-off	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
H. Profit before tax (F-G)	25.03	32.64	58.15	54.09	50.93	47.45	43.82	38.11	30.85	33.99
I. Income tax	1.62	5.75	14.41	14.45	14.46	14.18	13.71	12.53	10.83	9.090
J. Profit after tax (H-I)	23.41	26.89	43.74	39.64	36.47	33.27	30.11	25.58	20.02	24.9
K. Dividend**	9.01	13.52	13.52	13.52	13.52	13.52	13.52	13.52	13.52	13.52
L. Retained Profit (J-K)	14.40	13.37	30.22	26.12	22.95	19.75	16.59	12.06	6.5	11.38

* Contingency of 5% is provided on operating cost excluding raw materials, packing materials and depreciation to meet any escalations in expenses.

** Dividends have been estimated to be paid at 10% and 15% of share capital in the I and II year onwards.

Table: Projected Cash Flow Statement

(Rs. in lakh)

		Pre-operative period	Year									
			I	II	III	IV	V	VI	VII	VIII	IX	X
A.	SOURCE OF FUNDS											
	Profit before tax & preli. expenses	0.00	25.23	32.84	58.35	54.29	51.13	47.65	44.02	38.31	31.05	34.19
	Add: Depreciation	0.00	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	3.09
	Total generation of funds	0.00	38.61	46.22	71.73	67.67	64.51	61.03	57.40	51.69	44.43	37.28
	Equity capital	90.12										
	Term Loan	100.00										
	Govenment subsidy	10.00										
	Increase in working capital loan		22.19	3.65	7.95							
	Total (A)	200.12	60.80	49.87	79.68	67.67	64.51	61.03	57.40	51.69	44.43	37.28
B.	APPLICATION OF FUNDS											
	Fixed assets	158.00										
	Preliminary/Pre-operative expenses	20.00										
	Increase in working capital*		30.40	5.33	11.24							
	Repayment of Term Loan		0.00	0.00	20.00	20.00	20.00	20.00	20.00	0.00	0.00	0.00
	Income tax		1.62	5.75	14.41	14.45	14.46	14.18	13.71	12.53	10.83	9.09
	Dividend/Withdrawal		9.01	13.52	13.52	13.52	13.52	13.52	13.52	13.52	13.52	13.52
	Total (B)	178.00	41.03	24.60	59.17	47.97	47.98	47.70	47.23	26.05	24.35	22.61
	Opening balance	0.00	22.12	41.89	67.16	87.67	107.37	123.90	137.23	147.40	178.04	193.12
	Difference (A-B)	22.12	19.85	25.27	20.51	19.70	16.53	13.33	10.17	25.64	20.08	14.67
	Closing balance	22.12	41.89	67.16	87.67	107.37	123.90	137.23	147.40	173.04	193.12	207.79

Table: Projected Balance Sheet*

(Rs. in lakh)

	Year									
	I	II	III	IV	V	VI	VII	VIII	IX	X
A. FIXED ASSETS										
Gross block	176.00	162.62	149.24	135.86	122.48	109.10	95.72	82.34	68.96	55.58
Depreciation	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	13.38	3.09
Net block (A)	162.62	149.24	135.86	122.48	109.10	95.72	82.34	68.96	55.58	52.49
B. CURRENT ASSETS										
Inventory	17.41	20.89	27.86	27.86	27.86	27.86	27.86	27.86	27.86	27.86
WIP	1.17	1.41	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87
Finished goods	10.76	13.08	17.37	17.37	17.37	17.37	17.37	17.37	17.37	17.37
Receivables	2.80	3.36	4.48	4.48	4.48	4.48	4.48	4.48	4.48	4.48
Cash & bank balance	41.89	67.16	87.67	107.37	123.90	137.23	147.40	173.04	193.12	207.79
Total (B)	74.03	105.90	139.25	158.95	175.48	188.81	198.98	224.62	244.70	259.37
C. CURRENT LIABILITIES										
Working Capital loan	22.19	25.84	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79
Others	1.74	3.01	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61
Total (C)	23.93	28.85	38.40	38.40	38.40	38.40	38.40	38.40	38.40	38.40
D = B – C	50.10	77.05	100.85	120.55	137.08	150.41	160.58	186.22	206.30	220.97
E = A + D	212.72	226.29	236.71	243.03	246.18	246.13	242.92	255.18	261.88	273.46
F. Investments	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Tangible Assets	212.72	226.29	236.71	243.03	246.18	246.13	242.92	255.18	261.88	273.46
H. Term Loan	100.00	100.00	80.00	60.00	40.00	20.00	0.00	0.00	0.00	0.00
I. NET WORKING CAPITAL (B – C)	112.72	126.29	156.71	183.03	206.18	226.13	242.92	255.18	261.88	273.46
Evidenced by										
J. Promoter's Capital	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12
K. Subsidy	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
L. Reserves & Surplus	14.40	27.77	57.99	84.11	107.06	126.81	143.40	155.46	161.96	173.34
M. Total	114.52	127.89	158.11	184.23	207.18	226.93	243.52	255.58	262.08	273.46
N. Preliminary expenses not written-off	1.80	1.60	1.40	1.20	1.00	0.80	0.60	0.40	0.20	0.00
O. Net worth (M – N)	112.72	126.29	156.71	183.03	206.18	226.13	242.92	255.18	261.88	273.46

* Balance sheet can also be prepared in the usual format of assets and liabilities.

** The figures (except cash) have been taken from Table.

DETAILED PROJECT REPORT

Having discussed the financial appraisal of the project, it is advisable to prepare a detailed feasibility study has to be undertaken covering marketing, technical, financial, economic and all other aspects of the project. The study in the form of Detail Project Report (DPR) contains specific estimates of the project cost, means of financing, schedules of implementation of cost and benefits streams in terms of cash flows. It further contains other information such as background of the promoters, location of the company etc. The ultimate decision whether to go in for the project or not and how to finance it, is undertaken after this study which discloses whether the project is technically feasible, economically viable and financially sound. A feasibility study is documented with a report showing all the ramifications of the project. In project finance, the pre-financing work (sometimes referred to as due diligence) is to make sure there is no "dry rot" in the project and to identify project risks ensuring they can be mitigated and managed in addition to ascertaining "debt service" capability. DPR is submitted to financial institutions. The contents of DPR are given below and the format of application form for All India Financial Institutions for financial assistance is given in Annexure II.

Contents of DPR includes:

1. General information
   i. Name
   ii. Constitution and Sector
   iii. Location
   iv. Nature of industry and product
   v. Promoters and their contribution
   vi. Cost of project and Means of Finance
2. Promoters' details
3. Marketing and Selling Arrangements
4. Particulars of the project
   i. Product mix and capacity
   ii. Location and site
   iii. Plant and Machinery
   iv. Raw materials
   v. Utilities
5. Technical Arrangements
6. Production Process
7. Environmental Aspects
8. Schedule of Implementation
9. Cost of the project
10. Means of Finance
11. Profitability estimates
    i. Assumptions
    ii. Projected income statement
    iii. Projected balance sheet
    iv. Projected cash flow statement
12. Appraisal based on profitability estimates
13. Economic considerations

14. Appendices
    i. Estimates of costs of production
    ii. Calculation of depreciation
    iii. Calculation of working capital and margin money for working capital
    iv. Repayment / Interest schedule of term loan and bank finance
    v. Calculation of tax
    vi. Coverage ratios
    vii. NPV, IRR, etc.
    viii. Sensitivity Analysis.

SUMMARY

- The life of the project is divided into four phases – Conception and Selection, Planning and Scheduling, Implementation, Monitoring and Control, and Evaluation and Termination.
- The project manager's duty is to co-ordinate and integrates activities being carried out across various functional departments; possess strong communicational and interpersonal skills to succeed. He need not be a technical specialist. Communicative and interpersonal skills are supposed to be his forte.
- Line Manager decides who does with what resources and when, within the constraints laid down by the project manager. Line manager is almost always a technical specialist. He has the knowledge and also the duty to point out to the authorities the lacunae and inconsistencies, if any in the specifications and constraints laid down by the project manager.
- Project financing is sometimes called off-balance sheet financing or non-recourse or limited-recourse finance. Project finance is the most preferred and mode of long term finance differs from other financing methods.
- To increase the flow of funds for developmental projects and reduce public borrowings by the government as well as to create confidence among investors, private sector participation in project finance was encouraged.
- The most important participants in project finance include equity investors called project sponsors and a syndicate of banks that generally provide loans to risky projects. Others involved in project finance are Special Purpose Vehicle (Project Company), operator, financial advisor and technical expert.
- Project financing requirements were met by financial institutions such as ADB, IDBI, IFCI, IDFC and others.
- Cost of project is one of the important steps in planning a project and first step in conducting financial analysis. It comprises of Land and Site development, Building and Civil works, Plant and Machinery, Miscellaneous fixed assets, Pre-operative Expenses, Provision for Contingencies, Preliminary expenses, Technical know-how fees and Estimation of Bank Finance and Margin money.
- Means of finance includes all the available avenues should be evaluated and the means and pattern of financing should be fixed carefully. Various sources of finance includes equty capital, preference capital, debenture capital, term lona, deferred credit, bill rediscounting scheme, seed capital assistance, unsecured loans, deposits, leasing and hire purchase.
- Detail Project Report (DPR) contains specific estimates of the project cost, means of financing, schedules of implementation of cost and benefits streams in terms of cash flows. It further contains other information such as background of the promoters, location of the company etc DPR is submitted to financial institutions.

Annexure I

Lending Practices of Financial Institutions

The various forms of assistance available from the financial institutions have already been dealt with briefly in the discussion on the means of financing a project. This annexure aims to provide an overview of the structure of the financial institutions in India, various schemes of assistance offered by them, their lending norms, the procedure for obtaining a term loan from these institutions and finally a broad description of how these institutions appraise the projects they finance.

Structure

Financial institutions can be broadly classified into all India financial institutions and state level institutions. As their names indicate, the all India institutions serve businesses all over the country and have their branches in all major centers of India. The state level institutions, on the other hand, cater to the state to which they belong. Some schemes of the all India institutions, in which the amount lent is small, are administered through the state level institutions. The all India institutions cater basically to the medium and large industries. Their direct finance to the small scale sector is negligible.

All India Institutions

Industrial Finance Corporation of India

Industrial Finance Corporation of India (IFCI) is the first financial institution to be established in India and was established in 1948, by an act of the parliament with the objective of providing medium and long-term finance to industrial concerns eligible for financing under the act. The sectors for which the IFCI provides finance extend through the industrial spectrum of the country.

Industrial Credit and Investment Corporation of India (ICICI)

The Industrial Credit and Investment Corporation of India (ICICI) was established in 1955, with the objective of providing finance to the industries in the private sector. It was incorporated under the Companies Act. Even though the IFCI was existing at that time, the need was felt for a separate financial institution to provide finance to the private sector, especially in foreign currency. The ICICI was started as a private sector financial institution unlike the IFCI. However, as the banks and insurance companies that were holding the shares were nationalized, the central government came to own a substantial holding in the company through them.

The ICICI is widely known for its flexible approach in financing. Recently, it has ventured into leasing, guarantee for export obligations and performance guarantees.

Industrial Development Bank of India (IDBI)

Industrial Development Bank of India (IDBI) was established in 1964, as a subsidiary of the Reserve Bank of India by an Act of the Parliament and was made a wholly owned government of India undertaking in 1975. It was established with the main objective of serving as an apex financial institution to co-ordinate the functioning of all other financial institutions. Planning, promoting and developing industries to fill the gaps in the industrial structure of the country, providing technical and administrative assistance for promotion or expansion of industry, undertaking market and investment research surveys in connection with the development of the industry and to provide finance, keeping in view the national priorities irrespective of the financial attractiveness of projects are its other objectives. IDBI finances industries directly and also supports State Financial Corporations and State Industrial Development Corporations by providing refinance and through the bill rediscounting scheme.

Life Insurance Corporation of India (LIC)

The LIC was established in 1956, by amalgamation and nationalization of 245 private insurance companies by an enactment of the parliament. The main business of the LIC is providing life insurance and it has a monopoly in this business. The LIC Act permits it to invest up to 10% of the investible funds in the private sector. It provides finance by participating in a consortium with other institutions and does not undertake independent appraisal of projects.

General Insurance Corporation of India (GIC)

The GIC was established in 1974, with the nationalization of the general insurance business in the country. It can invest up to 30% of the fresh accrual of funds in the private sector. Like the LIC, the GIC also provides finance by participating in consortium based on the appraisal made by the other financial institutions, but does not finance independently.

Unit Trust of India (UTI)

The UTI was founded in 1964, under the Unit Trust of India Act, 1963. Initially 50% of the capital of the trust was contributed by the RBI while the rest was brought in by the State Bank of India and its associates, LIC, GIC, and other financial institutions. In 1974, the holding of the RBI was transferred to the IDBI making the UTI an associate of the IDBI. The primary objective of the UTI is to mobilize the savings in the country and channelize them into productive corporate investments. UTI provides assistance by underwriting shares and debentures, subscription to public and rights issues of shares and debentures, subscription to private placement, and bridge finance.

Industrial Investment Bank of India (IIBI)

The IIBI first came into existence as a central government corporation with the name Industrial Reconstruction Corporation of India in 1971. Its basic objective was to finance the reconstruction and rehabilitation of sick and closed industrial units. Its name was changed to Industrial Reconstruction Bank of India and it was made the principal credit and reconstruction agency in the country in 1985, through the IRBI Act, 1984. The bank started co-ordinating similar work of other institutions and banks, preparing schemes for reconstruction by restructuring the liabilities, appraising schemes of mergers and amalgamation of sick companies and providing financial assistance for modernization, expansion, diversification, and technological upgradation of sick units.

In March 1997, in line with the ongoing policies of financial and economic reforms, IRBI was converted into a full fledged Development Financial Institution. It was renamed as Industrial Investment Bank of India Limited and was incorporated as a company under the Companies Act, 1956. Its entire equity is currently being held by the Government of India. Its activities include providing finance for the establishment of new industrial projects as well as for expansion, diversification and modernization of existing industrial enterprises. It provides financial assistance in the form of term loans, subscription to debentures/equity shares and deferred payment guarantees. The IIBI is now active in Merchant Banking also and its services include, structuring of suitable instruments for public/rights issues, preparation of prospectus/offer documents and lead managing public issues. It also offers its services for debt syndication, and the entire package of services for mergers and acquisitions.

The Export-Import Bank of India (EXIM Bank)

The EXIM Bank was set up in 1982, to co-ordinate the activities of the various institutions engaged in trade finance. It helps Indian exporters in extending credit to their overseas customers by providing long-term finance to them. It also provides assistance to banks in extending credit for exports and export-linked imports. It also provides advisory services and information to exporters.

State Level Institutions

State Financial Corporations (SFCs)

At the beginning of the fifties, the government found that for achieving rapid industrialization, separate institutions should be set up to cater exclusively to the needs of the small and medium sector. Therefore, the SFCs Act was passed by the Parliament in 1951, to enable the state governments establish SFCs. The basic objective for which the SFCs were set up was to provide financial assistance to small and medium scale industries and establish industrial estates. The SFCs provide finance in the form of term loans, by underwriting issues of shares and debentures, by subscribing to debentures and standing guarantee for loans raised from other institutions and from the general public.

State Industrial Development Corporations (SIDCs)

The State Industrial Development Corporations have been set up to facilitate rapid industrial growth in the respective states. In addition to providing finance, the SIDCs identify and sponsor projects in the joint sector with the participation of private entrepreneurs.

Forms of Assistance

The schemes of assistance of the financial institutions can be broadly classified into direct assistance and indirect assistance. In the direct forms of assistance, the institutions provide the customers with funds. In indirect forms, the institutions support them by providing guarantees on their behalf.

Direct Assistance

The direct forms of assistance is of two types: fund based and non-fund based forms of assistance. In fund based assistance, the institution extends loans by paying cash. In non-fund based forms of assistance, the institutions stand guarantee on behalf of their constituent.

Fund Based Assistance

The most frequent form of assistance provided by the institutions is term loans. Term loans are provided in both rupees and foreign currencies. Apart from term loans, finance is also provided by subscription to the equity shares of the company and by augmenting the promoters' contribution to the project through seed capital assistance.

Rupee Term Loans

Rupee term loans are extended for the purchase of fixed assets such as site, construction and purchase of factory and other buildings, purchase of plant and machinery, technical know-how, to finance the preliminary and pre-operative expenses and margin money for working capital. The repayment period is generally five to fifteen years with an initial moratorium of six months to two years.

Foreign Currency Term Loans

Institutions extend term loans in foreign currency to fund the acquisition of fixed assets such as plant and machinery and technical know-how from foreign suppliers. The categories of machinery and equipment financed, and the extent of finance vary slightly from one institution to the other. The repayment period is generally two to seven years with an initial period of moratorium which may be six months to two years. The interest rate at present is around 12.50%. The installments are generally quarterly. As already explained, the loan account is maintained in the foreign currency in which the loan is allowed and the principal and interest are converted into rupees at the time of payment or at the time of repayment.

To secure the loans, the institutions ask for a first charge on the assets financed by them and also on all other fixed assets of the borrower. If more than one institution is involved in providing finance, either one of the institutions will settle for a second charge on the assets not financed by it, or all the institutions may have a pari passu charge on the assets.

Subscription to Equity Shares

This form of assistance is provided only when the institutions feel that the project, though worthwhile, cannot take any more debt and is often a very small part of the project cost.

Seed Capital Assistance

Seed Capital Assistance schemes of all the institutions are operated through the State Finance Corporations and the State Industrial Development Corporations. The borrowers have to submit their applications through their respective SFC or SIDC. This form of assistance carries interest at as low as one percent and will be payable in very easy terms depending on the profitability of the project. The initial period of moratorium is up to five years. The other important features of this scheme are:

i. The maximum amount of loan is the lower of 10% of the project cost or Rs.15 lakhs or the contribution brought in by the promoter.

ii. The Debt Equity ratio should be at least 2:1 for medium scale projects and 3:1 for SSI units.

iii. Only new entrepreneurs who are technically and/or professionally qualified are eligible for finance under this scheme.

Risk Capital Assistance

Risk capital assistance is almost the same as the seed capital assistance scheme offered by the IDBI and is offered by the IFCI. The IFCI runs this scheme through a society formed under the Societies Registration Act, 1860, with objective of providing finance to entrepreneurs on soft terms. Assistance is provided to first generation entrepreneurs, particularly qualified technologists, technocrats and professionals. The loans under this scheme are generally interest free and range between Rs.15 lakh and Rs.40 lakh depending on the number of promoters and the cost of the project.

Indirect Assistance

Deferred Payment Guarantee

Financial Institutions stand guarantee on behalf of their clients who avail the deferred credit facility from their equipment suppliers and charge guarantee commission for the same. Guarantee is provided for the purchase of both indigenous and imported equipment. The pre-condition for providing guarantee for the purchase of imported machinery is that the client should be in possession of an import license for the same. Guarantee is also provided for borrowing from scheduled banks, co-operative banks and others.

Guarantee for Foreign Currency Loans

It has been already mentioned that foreign currency term loans can be raised directly from overseas banks and other institutions. In such cases the financial institutions stand guarantee to the borrower, which is especially needed if the borrower is not known in the overseas market or has a not so high credit standing.

Underwriting

Financial Institutions frequently used to underwrite the public issues of their clients where a part of the project cost is financed by them through term loans. However, this activity has come down substantially since the SEBI made underwriting optional.

Special Schemes

The forms of assistance that we have discussed so far, particularly those relating to direct assistance have been very generalized. Financial Institutions have formulated various schemes under each of these forms to suit the different needs of the borrowers. Some of the important schemes which have been in wide use by the borrowers are as follows:

Bill Rediscounting Scheme

The bill rediscounting scheme was introduced by the IDBI in 1965, to help the domestic producers and dealers of capital goods push their sales by offering deferred payment facility to their customers. Under this scheme, deferred payment facility is available for purchase of machinery to all forms of businesses such as proprietary concerns, partnerships, private and public companies, cooperative societies and corporations. The period of credit offered generally varies from two to five years.

The mechanism of the scheme may be described as follows:

i. The buyer locates the manufacturer/dealer/agent/distributor from whom he has to purchase the necessary machinery or equipment and negotiates with him that the purchase will be made under the IDBI bill rediscounting scheme.

ii. The buyer obtains the credit facilities or acceptance limits for the necessary amount from his bankers.

iii. A down payment of 15% of the invoice amount is made by the buyer to the seller.

iv. The buyer draws bills of exchange on his banker for the deferred payments to be made according to the schedule of payments negotiated with the seller and the banker accepts the bills. Alternatively, the bank may issue a separate guarantee.

v. The seller discounts the bills of exchange with his banker and gets his payment.

vi. The seller's banker rediscounts the bills of exchange with the IDBI and gets payment.

vii. Three days before the due date of the bills, the IDBI sells the bills to the seller's bank.

viii. The seller's bank sends the bills to the buyer's bank and gets payment.

In sum, the credit is provided by the IDBI and the credit risk is borne by the buyer's bank.

Suppliers' Line of Credit

This scheme has been floated by the ICICI to enable domestic manufacturers and dealers increase their sales by offering deferred credit to their buyers. The mechanism of this scheme is also quite similar to the bill rediscounting scheme of the IDBI. In this scheme also the buyer is supposed to have or obtain credit facilities from his bank and the credit risk is borne by the buyer's bank while credit is provided by the ICICI. The major difference between the schemes is that while the IDBI scheme involves the seller's bank, in this scheme, payments are made directly to the seller. The procedure involved in this scheme is as follows:

i. The buyer identifies the equipment supplier and negotiates with him for making payments under the suppliers' line of credit scheme of the ICICI.

ii. The buyer ensures that he has adequate bill discounting or acceptance limits with his bank.

iii. The buyer makes a down payment of 10 to 20 percent of the invoice amount and draws bills of exchange on his bank according to the schedule of payment accepted by the seller and gets the bills accepted by his bank. The advance payment is necessary because the ICICI finances only 80 to 90 percent of the cost of the machinery.

iv. The seller discounts the bills with the ICICI and gets payment. The ICICI opens a non revolving letter of credit in favor of the seller. The LC has a period of validity of two years, but the seller has to obtain the permission of the ICICI each time he wants to avail the scheme

v. On maturity, the ICICI sends the bills to the buyer's bank and gets payment.

Equipment Finance Scheme

This scheme is offered by two institutions – IDBI and IFCI, under which they provide assistance to existing units to acquire indigenous/imported equipment. The salient features of the scheme are:

i. The concern seeking finance must be a private or public limited company or a co-operative society.

ii. Finance is available for the purchase of capital goods, balancing equipment, inspecting equipment and tools, dies, toolings and components, and other imports cleared under the Technical Development Fund Scheme.

iii. Units seeking finance for purchase of imported equipment should have obtained Open General License for the import or should have got it cleared under the Technical Development Fund Scheme.

iv. For imported machinery, the amount of loan is calculated on the foreign exchange cost and rupee costs such as customs duty and transportation have to be borne by the borrower completely. The borrower is expected to bear at least 25% of the cost of the equipment.

v. The period of repayment is generally two to seven years.

Lending Norms and Policies of the Institutions

Until recently, the institutions were lending only to those industries that are not mentioned in the negative list. Now, there is a marked shift in their policy and they are willing to finance any industry if it is profitable and has the necessary repaying capacity. Also, institutions were required to finance only through a consortium beyond a limit and were not allowed to lend independently. This has also changed and now they can lend on their own up to any amount. The latest change in the policies of the institutions is their shift towards working capital advances. To compete effectively with the commercial banks, the development finance institutions are adopting the concept of 'Universal Banking' and are entering into short-term financing as well. Some institutions have their own banking subsidiaries.

Debt-Equity Ratio

The institutions generally ask for a debt equity ratio of 1.5:1. However, their definition of equity and debt is somewhat different from that used in general parlance. Equity is the sum of: (i) Ordinary share capital, irredeemable preference share capital, redeemable preference share capital, it is redeemable after three years, and share premium. (ii) Reserves and Surplus reduced by accumulated losses. (iii) Amount of central or state subsidy. (iv) Long-term interest free unsecured loans from the government or government agencies. (v) Long-term interest free unsecured loans from the promoters provided such loans are subordinated to the loans from the financial institutions.

Debt includes: (i) Redeemable preference shares redeemable within three years. (ii) Convertible and non-convertible debentures excepting that part of the convertible debentures that is compulsorily to be converted into equity. (iii) Long-term interest bearing loans from government or government agencies, promoters, etc. (iv) Deferred payments not falling due within 12 months. (v) Long-term loans from financial institutions including the loan that is under consideration.

The debt equity norm of 1.5:1 is followed only generally and is not a hard and fast rule. It is relaxed in certain cases keeping in view the following criteria:

i. The capital intensity of the project
ii. Location of the project
iii. The background of the promoters
iv. Nature of the industry
v. The size of the project
vi. Profitability potential and debt service capability
vii. Risk attendant on the project.

Promoter's Contribution

In order to make sure that the promoter will manage the project well, the institutions insist that the promoter should have a substantial stake in the project. The promoter is, therefore, asked to contribute a certain part of the total cost of the project. Earlier, the promoter's contribution used to be stipulated between 12.5% and 25%, keeping in view the same factors that have been mentioned in debt-equity ratio. Now, however, the institutions are asking for a contribution of 22.5% excepting in the case of small projects funded by the SIDBI for which it is fixing the contribution between 17.5% and 22.5%.

Project appraisal by the Financial Institutions

Financial Institutions take holistic view of projects during their appraisal and try to satisfy themselves whether the deficiencies in one area are covered up by the strengths in the other. They point out the weak points to the promoter and also suggest remedial measures. The appraisal of the institution hinges on the following aspects:

i. Market
ii. Technical
iii. Financial
iv. Economic
v. Management.

We have already discussed the analysis of the market, technical aspects of a project in the earlier chapters. The institutions basically study whether the analysis has been performed reasonably and honestly. In addition, they also study the project from the economic or social cost-benefit angle and try to evaluate the management. This section gives the reader a brief overview of all the aspects of appraisal by the institutions.

Market Appraisal

The market appraisal is done basically to check whether the demand and selling price projections made by the borrower are reliable. The appraisal includes ascertaining the current demand for the product, the demand supply gap, whether the demand is sustainable in the long run and the likely changes in price and volume in the future. The appraiser tries to cross check the projections made by the borrower with information from his own sources. Where the projections are based on a study or survey carried out by the borrower, the appraiser tries to gauge the quality of the study or survey.

Technical Appraisal

Technical appraisal involves a critical study of the following aspects:

- Location
- Land and site development
- Buildings
- Technology and manufacturing process

- Foreign collaboration
- Installed capacity
- Plant and machinery
- Raw materials
- Schedule of implementation
- Manpower requirement.
- The analysis is performed by professionals experienced in the relevant fields.

Financial Appraisal

The financial analyst critically examines the following to form a reasonable opinion of the financial desirability of the project:

i. Cost of the project

ii. Means of finance

iii. Projected working results.

The estimated cost of the project is analyzed to ensure that:

- the costs are based on current quotations from suppliers,
- adequate provision has been made for escalation of costs,
- there is no over or under estimation of the costs.
- While analyzing the means of financing, the institutions generally look for:
- a debt equity ratio of less than 1.5:1,
- a substantial contribution from the promoter, which is generally 22.5%,
- compliance with listing requirements of the stock exchanges on which listing is proposed.

The appraisal of working results comprises checking whether:

- the segregation of the expenses into fixed and variable and the computation of the break even point,
- the break even level of capacity utilization is reached and ensuring that the BEP is reached sufficiently early,
- the projections for expenses have been made reasonably,
- the project provides a reasonable rate of return. The institutions generally find a minimum IRR of 15%, Return on Investment of 20-25% and debt service coverage ratio of 1.5 to 2 as the minimum desirable.

Economic Appraisal

Economic appraisal is intended to verify the impact or contribution of the project on the economy as a whole and particularly on specific sectors which demand immediate attention. The institutions finance those projects whose contribution to the economy is in conformity with the national priorities. They consider the following factors:

- Economic rate of return calculated in accordance with the Partial Little-Mirrlees approach,
- The effective rate of protection,
- The domestic resource cost.
- All these concepts will be discussed in the chapter on social cost benefit analysis.

Managerial Appraisal

The institutions try to judge the capacity and commitment of the core promoters and also the top management, if it is manned by people other than the promoters, as the success of any venture, however, attractive it may be financially, depends on the people, who manage it. In other words, the managerial, entrepreneural and personal attributes of the promoter are evaluated. The following factors are generally considered:

Capacity

- Ability to plan clearly and set realistic goals and objectives,
- Ability to organize things,
- Ability to select the right kind of people and lead them effectively,
- Ability to negotiate with different kinds of people under different conditions,
- Problem solving ability,
- Communication and human relations skills,
- Financial strength,
- Perception of market opportunities.

Commitment

- Willingness to bring in more capital into the project if the need arises,
- Ability and willingness to work hard and to take new challenges,
- Adaptation to different circumstances,
- Honesty and sincerity.

In performing managerial appraisal, institutions generally rely on the performance of the promoter in other ventures managed by him. In the absence of any, they try to judge him depending on the way the proposed project is being handled, the progress achieved so far, and the impression gained by them in the course of interaction with him.

Annexure II

Format of Application Form of All India Financial Institutions

Application for Financial Assistance

1. **APPLICATION** Date

D	M	Y

Rs. in lakh

For

Rupee Loan :

Foreign Currency Loan :

Underwriting – Equity :

– Preference Shares :

– Debentures :

Guarantee :

Others :
(Please specify)

1.0 GENERAL INFORMATION

1.01 Name & Address of Applicant Company

1.02 Telephone/Telex/FAX Nos.

Tel	
Telex	
FAX	

1.03 Constitution

(Tick Appropriate Box)

Public Ltd. Co.	
Pvt. Ltd. Co.	
Others	

1.04 Name of Business House/Group

1.05 Details of other companies in the group (for the last 3 years)

GROUP COMPANIES								(Rs. in lakh)
Name	Line of Business	Equity	Reserves	Loans	Turnover	FBIDT *	PBT *	PAT *

* PBIDT : Profit Before Interest, Depreciation and Tax

PBT : Profit Before Tax

PAT : Profit After Tax

1.06 Type of Company

– FERA	YES	NO
– MRTP	YES	NO

2. PARTICULARS OF APPLICANT

2.01 Date of Incorporation

DD	MM	YY

2.02 Is the company a subsidiary or promoted by a corporate body?

If yes, please give particulars of holding company or promoters as follows:

– Name of Holding/Promoter Company ____________

– Activity of Holding/Promoter Company ____________

– Other Subsidiaries of holding Company (Please give details including percentage holdings)

Copies of audited financial reports for the last 3 years for the holding/promoter company should be enclosed.

2.03 Does the company have subsidiaries of its own? YES / NO

If yes, please give particulars of subsidiaries including percentage holdings. Copies of audited financial reports for last 3 years should be enclosed.

2.04 List of promoters of the company

Name of Promoter/s	Age	Address	Qualifications	Professional Experience

2.05 List of directors (Please indicate Chairman, MD, Wholetime Director)

Name	Age	Qualifications	Experience	
			No. of Years	Professional

2.06 List of major shareholders (over 1% share holding)

Name	% holding

3. PARTICULARS OF THE INDUSTRIAL CONCERN

(Many of the questions in this section are applicable to existing concerns only)

3.01 Give a brief history of the concern including any changes in name, business, management, etc. Also indicate any mergers, reorganisation etc. which took place in the past.

3.02 Provide a list of subsidiaries, showing percentage of holding in each and nature of their business.

3.03 Give particulars of holding company (in the pro-forma given below), together with a self-explanatory note on the existing activities and its subsidiaries.

Enclose: Copies of audited balance sheets and profit and loss accounts for last five years of the holding company.

Name of the holding company	Names of subsidiary companies	Paid-up capital of subsidiary Companies as on		% held by holding company	
		Equity	Preference	Equity	Preference

3.04 Give names, age and address of directors, including wholetime directors, their qualifications, past experience and business and industrial background and existing and proposed shareholdings in the company.

Enclose: Certified copies of

i. agreement with the Managing Director/Whole-time Director/Chief Executive

ii. approval of the Central Government for the appointment(s).

3.05 Enclose certified copies of audited balance sheets and profit and loss accounts for the last five years together with pro-forma balance sheet and profit and loss account of as recent date as possible. Give brief explanations for year to year variations in production, sales, stocks, profits, etc. Also give a note on the contingent liabilities, if any, shown in the balance sheet.

3.06 In case the assets have been revalued or written up at any time during the existence of the company, furnish full details of such revaluation together with the reasons therefor.

3.07 Provide a list of existing key technical and executive staff giving their names, age, qualifications, salaries, length of service with the Company and previous experience. Furnish number of supervisory, skilled, semi-skilled and unskilled personnel employed in each of the existing plants.

Enclose: Organisation Chart showing the lines of authority.

3.08 Give particulars of existing long-term and short-term borrowings as set out in Forms II and III.

3.09 Provide a list of shareholders owning or controlling 5% or more of equity shares, indicating the amount owned and business relationship, if any, with the company. In case of preference shareholders, give a list of ten largest shareholders. Also give the number of equity shareholders and preference shareholders. Furnish distribution of shareholdings in Form IV.

3.10 Give a note on the Company's tax status, viz., the years up to which the company has been assessed for income tax, the estimated unassessed liability, the concessions available and the basis on which provision for tax has been made. Provide details of unclaimed tax benefits, if any.

3.11 Indicate whether the Company is regular in crediting its contribution and the contribution of its employees to the Employees' Provident Fund.

Please enclose: Provident Fund Dues Clearance Certificate from the Provident Fund authorities.

3.12 Describe manufacturing facilities separately at each plant including –

a. Location;

b. Date(s) of installation and major remodelling;

c. Estimated annual capacity of major plant sections and major items of equipment (design capacity and normal capacity with basis for these estimates); and

d. Specifications of products manufactured.

3.13 Furnish figures of licensed capacity, installed capacity, production and sales (quantities and value) net of excise duty of each major product/product group during the last five years. Give reasons for under utilisation of capacity and significant variations in production and sales, if any.

3.14 Describe the locational advantage of the existing plant with respect to supply of raw material, power, water, fuel and labour as also with respect to facilities for transportation, effluent disposal and market.

3.15 Indicate the existing requirement of various utilities and services and the arrangements for their supply.

3.16 Give destination, physical volume and proceeds of export sales by main product lines in each of the last five years. Also detail the export incentives available to the concern.

3.17 Give details of insurance carried on fixed assets, inventories, etc. showing basis of insurance, names of insurers and types of risks covered.

3.18 Give details of any pending litigation either by or against the company.

3.19 Furnish a detailed note on the R&D activities of the company including information on the nature of R&D activities, total amount of capital expenditure incurred, annual budget, number of scientists/technical personnel employed, list of new products/processes developed and the extent of their commercial exploitation.

3.20 Give a brief note on preventive maintenance adopted by the company indicating the organizational set-up.

3.21 Whether the company's shares are listed; if so the name of the stock exchange(s).

4.01 Particulars of outstanding term loans from Banks/Financial Institutions/Others
(Please attach a sheet in Format specified below)

Sl. No.	Institution	Purpose of Assistance	Outstandings		Sanction date	Instalment details	Terms		
			Foreign currency amount * (Re. equivalent)	Rupee Loans			Maturity	Interest	Security

*Indicate foreign currency and exchange rate.

4.02 Particulars of Debentures

Sl. No.	Type *	Nominal Value	Year of Issue	Terms				Terms of conversion if any	Purpose for which debentures were redeemed
				Interest	Year of Redemption	Terms of Redemption	Security		

*convertible, non-convertible, yearly convertible, etc.

4.03 Details of Short-term borrowings

4.04 Details of Public Issues (For last five years)

Sl. No.	Type of Issue	Nominal Value per share	Date	Paid-up Capital at the time of issue	Size of issue	Terms of issue	Response to issue (Amount of subscription)
1.	Equity Issue						
2.	Rights Issue						
3.	Pref. Shares						
4.	Debentures – Convertible – Non-convertible						
5.	Bonus Issues						
6.	Stock Dividend						
7.	Others						

4.05 Shareholding Pattern

Shareholder *	No. of shares	Amount (Rs.)	Percentage

* By categories like promoters, institutions, public, etc.

4.06 Dividend Record
(For last five years)

Years	Paid-up Capital	Dividend Amount	Percentage	Pay/out ratio

4.07. Market Price of the shares (last 3 years)

(Rs. in lakh)

Years	Financial year end market price	Market Price during the year	
		High	Low

4.08 Financial Performance/Details

Please attach the following:

- Audited financial statements for the last five years.
- Statement of current working and proforma balance sheet as on a recent date.
- Details of defaults, if any, in repayment of loans.
- Details of rescheduling if any, of loans.
- List of charges already created and effective on various assets of the company.

  (For the last 5 years) (Rs. in lakh)
- Deferred receivables instalments due in one year.
- Long-term loans and deferred payments maturing in one year.
- Repayments due within one year (in respect of other borrowings or public deposits)
- Leased assets, if any. Please also give a note on accounting of leasing transactions.
- Bills discounted/purchased.

5. PROJECT

5.01 Describe in detail the project for which financial assistance is required, indicating whether it relates to expansion, modernisation or setting up of a new plant.
Enclose: Copy of project report/feasibility report.

A. Capacity

5.02. Furnish details of installed capacity and production as below:
(Capacity is arrived at on the basis of __________ days' working on ________shift basis).

Product	Present installed capacity	Maximum production achieved	Proposed installed capacity	Maximum production envisaged	
i.					
ii.					
iii.					
iv.					

5.03 Give specifications of major products and by-products including size and weight and, where appropriate, chemical and physical properties as also their industrial uses.

B. Process

5.04 Explain in detail, the technical process proposed to be employed. Please indicate the advantages/disadvantages of the alternative processes and indicate reasons for adopting/choosing the particular process.

Enclose: Copy of process flow chart with material balance, utilities and process parameters.

5.05 Has the proposed process ever been tried in the country? If so, with what results.

C. Technical Arrangements

5.06 Explain the technical arrangements made/proposed for the implementation of the project.

5.07 In case any collaboration is involved, furnish a brief write-up on the collaborator company indicating its activities, size and turnover particulars of existing plants, other projects in India and abroad set up with same collaboration, etc.

Enclose:

i. copies of published brochures highlighting the activities of the collaborator and balance sheets for last three years;

ii. copy of collaboration agreement;

iii. copy of Government approval for the collaboration;

iv. copy of Government approval for availing of the services of foreign technicians.

5.08 Furnish the particulars of consultants as below:

a. name of the consultants (indicate whether Indian or foreign);

b. scope of work assigned to them;

c. fees payable and the manner in which payable;

d. brief particulars of the consultant including the organizational set up, bio-data of senior personnel, names of directors/partners, particulars of work done in the past and work on hand.

Enclose:

i. copies of published material on consultants;

ii. copy of agreement with consultants;

iii. copy of Government approval in case of foreign consultants.

D. Management

5.09 Describe proposed arrangements for executive management of the concern both during the construction period and for regular operations thereafter.

5.10 a. Give particulars of proposed key technical, administrative and accounting personnel.

b. Give a note on the proposed cost and budgetary control system and management reporting system.

E. Location and Land

5.11 Indicate location of the plant, requirements of land for the project and the arrangements made therefore. Enumerate the locational advantages.

5.12 Give the following particulars in respect of the land acquired/proposed to be acquired for the project -

a. Area and cost

b. Basis of valuation

c. Mode of payment

d. When purchased/taken on lease

e. Previous owners and their relationship, if any, to the promoters/directors

f. Is it industrial land? If not, has it been converted for industrial use?

g. Type of soil and load bearing capacity

h. Water table

Enclose:

i. copy of soil test report;

ii. copy of the Government order converting the land into industrial land, if applicable;

iii. location map;

iv. site plan showing the contour lines, the internal roads, power receiving station, railway siding, tube wells, etc.

F. Buildings

5.13 Explain the arrangements made/proposed for constructing the buildings. Furnish particulars of buildings as per Annex 1.

Enclose: Masterplan showing location of buildings and roads, power receiving station, railway siding, tube wells, etc.

5.14 Give the following particulars of architects :-

a. Name of architect/firm.

b. Scope of work.

c. Fees payable and manner in which payable.

d. Past experience of the architects.

e. Bio-data of senior personnel in architects' firm.

G. Plant and Machinery

5.15 Explain the basis of selection of equipment for the project. Furnish list of imported and indigenous plant and machinery acquired/to be acquired for the project, along with detailed specifications etc., as per Annex 2 and 3.

Enclose: Layout of the plant and machinery.

H. Raw Materials

5.16 Provide information as per Annex 4 indicating the requirement of the raw materials, components, chemicals, etc.

5.17 Are there any price or distribution controls on any of the items listed above? If so, give details.

5.18 Give a detailed note on the arrangements made/proposed for obtaining the raw materials/ chemicals.

I. Utilities

5.19 Power: Furnish the following details:-

a. Source of power and supply voltage
   - purchased
   - own generation
   - standby arrangements

b. Maximum demand

c. Connected load

d. Peak hour requirements

e. Contracted load

f. Power tariff

g. Cost of power per annum at maximum capacity utilisation (give calculations)

Enclose:

i. copy of letter of sanction for power;

ii. copy of agreement with Electricity Board;

iii. a note on the availability of power in the region.

5.20 Water: Give details on -

a. Requirement of water, separately for
   - circulating
   - make up
   - process
   - boiler feed
   - drinking
   - cooling.

b. Sources of water arrangements proposed and water charges payable

c. Capacities of the tanks, reservoirs

d. Describe water treatment arrangements proposed.

5.21 Steam: Detail the following -

a. Steam requirements and the steam balance

b. Capacity and type of the boiler with detailed specifications.

5.22 Compressed air, fuel etc: Provide information

a. Requirement

b. Sources

c. Arrangements proposed.

5.23 Transport: Furnish information on –

Arrangements proposed for carrying raw materials and finished goods; provision for own trucks, railway siding, etc. and arrangements with private truck operators indicating rates, subsidy, if any, available, etc.

J. Environment:

5.24 Furnish details of the nature of atmospheric, soil and water pollution likely to be created by the project and the measures proposed for control of pollution. Indicate whether necessary permissions for the disposal of effluents have been obtained.

Enclose: Copy of approval from concerned authorities for the proposed arrangements including environmental clearances.

K. Manpower:

5.25 Give estimates of total requirements and availability of skilled and unskilled labour and plans for training of personnel. Briefly describe the manpower development programme. Give category-wise classification of total personnel requirements.

L. Quarters and Labor Housing:

5.26 Furnish existing and proposed arrangements for housing the staff and workers.

M. Schedule of Implementation

5.27 a. Describe how the design engineering, erection, installation and commissioning of the project will be carried out. Also indicate the progress made so far in the implementation of the project.

b. Furnish the schedule of implementation as follows:

	Commencement (Month and Year)	Completion (Month and Year)
i.	Acquisition of land	
ii.	Development of land	
iii.	Civil works –	
	• factory building	
	• machinery foundation	
	• auxiliary building	
	• administrative buildings	
	• miscellaneous buildings	
iv.	Plant and machinery	
	Imported - placement of order	
	- delivery of site	
	Indigenous - placement of order	
	- delivery at site	
v.	Arrangements for power	
vi.	Arrangements for water	
vii.	Erection of equipment	
viii.	Commissioning	
ix.	Procurement of raw material and chemicals	
x.	Training of personnel	
xi.	Trial runs	
xii.	Commercial production	
	Enclose: PERT chart	

N. Other Projects of the Concern:

5.28 Give details of any other new/expansion/modernisation etc. projects which are under implementation or which the company/promoters propose to implement, giving the estimated cost, means of financing and the present status.

6.1 **Cost of Project**

Furnish estimate of cost of project under following heads (details may be furnished as per Annex 5). Also provide the basis of cost estimate (such as quotation, orders placed, etc) bringing cut the built-in provisions for cost escalation, if any.

Sl. No.	Item	Foreign Exchange (Re. equiv)	Re. Amount	Total
1.	Land & site development			
2.	Buildings			
3.	Plant and machinery			
	– imported			
	– indigenous			
4.	Technical know-how fees			
5.	Miscellaneous fixed assets			
6.	Preliminary and preoperative expenses			
7.	Provision for contingencies			
8.	Margin money for working capital			
	TOTAL			

Give estimates of contingency provisions as in Annex 6 and margin money for working capital as in Annex 7.

6.2 **Means of Financing**

(Rs. in lakh)

Sl. No.	Item	Foreign Exchange (Re. Equiv)	Re. Amount	Total
1.	Equity – Promoters			
	– Fin. Inst.			
	– Others			
	– Public			
	Pref. shares			
2.	Subsidy, if any			
3.	Term loans – SCICI			
	– Other F.I.S.			
	– Banks			
4.	Debentures			
5.	Unsecured loans and deposits			
6.	Deferred payments			
7.	Internal accruals			
8.	Bank borrowings			
	– Working capital			
9.	Others			
	TOTAL			

(Give details of the means of financing envisaged and the proposals for raising share capital and losses in * Annex 8, and Annex 9 respectively).

6.2.1 In case internal accruals are taken as a source of finance, explain the basis of estimation of internal accruals by means of a suitable statement.

6.2.2 Briefly describe the arrangements so far made for raising the finance and the proposed arrangements.

(Enclose: Copies of letters sanctioning assistance)

6.2.3 Indicate sources of foreign exchange and arrangements, if any, made for obtaining foreign exchange from which expenditure already incurred has been financed.

6.2.4 Indicate sources.

6.2.5 List of persons/firms who would be contributing to the promoters share of the capital and the respective amounts.

6.2.6 Give details of security proposed to be offered for loan/and/or guarantee for deferred payments on plant and machinery or guarantee for foreign currency loans.

6.2.7 In case it is proposed to offer a bank guarantee instead of mortgage of fixed assets, specify the name of the bank and enclose copy of letter from the bank indicating its willingness to provide the guarantee.

7. MARKETING

(Enclose: Copy of market survey report, if any, conducted by the company or independent consultants)

7.01 Give brief notes on the products, their major uses, scope of the market, possible competition from substitute products, etc. Indicate the special features (regarding quality, price, etc.) of the product which would result in consumer preference in relation to competitive products.

7.02 Provide detailed notes on the existing and future demand and supply of the products proposed to be manufactured.

7.03 Give an assessment of likely competition in the future and indicate any special features of the project which may enable it to meet the competition.

7.04 Provide information regarding export possibilities and the nature of competition to be faced in foreign markets; also give comparative data on the manufacturing costs and prices (domestic as well as foreign). Also provide data on the major expert markets.

7.05 Indicate whether sales are to be made directly by the company or through distributors or selling agents. If the sales are proposed to be made directly, provide information on the nature of the proposed selling organization. Give particulars of proposed selling arrangements both in India and abroad and commission proposed to be paid. Give a brief note on the selling agent's organization.

Enclose: Copy of the agreement with selling agent, if any.

7.06 In case the company proposes to have any sole selling agency for any of its products, furnish the following particulars:-

a. Name of the sole agent.

b. Remuneration.

c. Special advantages/reasons for the appointment of sole selling agent.

d. Relationship of the directors/promoters of the company with the directors/partners of the sole selling agent.

e. Past experience in handling the same/similar products and financial position of the sole selling agent.

f. Storage facilities and facilities for after-sales service available with the sole selling agents and the adequacy of the facilities.

7.07 Give details regarding the trend in prices during the last five years. If the prices are controlled by the Government or on a voluntary basis, indicate the basis on which prices are fixed.

8. PROFITABILITY AND CASH FLOW

8.01 Give estimates of costs of production and working results for the first ten years of operation as per Annex 10, and 11. Basis for all the calculations should be shown separately.

Note: In case of expansion/diversification of existing companies, two sets of profitability statements may be prepared – (1) for the project, and (2) for the existing operations only.

8.02 Based on the estimates of working results in Annex 11 provide a cash flow statement for the company as a whole, for ten operating years of the project in Annexure 12.

8.03 From the foregoing statements, provide a projected balance sheet for ten operating years for the company as a whole, as indicated in Annex 13.

8.04 Give the break even and sensitivity analysis for the project.

9. ECONOMIC CONSIDERATIONS

9.01 Give prices of competing import/export products giving a break-up as FOB, CIF, landed cost (including import duty) and selling price.

9.02 Provide detailed explanation for differences in selling prices of the products and these of imported goods with quantitative data on differences in cost of production (such as scale of operation, differences in costs of inputs and various local duties and taxes).

9.03 Give the international CIF/FOB prices of all inputs which can either be imported/exported.

9.04 Give brief write up on the economic benefits to the country in general and the region in particular, on account of the proposed project.

9.05 How far does the unit contribute to the establishment of ancillary industries in the region?

10. GOVERNMENT CONSENTS

10.1 Indicate whether the various licences/consents required for the project, have been obtained from the respective authorities. Give details as follows:

		Whether required	Date of issue	Valid up to	Present status if not already obtained
a.	Letter of intent				
b.	Industrial licence				
c.	Capital goods clearance				
d.	Import licence				
e.	Foreign exchange permission				
f.	Approval of technical/financial collaboration				
g.	Consent of the Controller of Capital Issues				
h.	Any other (specify)				

Enclose: Copies of licences/consents, etc. received

10.2 Specify any special conditions attached to the licences/consents and the undertakings given by the company in connection with them.

11. DECLARATION

We hereby declare that the information given herein before and the statements and other papers enclosed are, to the best of our knowledge and belief, true and correct in all particulars.

(Signature)

Name and Designation

Name of the concern

Station:

Date:

Ref Q.6.1

Annexure III

Estimated Cost of the Project

(Rs. in lakh)

		Cost already incurred up to			Cost to be incurred			Grand total
		Rupee cost	Rupee equivalent of foreign exchange cost	Total	Rupee cost	Rupee equivalent of foreign exchange cost	Total	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Land & site development							
a.	Cost including conveyance charges of ___ hectares of freehold land acquired/ proposed to be acquired @ Rs.___ per hectare.							
b.	Premium payable on leasehold land and conveyance charges (___ hectares @ Rs.____ per hectare).							
c.	Cost of levelling & development of ___ hectares of land at Rs.___ per hectare.							
d.	Cost of laying roads							
	i. approach road connecting the factory site to main road ___ in (type of construction) at Rs.___ per r.m.							
	ii. Internal roads for the factory ___ in ___ (type of construction) at Rs.___ per r.m.							
e.	Cost of fencing/ compound wall ___ of ___ (type of construction) at Rs.___ per r.m.							
2.	Buildings							
a.	Factory buildings for the main plant and equipment.							
b.	Factory buildings for auxiliary services like steam supply, water supply, laboratory, workshop, etc.							
c.	Administrative buildings							
d.	Godowns, ware houses and open yard facilities							
e.	Misc. non-factory buildings, like canteen, guest house, time office, excises house, etc.							
f.	Quarters for essential staff							
g.	Silos, tanks, wells, chest, basin, cisterns, hoppers, bins and other structures which are necessary for installation of plant & equipment and which may be constructed in RCC and such other structural civil engineering materials.							

		Cost already incurred up to			Cost to be incurred			Grand total
		Rupee cost	Rupee equivalent of foreign exchange cost	Total	Rupee cost	Rupee equivalent of foreign exchange cost	Total	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
h.	Garages							
i.	Cost of sewers, drainage, etc.							
j.	Civil engineering works not included above							
k.	Architects' fees							
3.	Plant & Machinery							
i.	Imported							
	a. FOB value							
	b. Shipping freight & insurance [__ % of (a)]							
	c. Import duty							
	d. Clearing loading, unloading & transport charges to factory site							
ii.	Indigenous							
	a. F.O.R. Cost							
	b. Sales tax (%) Octroi (%) and other taxes if any							
	c. Railway freight & Transport charges to site							
iii.	Machinery stores & spares							
iv.	Foundation & installation charges on imported and indigenous machinery							
4.	Technical know-how fees and expenses payable to technical collaborators							
5.	Mis. fixed assets							
	a. Furniture							
	b. Office machinery & equipment							
	c. Misc. tools & equipment including erection tools.							
	d. Cars, trucks, etc (___cars ; ___ trucks)							
	e. Railway siding							
	f. Equipment (including cost of installation) cabling etc for distribution of power and light for factory and colony.							
	g. Equipment and piping for supply & treatment of water (including cost of installation)							
	h. Equipment & piping for distribution of steam, air etc (which do not form part of the main plant & machinery)							
	I. Effluent collection treatment & disposal arrangement							
	m. Misc. fixed assets							

		Cost already incurred up to			Cost to be incurred			Grand total
		Rupee cost	Rupee equivalent of foreign exchange cost	Total	Rupee cost	Rupee equivalent of foreign exchange cost	Total	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
6.	Preliminary & pre-operative expenses							
	a. Brokerage & commission on capital (__%) of Rs. lakh)							
	b. Other capital issue expenses (legal, advertisement, printing, stationery, etc.)							
	c. Other preliminary expenses (company floatation & other initial expenses) [from ___ (date) to (date of commencement of commercial production)]							
	d. Establishment							
	e. Rent, rates & taxes							
	f. Travelling expenses							
	g. Misc. expenses							
	h. Interest & commitment charges on borrowings (give details of calculations)							
	i. Insurance during construction including erection insurance							
	j. mortgage, expenses (stamp duty, registration charges and other legal expenses) (__%) of loan of Rs. lakh.							
	k. Interest on deferred payment, if any							
	l. Start-up expenses							
7.	Provision for contingencies (details as per Annexure 6)							
8.	Margin money for working capital (as per Annexure 7)							
Total cost								

Ref Q.6.1

Annexure IV

Estimates of Contingency Provision

Item of cost	Considered		Reason for considering the cost as firm
	Firm (Rs. in lakh)	Non-firm (Rs. in lakh)	
1	2	3	4
1. Land			
2. Buildings			
3. Plant and Machinery			
– Imported			
– Indigenous			
– Stores & spares			
– Foundation and installation			
4. Technical know-how fees, etc.			
5. Miscellaneous fixed assets			
6. Preliminary and pre-operative expenses			
Total			

Contingency Provision and the basis for calculations

Ref Q.6.1

Annexure V

Margin Money for Working Capital

	Items	Normal year of operations		
		Expected level of holdings		No. of months requirements
i.	Indigenous raw materials components			
ii.	Imported raw materials components			
iii.	Consumable stores			
iv.	Wages and salaries			
v.	Cost of repairs and maintenance			
vi.	Sales expenses (other than salaries and wages on sales staff which should be included under (iv) above)			
vii.	Stock of finished goods at cost (to be held for the period between production and realisation of sale proceeds)			
viii.	Stock of goods in process (cost of production, excluding depreciation during the period taken for one complete cycle, i.e. from the raw material to the finished goods stage)			
ix.	Trade Receivables			
x.	Other items of working capital, if any (excise duty payable on one months' sale, deposits for utilities etc)			
	Less: Trade credits available on raw materials and consumables			
	NET WORKING CAPITAL*			

Note:

i. The information may be provided for the initial years until the unit reaches maximum capacity utilisation.

ii. The amounts given here should agree with the figures in the profitability statement and the cash flow statements.

* Advance payments, if any, from customers against orders should be deducted from the net working capital.

Ref Q. 8.2

Annexure VI

Means of Financing

(Rs. in lakh)

		In rupees	In rupees equivalent of foreign exchange	Total
		(1)	(2)	(3)
1.	Issue of ordinary shares (shares of nominal value of Rs. ___ per share)			
2.	Issue of preference share capital (___ % redeemable after ___ years but before ___ years)			
3.	Issue of debentures (State the type and terms)			
4.	Secured long-term and medium-term loans			
5.	Unsecured loans and deposits (indicate by means of footnote the source, nature of security, rate of interest, amortisation schedule, and any other special terms of loans already availed of)			
6.	Deferred payments (incl. interest) to machinery suppliers (less amts due up to start of production)			
7.	Capital subsidy from Central Govt			
8.	Internal cash accruals			
9.	Any other source (specify)			

Note: In case the total of col. 2 is less than the total foreign exchange shown in Annexure 5 indicate clearly the sources of meeting additional foreign exchange requirements.

Q 6.2

Annexure VII

Proposals for Raising Share Capital, Loans and Debentures

(Rs. in lakh)

	Subscription/ Underwriting of share capital		Rupee loans	Foreign currency loan	Debentures	Remarks *
	Equity	Pref.				
Subscription						
a. Indian promoters						
i. in cash						
ii. for consideration other than cash (specify)						
b. Foreign collaborator						
i. in cash						
ii. for consideration other than cash (specify)						
c. State Government						
d. State Industrial Development Corpn. (SIDC)						
e. Financial institutions and mutual funds (Please specify)						
Underwriting/Loans						
i. SCICI						
ii. IDBI						
iii. IFCI						
iv. ICICI						
v. LIC						
vi. UTI						
vii. SFC (specify)						
viii. SIDC (specify)						
ix. Commercial banks (specify)						
x. Insurance companies (specify)						
xi. Others (specify)						
TOTAL						

* In this column, indicate whether the arrangement has already been made/applied for, etc.

Ref Q. 8.01

Annexure VIII

Estimate of Production and Sales

(Details may be furnished separately for each product and until the plant reaches capacity utilisation)

(Rs. in lakh)

		Product				Product				Product			
		1st year	2nd year	3rd year	4th year	1st year	2nd year	3rd year	4th year	1st year	2nd year	3rd year	4th year
1.	Installed capacity (quantity per day/ annual)												
2.	No. of working days												
3.	No of shifts												
4.	Estimated production per day (quantity)												
5.	Estimated annual production (quantity)												
6.	Estimated output as percentage of plant capacity												
7.	Sales (quantity) (after adjusting stocks)												
8.	Gross sales Less: excise duty												
9.	Net sales												
10.	Other income												
11.	Total operating income :												

Note: Production in the initial period should be assumed at a reasonable level of utilization of capacity increasing gradually to attain full capacity in subsequent years.

Ref. Q. 8.01

Annexure IX

Estimates of Working Results

(The statement should be prepared for ten years)

(Rs. in lakh)

		Year ending	
		(ten years)	
A.	EXPECTED TOTAL		
	operating income (as per Annex 10)		
B.	COST OF PRODUCTION		
	Raw materials, chemicals components and consumable stores		
	i)		
	ii)		
	iii)		
	iv)		
	v)		
	vi)		
1.	Total material cost		
	Utilities		
	Power		
	Water		
	Fuel		
2.	Total utilities		
	Labor and plant overheads		
	Wages		
	Factory supervision salaries		
	Bonus		
	Provident fund		
3.	Total labor		
	Repairs and maintenance		
	Light		
	Rent and taxes on factory assets		
	Insurance rates on factory assets		
	Misc. factory expenses		
	Contingency at 5%		
4.	Total factory overheads		
	COST OF PRODUCTION (1 + 2 + 3 + 4)		
C.	ADMINISTRATIVE EXPENSES		
	Administrative salaries		
	Remuneration to directors		
	Professional fees		
	Rent, rates and taxes, Printing and Stationery, telephones, etc.		
	Miscellaneous expenses		
	Total Administrative Expenses		

Note: Indicate the basis (a) wastage for raw materials, and (b) rejection rate for finished products.

Annexure IX - contd

(Rs. in lakh)

Cost of production	Year ending	
	(ten years)	
D. ADVERTISING & PUBLICITY		
Commission/brokerage, other selling expenses		
Total sales/marketing expenses		
E. ROYALTY & KNOW-HOW PAYABLE		
F. TOTAL COST OF SALES (B + C + D + E)		
G. PROFIT BEFORE INTEREST AND DEPRECIATION (PBID) (A – F)		
Interest on term loans		
Interest on borrowings for working capital		
Guarantee commission		
Others		
H. TOTAL FINANCIAL EXPENSES		
I. DEPRECIATION		
J. OPERATING PROFIT (G-II-I)		
K. OTHER NON OPERATING INCOME (Please specify)		
L. PRELIMINARY EXPENSES WRITTEN OFF		
M. PROFIT/LOSS BEFORE TAX (J + K – L)		
N. PROVISION FOR TAXATION		
O. PROFIT AFTER TAX (M – N)		
Less: Dividend on – Preference capital		
– Equity capital (with rate)		
P. RETAINED PROFIT		
Add: Depreciation		
Preliminary expenses written off		
Q. NET CASH ACCRUALS		

Note: Provide detailed workings for calculation of depreciation (straightline and income tax method), interest, taxation, etc.

Ref. Q. 8.02

Annexure X

Cash Flow Statement

(This statement should be prepared for a period of ten operating years)

(Rs. in lakh)

	Construction period	Operating years
	(half yearly)	(ten years)
SOURCES OF FUNDS		
1. Share issue		
2. Profit before taxation with interest added back		
3. Depreciation provision for the year		
4. Development rebate reserve		
5. Increase in secured medium and long-term borrowings for the projects		
6. Other medium/long-term loans		
7. Increase in unsecured loans and deposits		
8. Increase in bank borrowings for working capital		
9. Increase in liabilities for deferred payment (incl. interest) to machinery suppliers		
10. Sale of fixed assets		
11. Sale of investments		
12. Other income (indicate details)		
Total (A)		
DISPOSITION OF FUNDS		
1. Capital expenditure for the project		
2. Other normal capital expenditure		
3. Increase in working capital		
4. Decrease in secured medium and long-term borrowings		
– (all-India institutions)		
– SFCs		
– Banks		
5. Decrease in unsecured loans and deposits		
6. Decrease in bank borrowings for working capital		
7. Decrease in liabilities for deferred payments (incl. interest) to machinery suppliers		
8. Increase in investments in other companies		
9. Interest on term loans		
10. Interest on bank borrowings for working capital		
11. Taxation		
12. Dividends – equity		
– preference		
13. Other expenditure (indicate details)		
Total (B)		

Annexure X - contd.

(Rs. in lakh)

	Construction period	Operating years
	(half yearly)	(ten years)
Opening balance of cash in hand and at bank Net surplus/deficit (A – B) Closing balance of cash in hand and at bank		

Note:

1. Detailed working of the figures shown should be provided.
2. Borrowings (as well as repayments) for the project and for other purposes should be separately).

Ref Q.8.03

Annexure XI

Projected Balance Sheet

(Rs. in lakh)

As on March 31	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
CAPITAL LIABILITIES										
Equity share capital										
- Ordinary										
- Preference										
Reserves + Surplus										
- General Reserve										
- Capital Redemption Reserves										
- Dividend Equalisation Reserves										
- Other reserves										
- Capital reserves										
- Surplus (P&L)										
Term Loans										
- Debentures (maturing after 1 year)										
- Foreign currency loans										
– SCICI										
– Others										
- Deferred payment guarantee (maturing after 1 year)										
– SCICI										
– Others										
- Term deposits (maturing after 1 year)										
- Rupee Loans										
– SCICI										
– Financial Institutions										
– Banks										
– Government										
TOTAL										

Annexure XI - contd.

(Rs. in lakh)

As on March 31	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
CURRENT LIABILITIES										
- Sundry Creditors										
- Short-term bank borrowings (incl. bills purchased /discounted										
- Unsecured loans										
- Long-term loans maturing in 1 year										
- Advance payments from customers/ dealers										
- Unpaid dividend										
- Provisions for tax										
- Other provisions										
- Other current liabilities (expenses accrued but not payable, advances received)										
TOTAL LIABILITIES										
ASSETS										
- Fixed Assets										
- Land & Building										
- Plant & Machinery										
- Others										
- Gross fixed assets										
- Less: Depreciation										
- Net fixed assets										
- Capital work-in-progress										
TOTAL NET FIXED ASSETS										
Other Assets										
- Investments in subsidiaries										
- Other investments										
- Advances to suppliers of capital goods + contractors										
- Deferred receivables										
- Dues from directors										
- Other – intercorporate deposits, etc.										
TOTAL										
- Investors										
- Receivables (incl. Bills purchased/discounted)										
- Instalments on deferred receivables										
- Loans + advances										
- Bank deposits										
- Cash and bank balances										
- Other current assets (prepaid expenses, advance payment of tax, etc)										
TOTAL ASSETS										
Debt equity ratio										
Assets debt ratio										
Current ratio										

Annexure XII

Format for authorization of Banker to disclose financial information to AIFI

Date:

The Manager
(Name of Bank)

Dear Sir,

We hereby authorize you to discuss with the Shipping Credit and Investment Company of India Limited (SCICI), to which our company is making an application for financial assistance, our affairs or any matters relating thereto and to disclose such information as they may request of you or as you may consider fit to disclose.

Yours faithfully,
Authorised Signato

Chapter II

Term Finance

After reading this chapter, you will be conversant with:

- Appraisal of Term Loans
- Key Financial Indicators
- Procedure for Sanction of a Term-loan
- Financing International Projects
- Project Exports
- Working Group
- Role of Exim Bank in Project Exports
- Role of ECGC in Project Exports

Introduction

Term lending facility refers to those financing instruments through which banks meet non-working capital needs of their clients. Term loans refer to loan availed by a borrower with a repayment facility in periodic installments over a pre-specified period. Repayment of the loan depends on the future income of the borrowing unit. Term loans are provided by financial institutions and commercial banks with a repayment period between seven to fifteen years.

Term loans are allowed in both rupees and foreign currency. Rupee term loans are given to the borrower for setting up of new projects or expansion etc. Foreign currency term loans are availed to meet the cost of imported equipment, cost of technology and know-how, etc., for which payments may have to be made in foreign currency. The loan account is maintained in foreign currency and the interest and installments are converted into rupees at the time of repayment at the prevailing rates.

Unlike short term loans, term loans are not so lacking in liquidity as they appear to be and are subject to definite repayment schedule. Term loans are sometimes called participation loans in view of the fact that banks or financial institutions (FIs) almost become shareholders or debenture holders in the borrowers unit.

Term loans both in rupees and foreign currencies are available from NBFCs also. But the limitation is that NBFCs do not finance the entire project; they limit themselves to the items they believe are safe to finance and even the rates are charged higher than financial institutions.

Banks are cautious while extending project loans to Small and Medium Enterprises (SMEs). The entry norm is longstanding clients with a good track record. The interest rate in case of the term loans from banks depend upon the credit rating of the client but tend to be lower than that of the state financial institutions on account of lower cost of funds.

Loans for purchase of assets (vehicle, equipment) are medium-term in nature with loan periods extending from 3-5 years. With regard to these loans, the main competition to banks is from the Non-Banking Financial Companies (NBFCs). The NBFCs compete primarily in the area of response time while interest rates tend to be higher. In recent times, banks are also facing competition from a new quarter in these loans. The manufacturer (either on its own or through a tie-up with a preferred financier) arranges financing of its products. This type of financing is known as Packaged financing.

APPRAISAL OF TERM LOANS

As the repayment of a term loans depends on the future income of the borrower, banks before granting a term loan have to assure that the borrowing unit provides the necessary amount of repayment for the loan. It requires appraisal of the different aspects of the project – financial, economic, technical, and managerial aspect. A model project appraisal followed by lenders is given in Annexure I.

KEY FINANCIAL INDICATORS

Break Even Point, and Debt Service Coverage Ratio are considered as the key financial indicators and are essential for the banker for credit analysis and to draw the repayment program.

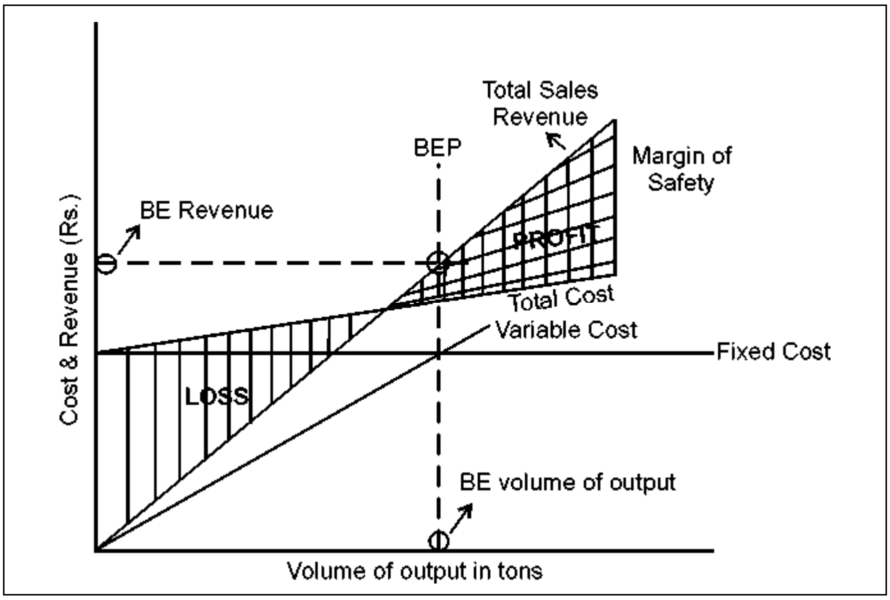
Break Even Point (BEP): It is the point at which the project makes neither profit nor incurs loss. The BEP for a project is calculated when the project is expected to reach its expected level of capacity utilization. A good project should have BEP, not higher than 75%. For calculating BEP, costs are divided into two categories – fixed cost1 and variable cost[2].

1 Fixed cost – Every business incur costs that fixed in nature. They remain constant irrespective of the change in the volume of output.

2 Variable cost – Vary with change in output.

BEP = Fixed Cost / (Unit sale price – Unit variable cost).

Figure 1: Break Even Analysis



Debt Service Coverage Ratio (DSCR)

DSCR serves as a guide for determining credit analysis of the borrower as well for the repayment programme. It is calculated by dividing cash accruals in a year by amount of maturing annual obligations towards repayment. Cash accruals comprise of Profit after tax, Depreciation, Other non-cash charges and Interest on term loan. Amount of maturing annual obligations comprise of interest on term loan and repayment of term loan. This ratio varies from industry to industry. DSCR between 1.5 to 2 is regarded as satisfactory by financial institutions.

DSCR = Cash Accruals/ Maturing Annual Obligations

PROCEDURE FOR SANCTION OF A TERM-LOAN

The procedure associated with term loan involves certain steps that are discussed below. The model followed by a leading bank in India is given in Annexure-II.

- **Submission of Loan Application:** Borrower needs to submit the application to any term lending institutions or commercial banks. Borrower needs to fill the application form giving information about the project. Application should be complete in all respects and contain copies of the approvals from the government agencies, agreement for foreign technical collaborations etc. The institutions don't process incomplete applications.
- **Initial Processing of Loan Application:** On submission of the application, one of the officers of the institution checks it for completeness and prepares a 'flash report', which is a summarized version of the application. The flash report is put up for scrutiny at a meeting of the senior executives of the institution. The Senior Executives Meeting (SEM) may grant in principle approval for the project and appoint a lead institution, which carries on the detailed appraisal of the project. The appointment of the lead institution is decided based on the location of the borrower, the type of the project, the experience of the institutions in handling similar projects and existing workload at the institutions.
- **Appraisal of the Proposed Project:** If the SEM approves the project, the lead institution then appraises it. If the institution to which the application has been submitted decides to finance the project independently, rather than

through a consortium, then the institution itself carries out the detailed appraisal. The lead institution may, if it finds necessary, ask for additional information on the project within 15 days from the receipt of the application by it. Once the final appraisal report is ready, the institution may call for a Senior Executives Meeting or an Inter Institutional Meeting for a final decision on the project. If a favorable decision is taken at the meeting, the project is recommended for sanction of assistance to the Board of Directors of the lead institution. The meeting also decides on the types of facilities to be sanctioned and how the institutions should share them.

- **Issue of the Letter of Sanction:** On receipt of the recommendation from the meeting, the board of directors of the lead institution accords its sanction for providing assistance to the project. A letter of sanction is then issued to the borrower informing him of the amount sanctioned by the lead institution and other participants in the consortium as also the terms and conditions associated with the loan. Other participants in the consortium then sanction their shares at their respective board meetings and send letters of sanction to the lead institution under copy to the borrower. The borrower has to interact with the lead institution only for the entire amount of advance.
- **Acceptance of the Terms and Conditions by the Borrowing Unit:** On receiving the letter of sanction from the lead financial institution, the borrowing unit organizes its board meeting in which the terms and conditions related to the letter of sanction are accepted and passed. The acceptance is conveyed to the institutions within 30 days.
- **Execution of Loan Agreement:** The lead financial institution, after receiving letter of acceptance from the borrower, sends drafts of the agreement to be executed by the borrower and duly stamped as per the Indian Stamp Act, 1899 and return back to it. Once the lead FI signs, the agreement becomes effective.
- **Disbursement of Loans:** The letter of sanction contains, along with the amount sanctioned and the interest and commitment charges payable, certain conditions such as creation of security before disbursement of the loan, appointment of nominee directors on the board of directors of the borrower, etc. The borrower is generally given thirty days to inform the lead institution of his acceptance of the terms and conditions. On receipt of the acceptance, the institution makes the loan agreement ready, which is signed first by the borrower and then by the officials of the institution. Disbursement follows the execution of the loan agreement.
- **Creation of Security:** When the creation of security is likely to take lot of time especially, creation of mortgage, the borrower is allowed time. In the mean while, payments are made to the sellers of the machinery or other assets on behalf of the borrower and not directly to the borrower.
- **Monitoring:** Lending institutions monitor the project continuously until the loan is recovered. Monitoring is done through the reports of the nominee directors on the board of the borrower, direct inspection of the project by the officials, report from the bankers, creditors, suppliers and others associated with the borrower and the study of the audited financial statements of the company. The intensity of the monitoring depends on the conduct of the account i.e. whether the principal and interest are being repaid promptly.

FINANCING INTERNATIONAL PROJECTS

Commercial banks have always had an active role in project finance transactions. In the recent years, they have played a role beyond their traditional boundaries in project finance transactions. Commercial banks are developing new roles in providing advisory services; construction financing; intermediation to permanent long-term fixed-rate financing; commodity, currency, and interest rate risk management; foreign tax absorption; and working capital financing for projects throughout the world. The development of these roles is in response to the increasing competition among commercial banks and other institutional lenders, and intermediaries to meet an explosion of worldwide project finance needs.

The term "project finance" is generally used to refer to a non-recourse or limited recourse financing structure in which debt, equity, and credit enhancement are combined for the construction and operation, or the refinancing, of a particular facility in a capital-intensive industry. It is important to understand that the term project finance does not necessarily imply that the loan is non-recourse to the project sponsor. As the definition indicates, project finance debt can be non-recourse or limited recourse. Project finance transactions can be placed on a continuum, with recourse to project sponsors ranging from non-recourse to almost complete recourse. Complete recourse is a different financing technique and is usually called direct lending.

In this financing, the lenders base credit appraisals on the projected revenues from the operation of the project, rather than on the physical assets or the creditworthiness of the sponsor. Instead they rely on the assets like revenue-producing contracts and other cash flows generated by the project, as collateral for the debt. There is a sharing of risks between various participants in the project, including the lender.

Typically, a project will involve the following parties with varying interests:

- Construction companies, operating companies, suppliers of capital equipment.
- Governments and quasi-governmental bodies (e.g., ADB).
- Customers for the outputs of the project.
- Providers of infrastructure such as transport.
- Export Credit Agencies (ECAs) and development bodies.

Project financings sometimes operates through a Special Purpose Vehicle (SPV), a business entity that has no assets of its own beyond those of the project, and which is jointly owned by project participants. The SPV insulates the other participants from the financial obligations and risks assumed by the project.

Role of Commercial Banks in Project Finance

Commercial banks continue to play a major role in project finance transactions. In fact, project finance is generally thought to have begun in the 1930s when a Dallas bank made a non-recourse loan to develop an oil and gas property. It "came of age" in the 1970s and '80s with the successful financing of North Sea oil and gas projects, Australia's Northwest Shelf gas project, independent non-utility power generation in the United States, and similar substantial projects.

Project finance has been employed in almost all capital-intensive industries, particularly in construction and infrastructure development (called project exports in India), transportation (aircraft, rail, and shipping), in mineral and other natural resource exploration and development (including oil and gas), and most recently, in independent power projects. Project finance is an alternative financing in countries whose domestic capital markets are small relative to their project development requirements (e.g., Australia and Canada), or are relatively immature (e.g., certain developing countries). Project finance allows project assets to be separated from the sponsor and to be financed on the basis of the cash flow from the project assets. It allows a sponsor to undertake a project with more risk than the sponsor is willing to underwrite independently.

Traditional Role

Commercial banks can provide project financing because they are able to evaluate and assess complex project financing transactions effectively. They also have the capacity to assess and assume the construction and performance risks usually involved in such financings. However, largely because of the short-term nature of a commercial bank's liabilities (its deposits), bank's participation is usually limited in amount. Project sponsors frequently seek financing through a “Request for Proposal” or “RFP” process, and several commercial banks are likely to form separate syndicates or “clubs” to respond to a loan request.

The successful commercial bank syndicate for a project financing usually seeks to “sell down” its underwritten commitments in a further coordinated syndication to a larger bank group. This subsequent syndication may occur before financial closing (i.e., the execution and delivery of definitive financing documents) or after, depending on:

1. The confidence of the original syndicate banks in the “marketability” of their transaction in the commercial bank project finance markets, and their willingness to assume the risk of adverse change in such markets;
2. The timing constraints of the project;
3. The project sponsor’s preferences in this regard, or the original banks’ desire to reduce their levels of commitment; or
4. All or any combination of these circumstances.

Now we will discuss the types of international projects that are financed by a commercial bank.

PROJECT EXPORTS

Financing of international trade takes two forms:

- Import financing.
- Export financing.

Import financing in a major way is done through letters of credit. Though a letter of credit, per se, is not a financing instrument, it is an important document, which facilitates financing. This is discussed in detail in the chapter “Fee based services.”

In export financing, commercial banks play a vital role since they become channels in the process of financing in one form or the other. As in the case of any business, commercial banks are predominantly involved in extending working capital finance as well as project finance to exporters. Project exports form the major section in export financing of banks.

A project export is the term collectively used for the following:

a. Export of engineering goods (e.g., Export of machinery, equipment, manufactured products) on deferred payment terms.
b. Turnkey contracts (e.g., Setting up of a Sugar Plant or a Cement Plant) on cash/deferred payment terms.
c. Overseas construction contracts (e.g., Construction of Roads, Dams, Bridges).

Project exports essentially connote engineering and erecting ‘projects’ overseas. These projects – construction or industrial (turnkey/engineering) in various sectors of economic and industrial development involve activities such as designing, engineering, procurement, construction/commissioning as well as provision of all kinds of supplies, consultancy, technology, technical know-how and/or other such project related services including multilateral funded projects in India.

Project exports are regarded as a key indicator of technological maturity, advancement and industrial capabilities of a country and contributes towards the economic growth of a country by way of foreign exchange earnings. Project exports give visibility to the knowledge, skills and experience in respect of the project execution capability of a company/country. Projects are created by employing engineering processes based on the state-of-the-art technologies which, through innovation, keep undergoing constant change/upgradation in the direction of providing optimum value to the client, which in the present time of increasing globalization/competition (WTO regime) becomes all the more significant.

Indian exporters offering deferred payment terms to overseas buyers in respect of export of goods and those participating in global tenders for undertaking turnkey/civil construction contracts abroad require specific approval of RBI for credit terms to be offered, third country imports and opening liaison office, etc., to a limited extent powers have also been delegated to the authorized dealers and the EXIM bank. The ECGC provides underwriting support to project exports from India.

Box1: Export Credit Agencies (ECA)
ECAs act as an export financing institutions, commercial export insurer, and foreign investment catalyst and project finance expert. In other words, they act as an intermediary between national government and exporters to issue export financing. ECAs expand measures to facilitate and thereby promote exports and not only perform their role of providing export credits but also offer gamut of other products like credit insurance, guarantee, working capital, lines of credit, leasing, buyers and suppliers credit, overseas investment finance and overseas equity participation. ECAs differ in role, function, resources and ownership. ECAs take on higher risk and longer terms than commercial banks. Projects that require large credit and carry high investment risk are not viable without the involvement of ECAs. ECAs may be those agencies which provide export credit with insurance from other agency or may provide both export credit and insurance together. The rationale for establishment of ECAs stems from the following factors: i. Enhanced capability to export capital and engineering goods as also project exports. Buyers may seek deferred payment terms to tailor their payments in conformity with the cash flow generated by production from such imported capital goods. ii. Developing countries are major importers of such product and project exports, and their balance of payments position necessitates deferred payment terms. iii. Spread of industrialization has meant intensified competition in international markets for manufactured products, which calls for the provision of competitive credit on extended payment terms. iv. As exports are seen as a national priority goal in most countries, ECAs are considered as institutions which catalyze export expansion through a variety of financing activities. ECAs offer various financing facilities in promoting national exports through export financing. ECAs in developed countries differ from those in industrialized economies and developing countries. ECAs in developing countries are involved in accelerating exports by offering diverse schemes as well as through energetic business promotion efforts. They are also involved in short term export financing. Other facilities offered by ECAs in developing countries include – Overseas Investment Credit, Import credit, Advisory and Promotional Services. Government supports to ECAs is extended by way of share capital, provision of sovereign guarantee for borrowings, interest make-up/equalization system and exemption from income tax. Exim Bank India receives share capital, whereas the Japanese counterpart receives share capital, sovereign guarantee for borrowings, and interest equalization support from government and tax exemption from government. Even Exim People's Republic of china receives share capital and interest equalization support from government. Several ECAs also maintain separate National Interest Accounts for transaction conducted on behalf or at the behest of their governments for example Japan, JBIC has a separate fund for financing Japanese exports supported by its government, and Exim bank of china administers Chinese government concessional loans and on lends foreign government loans.

Source: http://finmin.nic.in/, Report of Task Force on Project Exports

Classification of Project Exports

The project exports can be briefly and broadly categorized as below:

i. Civil/Construction Engineering Projects:

   a. Agriculture and Natural Resources
      - Fisheries
      - Irrigation and Rural Development
      - Industrial Corps and Agro Industries

   b. Energy
      - Electric
      - Thermal
      - Natural Gas and Oil
      - Others

   c. Environment

   d. Industry

   e. Multi-Sector

   f. Social Infrastructure
      - Education
      - Urban Development and Housing
      - Health and Population
      - Water Supply and Sanitation

   g. Transport and Communication
      - Roads and Road Transport
      - Ports and Shipping
      - Railways

   h. Consultancy

ii. Industrial (Turnkey/Engineering) Projects:

   a. Metals and Minerals

   b. Food and Agro processing: Wood/Paper

   c. Energy

   d. Chemicals/Petrochemicals: fuels, fertilizers, drugs/pharmaceuticals

   e. Textiles

   f. Transport and Telecommunications

   g. Miscellaneous.

Since construction contributes about 50% of the total cost of any project, construction engineering is a very significant component of project exports. A major difference between a turnkey contract and construction contract is that a turnkey contract has a large component of machinery and equipment going into the project, whereas, in a construction contract, this component is absent or is relatively small. The value of services in a civil construction contract is usually high and in a turnkey contract, service may sometimes be limited to the erection and commissioning of machinery/equipment supplied.

Every engineering project is, in effect, a change process; but for the civil engineering projects, the impact of the change is often of limited significance because many parameters of change are defined by the client or employer, while others such as environmental impact, have until recently been relatively neglected. However, engineers are now beginning to broaden the area of perceived responsibility to study the impact of the proposed projects on the communities that may be affected. Similarly, clients are appreciating the need to view projects as part of an overall process, which must be managed, operated and maintained.

In the present context of liberalization and globalization, new strategic initiatives have been taken to promote project exports, since they carry the following essential advantages:

1. Project exports employ minimum domestic resources.
2. Support funding provided by the banking system is of self-liquidating nature over a period of time.
3. Project exports provide employment opportunities to trained/skilled manpower as well as help in the absorption of state-of-the-art construction technology available in the world.
4. Project exports tend to create opportunities for generating demand for other Indian construction and engineering products and thus giving a fillip to other ancillary industries also.
5. It is an avenue to earn foreign exchange with minimum use of domestic resources. Purchase of equipment for execution of the project is paid through foreign exchange earned from the project.
6. The credit facilities granted by the banks in project exports are self liquidating in nature. Non-funded bonds and guarantees forms bulk of credit facilities required.
7. It is a vehicle for capital equipment and material exports.
8. Banks are normally required to provide funding support only for a fraction of the working capital needs of the project.
9. Project exports provide opportunities for skilled or unskilled manpower to work in foreign countries and repatriate valuable foreign exchange.
10. Project exports generate a ready market for construction and building materials, plants and equipment and associated services thus providing an avenue for added earnings in foreign exchange.
11. Undertaking projects abroad enables absorption of latest international technology and to appreciate the versatility state of art engineering and construction equipment.
12. Project exports can have a compounding effect to enhance foreign exchange earnings, since project exporters can create entry points for other Indian firms for supplies, consultancy and manpower exports.

Box 2: Role of Indian Missions
Indian missions enable promoting of project exports. Indian missions also increase Indian participation in multilateral funded projects overseas and in enhancing success rate of Indian bids. Strengthening and capacity building of Indian missions needs to be considered for improving delivery mechanisms and support structure to assist Indian project exporters, A Project Facilitation Cell (PFC) is formed in Indian missions in promoting Indian project exports. Its role includes identifying business opportunities; market intelligence; promotion of co-operation between Indian project exporters and foreign clients, projecting Indian capabilities, exploring overseas market opportunities and organizing buyer-seller

meets in India and abroad. Indian companies need to track project opportunities from the stage of conceptualization. Information may also be gathered by Indian missions on upcoming project opportunities in their regions through Project Facilitation Cells on continual basis. Role of Indian missions in various stages of project cycle and in emanating business opportunities can be to:

i Establish/enhance awareness of relevant Indian export capabilities.

ii. Track business opportunities through the project eycle.

iii. Provide specific inputs to interested Indian exporters.

iv. Coordinate with concerned agencies.

v. Analyze reasons for bid success/failure and provide feedback.

Source: http://finmin.nic.in/, Report of Task Force on Project Exports

Indian Scenario

Project exports have occupied an important place in India's export portfolio, particularly after the early 1970s, when the construction sector in the oil-exporting region of the Middle East underwent a spurt in activity. During the initial years of the 70s, most of the project contracts abroad were for civil construction works and about 80 percent of these were concentrated in Iraq and Libya. The later developments in the region adversely affected this trend, but Iraq continued to be a major market for Indian construction contracts till the Gulf War in 1990-91. The UN sanctions against Iraq thereafter resulted in a decline in business opportunities for Indian projects. Moreover, dues for works already completed could not be realized and this affected the ability of Indian companies to seize overseas project opportunities elsewhere. The West Asia region is the major market for the project export contracts secured in 1999-2000. The remaining projects primarily concentrated in South East Asia, South Asia and North Africa.

Indian exporters offering deferred payment terms to overseas buyers in respect of export of goods and those participating in global tenders for undertaking turnkey/civil construction contracts abroad requires specific prior approval of RBI for credit terms to be offered, third country imports and opening liaison office, etc. To a limited extent, powers have also been delegated to authorized dealers and the EXIM bank. The ECGC provides underwriting support to exports project from India.

Table 1 below gives the performance of Indian companies under which project exports contains.

Table 1: Trends in Project Exports from India supported by Exim Bank

Particulars	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Value of Contracts	18.33bn	41.62bn	65.31bn	75.43bn	79.45	135.30bn	184.9bn	326.83bn
No. of Contracts	38	59	110	164	570	568	820	977
No. of Exporters	21	34	59	96	198	174	172	147
No. of Countries	23	26	45	48	64	64	93	92

Source: Eximbank India.

Services Exports

Services – consultancy/technical or other services - are categorized as a separate class of exports and are classified into the following four groups:

- Preparation of project/feasibility reports, drawings, designs, etc.
- Technical know-how/engineering services in different fields.

- Operation, maintenance and supervision of manufacturing plants, buildings and structures, etc.
- Management contracts for commercial firms/companies. Export of services may also involve supply of some associated mechanical wherewithal, consumables and spares.

"Services" include all the 161 tradable services covered under the General Agreement on Trade in Services. The service providers shall be eligible for recognition as Service Export House, International Service Export House, International Star Service Export House and International Super Star Service Export House on achieving the prescribed minimum average or net free foreign exchange earning.

Box 3: Constraints Faced by Indian Project Exporters

– Scope to secure large volume turnkey contracts in regions such as Middle East and Asia; necessitate bids being accompanied by packages comprising low cost credits and extended credit terms. This is possible only with Government support and through strengthening of institutions purveying export credit.

– Although, Indian Project Exporters are technically competent and have demonstrated capabilities, the brand image of India, as a significant project exporter, is yet to be well-established.

– Although, Indian Project Exporters are technically competent and have demonstrated capabilities, the brand image of India, as a significant project exporter, is yet to be well-established.

– A multi-pronged coordinated approach involving appropriate institutional support and focusing on specific projects/ markets, has yet to be developed. Consortia approach should be given an impetus by both government and industry.

– There is a need for Indian consultants to have enhanced presence in thrust markets at early stages of the planning process. Higher success rate in securing consultancy contracts would have a multiplier effect for securing downstream turnkey and construction contracts as well as supply contracts.

– The financial packages available from the Indian financial system are at times considered not to be competitive enough. Exim India has also compiled data, where Indian companies were unable to pursue business opportunities due to lack of attractive financial packages. Stiff competition is offered by other countries, including China and Korea, who arrange financing at more competitive terms.

– ECGC charges of premium for counter guarantees and risk insurance, being higher than the Competitors, affects adversely the cost competitiveness of Indian Project Exporters. An analysis of proposals of value more than Rs.100 crores received during the year October 2001-September 2002 establishes that 38 such proposals of value amounting to Rs.9000 crores covered only 17 countries and 14 exporters.

– ECGC is considered to have limited risk taking capability to support large value project exports, e.g. infrastructure projects overseas – BOT, BOO projects and projects in marginal risk countries.

– The world market for power projects is dominated by few world renowned large integrated electrical engineering companies which acts as an entry barrier for Indian companies.

– In case of Turnkey contracts, specifications at times, stipulate the use of equipment of certain international specifications making it mandatory for the Indian exporter to source it through third country imports at a premium. These third country imports make the cost of Indian turnkey projects uncompetitive.

–	Price competitiveness owing to cheaper technical manpower is continually eroding since Indian companies increasingly face competition from companies, for instance, from China in their segments.
–	Time lags in receipt of information, uncertainties relating to the project parameters, recourse to imported raw materials, completion time, get built up in the form of cushions, rendering the total price for the contract uncompetitive.
–	Inter American Development Bank (IADB) funds projects worth about US$10 billion per annum in Latin and Central America. Indian companies cannot participate in these projects, as India is not a member of IADB.

Source: http://finmin.nic.in/, Report of Task Force on Project Exports

Deferred Payment Exports

According to the Regulation 9 of the Foreign Exchange Management Act 1999, the amount representing the full export value of goods exported must be realized and repatriated to India within 6 months of date of export. Exports where more than 10% of the value is realized beyond the prescribed period, i.e., six months from the date of shipment, are treated as Deferred Payment Exports.

Pure supply contracts (contracts for export of goods) where at least 90% of the export value is realized within the prescribed period, i.e., six months from the date of export and the balance amount within a maximum period of two years from the date of export are not treated as deferred payment exports, provided the exporter does not require/avail of any funded or non-funded facilities for such exports from authorized dealers. Indian exporters offering deferred payment terms to overseas buyers and those participating in global tenders for undertaking turnkey/civil construction contracts abroad are required to obtain approval of Authorized Dealer/EXIM Bank/Working Group at post-award stage before undertaking execution of such contracts.

Extension of Credit

i. **Period of credit:** The Project Exports Manual of RBI lays down maximum period of credit, which an Indian project exporter can grant, for a project export proposal. They are:

Table 2: Project Export Contracts

Contract Value	Maximum Period	
	Capital	Turnkey Projects
Up to 10 lakh	3 years	4 years
> Rs 10 lakhs but < Rs 50 lakh	5 years	6 years
> Rs 50 lakhs but < Rs 1 crore	8 years	9 years
> Rs 1 crore	11 years	12 years

In case of civil construction contracts on deferred terms, the period of repayment should not exceed 5 years including period of moratorium.

ii. **Moratorium on repayment of principal:** Not more than one year for the supply of goods and services and two years for turnkey projects.

The computation of the period is done with reference to the following dates:

a. For supplies: Mean date of shipment

b. For turnkey projects: Date of contract or mean date of shipment.

Interest should be payable even during the moratorium period and should normally cover the cost of post shipment finance.

Other Conditions

ADVANCE PAYMENT

Advance payment provided by the overseas buyer is an important source of working capital required for contract execution. A minimum level of advance/ down payment has been stipulated in PEM as shown below:

Table 3

Type of Contract	Advance Payment Normal (Minimum)
Deferred payment Pure supply contract Turnkey/ civil construction	15% Minimum 5% 15% Minimum 5%

FOREX OUTGO

It is the amount remitted abroad or paid in India, which is convertible in foreign currency. This includes agency commission and royalties payable, freight payable in foreign currency, value of import replenishment and value of third country imports. For turnkey/civil construction contracts net foreign exchange outgo (which is foreign exchange outgo less advance payment/down payment) up to a ceiling of 25% of the contract value can be allowed.

BRIDGE FINANCING

Normally, the turnkey projects and construction contracts should be self financed by the way of advance/down payment and during the execution period, the exporter should not require bridge finance to meet temporary cash flow deficit. However, up to an extent of 15% of the contract value, bridge finance can be extended to meet the shortfall in the working capital. Ordinarily, no credit should be provided in respect of services segment of a turnkey project, but in special cases, it could be considered on the same basis as supplies.

All the project export proposals are assessed based on the following:

- Exchange control angle to examine if the proposal meets the requirements as laid down by the RBI or the PEM.
- Credit angle to assess the facilities required for project bidding/execution. At the time of bidding itself all credit facilities that may be required for execution are sanctioned in principle.

From exchange control angle all proposals of project export have to be cleared before bidding. The authority structure for clearance of project export proposals is shown below:

Table 4:Turnkey, Construction and Supply Bids/Contracts

	Project exports
Authorized dealers	Up to 50 crore
EXIM bank	Up to 200 crore
Working group	Above Rs. 200 crore

No clearance from the ADs, RBI or the working group is required for service contracts if it is on cash terms and no facilities are required by the exporter. Projects involving buyer's credits and export of managerial/technical consultancy services involving fund based facilities with deferred payment terms must be referred to working group.

Applications by project exporters are submitted in the following formats:

DPx-1 : Application for export of engineering goods on deferred payment and turnkey contracts

Pex-1 : Application for submitting tender/offer for civil construction projects

TCS-1 : Application for submitting tender/offers for managerial/technical/ consultancy service contracts abroad.

Box4: Exports Policy and Procedures

Memorandum of Instructions on Project & Service Exports, in short known as "Memorandum-PEM" issued, by the RBI lays down the regulations relating to project exports as well as guidelines to be observed by all the constituents, namely project exporters, EXIM Bank of India as well as banks dealing with the project exports. Each exporter has to obtain the IEC Number from the regional licensing authorities under the office of the Directorate General of Foreign Trade (DGFT), Ministry of Commerce & Industry, Government of India

1. **Membership and registration of Overseas Construction Council of India (OCCI)**

   Membership of OCCI is obligatory for all project exporters: Application for membership of the Council is to be submitted to the Council in the form as prescribed duly filled-in along with all the desired enclosures. However, the member is also required to obtain a Registration-cum-Membership Certificate (RCMC).

   In regard to the possibility of execution of overseas projects by Indian engineering contractors, there is an element of selectivity. Only those engineering contractors who happen to be on the approved list of Ministry of Commerce & Industry and fulfill the prescribed norms of financial and technical capability are approved by the Screening Committee set up by the Ministry of Commerce so as to enable them approach the Working Group on Project Exports for considering their proposals for undertaking construction engineering projects. However, no Screening Committee clearance would be needed for industrial or consultancy projects.

2. **RBI approval**

   Indian project exporters are required to approach RBI for prior approval for a variety of purposes while executing projects abroad such as executing corporate guarantee at the bid or post award stage instead of providing bank guarantee, advance payment of commission instead of pro rata payment, inter-project transfer of funds, etc. Permission is required from the RBI in respect of the following:

   - For opening of foreign currency account abroad
   - For opening of temporary site offices
   - For availing of temporary overseas borrowing

3. **Insurance cover**

   It is mandatory to obtain full insurance cover against export credits from ECGC and thus procure a Construction Works Policy or other such policy.

4. **Deployment of personnel**

   Clearance is required from Protector General of Emigrants (under the Ministry of Labor, Government of India) for deployment of personnel abroad

5. **Assistance given by government**

   At present, Market Development Assistance (MDA) according to the conditions stipulated by the Government of India (Ministry of Commerce & Industry) is given for the following export promotion activities overseas:

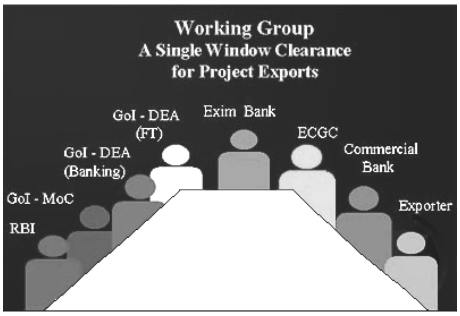
   - Sales cum Study Tours.
   - Participation in exhibitions/fairs.
   - Production of publicity material.

Source: www. projectexports.com

WORKING GROUP

'Working Group' refers to the Group constituted by the Reserve Bank for the purpose of considering proposals of export of goods and services on deferred payment terms or in execution of a turnkey project or a civil construction contracts. In order to avert the need to approach these institutions individually and avoid delays, a working group was constituted comprising the representatives of RBI, EXIM bank and ECGC for the purpose of giving package approvals for proposals submitted by exporters to bid such projects. Where the value of contract is huge, representatives of government of India will also be associated in the working group. Similarly, where Indian sub contractors are to be engaged, bankers of such proposed subcontractors would also be invited.

Figure 2: Working Group Mechanism



Source: Reserve Bank of India

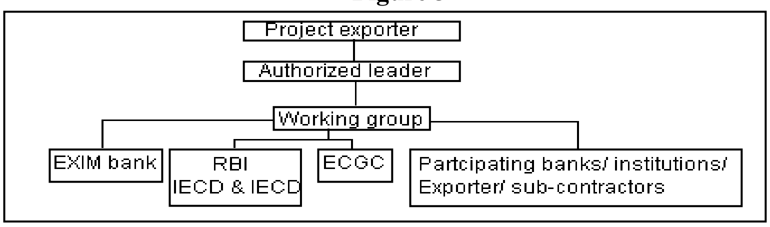
Working Group mechanism has been evolved for the purpose of giving package approvals in principle at pre-bid/post-bid stages for high value overseas project exports. The role of the Working Group is mainly regulatory in nature, but the responsibility of project appraisal and that of monitoring the project lies solely on the sponsor bank. As the Working Group approvals are based on the recommendations of the sponsor banks, the latter should examine the project proposals thoroughly with regard to the capacity of the contractor/ sub-contractors, protective clauses in the contracts, adequacy of security, credit ratings of the overseas sub-contractors, if any, etc.

Therefore, the need for a careful assessment of financial and technical demands involved in the proposals vis-à-vis the capability of the contractors (including sub-contractors) as well as the overseas employers can hardly be under-rated to the financing of any domestic projects. In fact, the export projects should be given more attention in view of their high values and the possibilities of foreign exchange losses in case of failure apart from damage to the image of Indian entrepreneurs. While bid bonds and performance guarantees cannot be avoided, it is to be considered whether guarantees should be given by the banks in all cases of overseas borrowings for financing overseas projects. Such guarantees should not be executed as a matter of course merely because of the participation of EXIM Bank and availability of counter-guarantee of ECGC. Appropriate arrangements should also be made for post-award follow-up and monitoring of the contracts.

Working Group Mechanism

The project export proposal of high value falling beyond the powers of AD/ EXIM bank are cleared through working group mechanism which is given below:

Figure 3



Authorized dealer: Sponsoring and financing agency (a sponsor bank is a bank interested in providing the credit for a project).

EXIM bank: Is the nodal agency for project exports and financing agency.

RBI: Regulatory agency with powers for approval of terms of payment, forex/ credit requirements.

ECGC: Insurance agency.

Banks: Funding/ participation agencies.

TIME LIMIT FOR CLEARANCE OF PROJECT EXPORTS

Authorized Dealer: The AD should submit recommendations to the working group within 5days of the submission of the applications.

Working Group: Package approval will be given by the EXIM bank within 7days of the receipt of the completed applications**.**

Post Award Clearance

Exporters should apply on DPx or PEx within 15 days of signing the contract. In the event of deviations from the project at the bid stage, specific approvals for the changes may be required from ADs/EXIM bank/working group depending upon the nature of changes. Normally, for significant changes the exporter obtains necessary approvals prior to signing the contract foe execution of the project. All sub contractors to apply to the bankers to the prime contractor for obtaining approval for their respective shares.

Follow up of Project Exports

The following procedure is followed in respect of the follow up of the projects during the execution period:

a. Inspections by the AD or working group at agreed intervals.
b. **Financing follow-up:** Quarterly progress reports within one month of the close of the quarter.

From time to time, review meetings are held to take stock of the progress made by the project exporter, particularly with reference to the projections made at the commencement of the project or milestones set up by the contractor.

Box 5: Exchange Control Regulations
Project Exports and Service Exports The exchange control regulations relating to project exports and service exports have been amended in April 1999. The amendments are as under: a. **Constitution of Working Group:** In the context of operational freedom given to authorized dealers in extending export credit to project exporters, the Working Group for the purpose of granting package approval for project/ service export proposals has been reconstituted and it will consist of representatives of the Reserve Bank (ECD), EXIM Bank and Export Credit and Guarantee Corporation. Accordingly, it will not be necessary hereafter for the project exporters/bankers to forward a copy of application/ approval in respect of project/ service export proposals to Industrial and Export Credit Department (IECD) of the Reserve Bank. b. **Clearance of Proposals:** The EXIM Bank would receive, consider and approve project exports proposals viz. supply contracts on deferred payment terms, turn-key projects or construction contracts up to the value limit of Rs.l00 crores direct i.e., without the applications being routed through any authorized dealer, subject to certain conditions provided all the facilities required for execution of such contracts are extended by EXIM Bank.

Source: RBI

Permission for Issue of Corporate Guarantees by Project Exporters

The Reserve Bank has permitted exporters who have obtained pre-bid or post-bid letters of approval from the EXIM Bank on behalf of the Working Group on Project Exports or the EXIM Bank or an Authorized Dealer within their delegated powers, to issue corporate guarantees for performance or for availing of fund based and/or non-fund based facilities from banks/financial institutions abroad in connection with projects being executed abroad as approved in the letter of approval provided –

a. The approval is in respect of export of engineering goods on deferred payment terms or execution of turnkey projects/civil construction contracts abroad or for the export of consultancy, technical or other services abroad.

b. Terms and conditions specified in the letter of approval and any directions that may be given from time to time by the Reserve Bank are strictly complied with by the exporter.

c. Within 15 days of the issue of corporate guarantee, the exporter submits to the concerned Regional Office of the Reserve Bank, a statement containing full particulars of such corporate guarantee.

ROLE OF EXIM BANK IN PROJECT EXPORTS

EXIM Bank is fully owned by the Government of India and is managed by the Board of Directors with representation from Government, financial institutions, banks and business community. The Export-Import Bank of India (EXIM Bank) provides financial assistance to promote Indian exports through direct financial assistance, overseas investment finance, term finance for export production and export development, pre-shipping credit, buyer's credit, lines of credit, re-lending facility, export bills rediscounting, refinance to commercial banks. EXIM Bank has been extending lines of credit to various developing countries to encourage India's project exports. These are in addition to suppliers' credit and buyers' credit. The EXIM Bank's lending emphasis is on deferred export credit for medium and long terms. The bank also extends non-funded facility to Indian exporters in the form of guarantees. The diversified lending programme of the EXIM Bank now covers various stages of exports, i.e., from the development of export makers to expansion of production capacity for exports, production capacity for exports, production for exports and post-shipment financing. The EXIM Bank focus is on export of manufactured goods, project exports, exports of technology services and exports of computer software.

EXIM Bank has over the years, been playing an active role in creating export capability among Indian companies. In the emerging global trade scenario, EXIM Bank works closely with Indian construction industry to help them achieve global competitiveness and explore new markets. Presently, project exports are made to around 30 countries to a value of around $2.2 billion and there are plans to expand this to around $10 billion.

EXIM Bank provides a range of analytical information and export related services. The Bank's fee based services help identify new business propositions, source trade and investment related information, create and enhance presence through joint network of institutional linkages across the globe, and assists externally oriented companies in their quest for excellence and globalization. Services include search for overseas partners, identification of technology suppliers, negotiating alliances, and development of joint ventures in India and abroad. The bank also supports Indian project exporters and consultants to participate in projects funded by multilateral funding agencies. EXIM Bank finances exports of Indian machinery, manufactured goods, and consultancy and technology services on deferred payment terms. It also seeks to co-finance projects with global and regional development agencies to assist Indian Exporters in their effort to participate in such overseas projects.

Non-Fund Based Facilities

EXIM Bank issues following guarantees directly or in participation with other banks, for project export contracts:

Bid Bond: Bid Bond is generally issued for a period of six months. This ensures that a party awarded a contract will accept the award and perform the contract.

Advance Payment Guarantee: Exporters are expected to secure a mobilization advance of 10-20% of the contract value, which is normally released against bank guarantee and is generally recovered on a pro-rata basis from the progress payments during project execution. The contractor often seeks some funds from project buyer for mobilization of necessary resources before the start of the project. Such advance is adjusted from the progress payments that become due to project exporter during execution.

Performance Guarantee: Performance guarantee for 5-10% of contract is issued, valid up to completion of maintenance period normally one year after completion of contract period and/or grant of Final Acceptance Certificate (FAC) by the overseas employer. Format of guarantee is furnished by exporter at least four weeks before actual issue, to facilitate discussions and formal approval.

Guarantee for Release of Retention Money: This enables the exporter to obtain the release of retention money (normally 10% of contract value) before obtaining Final Acceptance Certificate (FAC) from client.

Down Payment Guarantee: On supply of equipment some project buyers agree to release a portion of the payment pending acceptance of the equipment. Down payment guarantees are issued to secure such guarantees.

Guarantee for Raising Borrowings Overseas: Bridge finance may be needed at the earlier phases of the contracts to supplement the mobilization advance. Bridge finance up to 25% of the contract value may be raised in foreign currency from an overseas bank against this guarantee issued by a bank in India. Request for overseas borrowings must be supported by currency-wise cash flows, also indicating the outstanding letters of credit and L/C drawal schedule.

Other Guarantees: For example, in lieu of customs duty or security deposit for expatriate labor.

Guarantee commission is charged at rates stipulated by the Foreign Exchange Dealers Association of India (FEDAI) or as stipulated by guarantee issuing bank. Margin requirement for issue of guarantee is generally waived by banks for Export Performance Guarantee. However, appropriate securities are availed of.

Funded Facilities

Packing Credit: This is granted in Indian rupees for meeting the preshipment expenses related to the project**.**

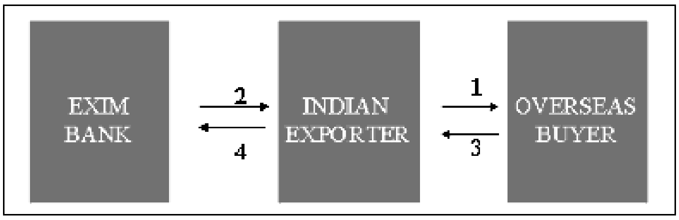
Rupee/Foreign Currency Supplier's Credit: when a project export is on deferred credit terms, the exporter may seek finance on matching terms so that his liquidity does not get affected. Such finance can be granted in Indian rupees or foreign currency.

Supplier's Credit

EXIM Bank enters into Supplier's Credit Agreement with Indian exporters as also with exporter's commercial bank in the event of the latter's participation in the Supplier's Credit. The agreement covers details of draw-down, repayment, and includes an affirmation by Indian exporter that repayment to EXIM Bank would be made on due date, regardless of whether due payments have or have not been received from overseas buyer. The exporter repays principal amount of credit to EXIM Bank as per agreed repayment schedule. Interest amounts are payable to EXIM Bank half-yearly without any moratorium. RBI has laid down guidelines for project exports and export of goods from India on deferred payment terms in Memorandum PEM.

Figure 3: Export Credits

Post Shipment Supplier's Credit



1. Export of goods/services/extension of deferred credit.
2. Extension of supplier's credit.
3. Repayment of deferred credit.
4. Repayment of supplier's credit

***Overseas Buyer's Credit*:** Credit is offered directly t.o overseas buyer for a specific project/ contract.

Pre-Shipment Rupee Credit: Pre-shipment Rupee Credit is extended to finance temporary funding requirement of export contracts. This facility enables provision of rupee mobilization expenses for construction/ turnkey projects. Exporters could also avail of pre-shipment credit in foreign currencies to finance cost of imported inputs for manufacture of export products to be supplied under the projects. Commercial banks also extend this facility for definite periods.

Refinance of Export Credit: Authorized dealers in foreign exchange can obtain from EXIM Bank, 100 percent refinance of deferred payment loans extended for export of eligible Indian goods.

Finance for Rupee Expenditure for Project Export Contracts (FREPEC)

The FREPEC program seeks to finance rupee expenditure for project export contracts, incurred by Indian companies.

The purpose of this credit is to enable Indian project exporters to meet Rupee expenditure incurred/required to be incurred for execution of overseas project export contracts such as for mobilization/purchase/acquisition of materials and equipment, mobilization of personnel, payments to be made in India to staff, sub-contractors, consultants and to meet project related overheads in Indian rupees.

Indian project exporters who are to execute project export contracts overseas secured on cash payment terms or those funded by multilateral agencies will be eligible to seek assistance under the FREPEC program. The purpose of the new lending program is to give boost to project export efforts of companies with good track record and sound financials. Under this program, the quantum of credit extended can be up to 100% of the peak deficit as reflected in the rupee cashflow statement prepared for the project. EXIM Bank will not normally take up cases involving credit requirement below Rs.50 lakh. Although, no maximum amount of credit is being proposed, while approving overall credit limit, credit-worthiness of the exporter-borrower would be taken into account. Where feasible, credit may be extended in collaboration with sponsoring commercial banks.

Disbursements made under this program are in rupees through a bank account of the borrower-company against documentary evidence of expenditure incurred accompanied by a certificate of Chartered Accountants.

A FREPEC loan can be repaid normally out of project receipts. Period of repayment would depend upon the project cash flow statements, but will not exceed four years from the effective date of project export contract. The liability of the borrower to repay the credit and pay interest and other monies will be absolute and will not be dependent upon the actual realization of project bills.

The security stipulated for a FREPEC loan is in the form of:

a. Hypothecation of project receivables and project moveables.

b. **Optional:** where available,

- Personal Guarantees of Directors of the Company.
- Available collateral security.

* Where cost is not prohibitive or where the borrower-company is prepared to bear the cost, packing credit guarantee of ECGC may be obtained.

ROLE OF ECGC IN PROJECT EXPORTS

The Export Credit Guarantee Corporation of India Limited was established in 1957 by the Government of India to strengthen the export promotion drive by covering the risk of exporting on credit. The ECGC has been playing a crucial role by providing credit insurance cover for exports from the country. Apart from credit insurance, pre-shipment and post-shipment credit is also offered. It also provides guarantee covers issued to overseas beneficiaries, lines of credit and buyers credit, receivables management and debt collection. Being an export promotion organization, it functions under the administrative control of the Ministry of Commerce, Government of India. It is managed by a Board comprising representatives of the Government, RBI, banking, insurance and export community. ECGC, the fifth largest credit insurer of the world, presently covers 17.31% of India's total exports. Limited risk taking capabilities, double premium payment against guarantees, not covering the loss are some of the inherent problems faced by ECGC.

Box 6: Specific Recommendations on Need of Government Support to ECGC
– Government should extend support to ECGC to provide service in the same manner as a project exporter in a competing country would be getting from his export credit insurance provider (counterpart of ECGC in competitors country).
– ECGC should be reimbursed the losses on account of political risks by Government of India by taking over the debts of Iraq. It has been done so in other countries in similar situations where the national governments have paid out compensations out of their budgets without affecting the financial position of credit risk insurer.
– Strengthening of equity base of ECGC to ensure capital adequacy as per accepted norms of credit insurance business.
– Wherever reinsurance is possible to arrange, if the costs are prohibitive, governmental support in the pricing to ensure smooth cash flow and lesser financial burden for exporter should be considered.
– Government Guarantees to enable ECGC to cover high value project risks without the need of reinsurance, which will make them competitive and also provide cover in some countries in emerging markets like Africa & Latin America.
– In the absence of reinsurance, ECGC should be in a position to draw support from the Government National Interest Account, or even to operate the cover on behalf of the Government.
– The underwriting of risks may be done on behalf of and to the account of Government.
– Yearly allocation currently to equity takes care of only short term underwriting capacity. A quantum jump say from the present level of Rs. 50 crores to Rs. 300 crores per year for 6 years will enable ECGC to undertake atleast 5 times of that as additional maximum liability.

– The proposal regarding National Interest Account as is prevalent in other countries like UK, Australia, Republic of Korea should be implemented. This enables cover for project exports which otherwise do not meet the normal commercial underwriting criteria.

– ECGC, as an institution, must evolve and gear itself to function as a significant credit insurance agency to support project exports from India.

Source: http://finmin.nic.in/, Report of Task Force on Project Exports

ECGC provides a range of credit risk insurance covers to exporters against loss in export of goods and services, and also offers guarantees to banks and financial institutions to enable exporters obtain better facilities from them. Exporters have a lot to benefit from ECGC as it provides:

- Insurance protection to exporters against payment risks.
- Provides information on credit-worthiness of overseas buyers.
- Provides information on about 180 countries with its own credit ratings.
- Guidance in export related activities.
- Makes it easy to obtain export finance from banks/financial institutions.
- Assists exporters in recovering bad debts.
- Offers guarantees to banks and financial institutions to enable exporters obtain better facilities from them.
- Provides Overseas Investment Insurance to Indian companies investing in joint ventures abroad in the form of equity or loan.

Box 7: Export Credit for Projects In Global Arena

In Canada, the United States and other industrialized nations most projects, outside of those carried out by government are financed through the private financial sector. In these countries, obtaining the project financing is not normally a responsibility of the construction contractor. In the developing countries this is not necessarily the case. A financing package, including local costs, is often the most important element of the contract proposal. The successful international contractors are those who are able to bring financing to the table during negotiations.

The financing for construction projects carried out by Canadian firms in developing countries is often provided by the Canadian government through the Export Development Corporation (EDC), the Canadian International Development Agency (CIDA) or an international financial institution (IFI) such as the World Bank.

In the past, financing from an export credit organization such as the EDC has been blended with development assistance from CIDA to provide mixed credit or "concessional financing" offering interest rates and terms more acceptable to the buyer. However, in view of recent agreements among members of the Organization for Economic Co-operation and Development (OECD), of which Canada is a member, such concessional financing is increasingly rare.

The role of the multi- and bilateral agencies, including the World Bank and its agencies (the International Finance Corporation and Multilateral Investment Guarantee Agency), the U.S. Export-Import Bank, the Overseas Political Insurance Corporation, and other regional development banks and export credit agencies is to provide and arrange finance and political risk insurance cover for international infrastructure projects. Several of these entities (e.g., U.S. EXIM and OPIC) have recently established or expanded their own project finance lending groups, however, and some have even established their own project advisory groups (e.g., the IFC).

ECGC Policy/Guarantee

The ECGC offers the following cover for the project export facilities.

i. Guarantee cover to the bank.

ii. Policy covers to exporters.

GUARANTEE COVER TO THE BANK

ECGC has designed a scheme of Guarantees for banks with a view to enhance the creditworthiness of the exporters, so as to enable them to secure better and larger facilities from their bankers. These Guarantees assure the banks that ECGC would make good a major portion of the bank's loss the loss in the event of an exporter failing to discharge his liabilities to the bank. The bank is required to be the co-insurer to the extent of the remaining loss. Any amount recovered from the exporter subsequent to payment of claims shall be shared between ECGC and the bank in the same ratio, in which the loss was borne by them at the time of settlement of claim. Recovery expenses shall be first charged on the amounts recovered.

To meet the varying needs of exporters, ECGC has evolved the following types of Guarantees:

- Packing Credit Guarantee.
- Export Production Finance Guarantee.
- Post-Shipment Export Credit Guarantee.
- Export Finance Guarantee.
- Export Performance Guarantee.
- Export Finance (Overseas Lending) Guarantee.

Packing Credit Guarantee

Any loan given to an exporter for the manufacture, processing, purchasing or packing of goods meant for export against a firm order or Letter of Credit qualifies for Packing Credit Guarantee. Pre-shipment advances given by banks to parties who enter into contracts for export of services or for construction works abroad, to meet preliminary expenses in connection with such contracts are also eligible for cover under the Guarantee. The Guarantee is issued for a period of 12 months against a proposal made for the purpose and covers all the advances that may be made by the bank during the period to a given exporter within an approved limit. For the banks, which undertake to obtain, cover for packing credit advances granted to all its customers on all-India basis, ECGC issues Whole Turnover Packing Credit Gguarantee (WTPCG). In consideration of the large volume of business offered for cover and widespread risks that will thus become available to it, the ECGC grants a higher percentage of cover, lower premium rate and considerable reduction in procedural formalities.

Export Production Finance Guarantee

The purpose of this Guarantee is to enable banks to sanction advances of the pre-shipment stage to the full extent of cost of production when it exceeds the FOB value of the contract/order, the differences representing incentives receivable. The extent of cover and the premium rate are the same of Packing Credit Guarantee. Banks having WTPCG are eligible for concessionary premium rate and higher percentage of cover.

Post-Shipment Export Credit Guarantee

Post-shipment finance given to exporters by banks through purchase, negotiation or discount of export bills or advances against such bills qualifies for this guarantee. It is necessary, however, that the exporter concerned should hold suitable policy of ECGC to cover the overseas credit risks.

Export Finance Guarantee

The Guarantee covers post-shipment advances granted by banks to exporters against export incentive receivable in the form of cash assistance, duty drawback, etc.

Export Performance Guarantee

Exporters are often called upon to execute bonds duly guaranteed by an Indian Bank at various stages of export business. An exporter who desires to quote for a foreign tender may have to furnish a bank guarantee for the bid bond. If he or she wins the contract, he or she may have to furnish bank guarantees to foreign buyers to ensure due performance, or against advance payment, or in lieu of retention money, or to a foreign bank, in case he or she has to raise overseas finance for his or her contract. Bank guarantees are also furnished by exporters to the customs, central excise or sales tax authorities for the purpose of clearing goods without payment of duty or for exemption from tax for goods procured for export.

The Export Performance Guarantee is aimed at meeting situations where the exporter's bank is unwilling to issue a Guarantee. The Guarantee, which is in the nature of a counter guarantee to the bank, is issued to protect the bank against losses that it may suffer on account of guarantees given by it on behalf of exporters. This protection is intended to encourage banks to give guarantees on a liberal basis for export purposes.

In the case of Bid Bonds relating to exports on medium/long term credit, overseas projects, and projects in India financed by international financial institutions as well as supplies to such projects, ECGC is agreeable to issue Export Performance Guarantee on payment of 25% of the prescribed premium. The balance of 75% becomes payable to the Corporation by the bankers if the exporter succeeds in the bid and gets the contract.

Export Finance (Overseas Lending) Guarantee

If a bank financing an overseas project provides a foreign currency loan to the contractor, it can protect itself from the risk of non-payment by the contractor by obtaining Export Finance (Overseas Lending) guarantee.

POLICY COVER TO THE PROJECT EXPORTERS

Policy covers are available to exporters to cover the risk of non-payment by buyer due to various reasons after due and satisfactory performance by the exporter. ECGC issues Construction Works Policy for contracts involving civil construction and Specific Contract Policy (SCP) for other project export contracts. A comprehensive policy covers both risks of commercial default as well as political risk i.e. where the foreign buyer has paid in local currency aboard but owing to various political factors like local government regulation, foreign exchange crisis, war, etc, the amount paid cannot be remitted to India.

Specific Policies

The Standard Policy is a whole turnover policy designed to provide a continuing insurance for the regular flow of an exporter's shipments of raw materials, consumer goods and consumer durables for which credit period does not exceed 180 days. Contracts for export of capital goods or turnkey projects or construction works or rendering services abroad are not of repetitive nature and they involve medium/long-term credits. Such transactions are, therefore, insured by ECGC on a case-to-case basis under specific policies.

All contracts for export on deferred payment terms and contracts for turnkey projects and construction works abroad require prior clearance of Authorized Dealers, EXIM Bank or the Working Group in terms of powers delegated to them as per exchange control regulations. Applications for the purpose are to be submitted to the Authorized Dealer (the financing bank), which will forward applications beyond its delegated power to the EXIM Bank. Proposals for Specific Policy are to be made to ECGC after the contract has been cleared by the Authorized Dealer, EXIM Bank or the Working Group, as the case my be.

To be eligible for cover under specific policies, the terms of payment for the export contracts should be in line with customary practices in the international markets. At least 15% of the contract value should be payable before shipment including an advance payment of at least 5%. The balance amount should be repayable in equal semi-annual installments commencing six months after the date of shipment or mean date of shipment. Where the contract provides for supply and erection of a complete plant, the first installment may fall due after six months from the date of commissioning of the plant. The credit period should not normally exceed 5 years. Longer credit period may be approved only in the case of exceptionally large projects if the circumstances of the case justified it. Adequate security should be obtained in the form of government guarantee or bank guarantee.

In order to be sure of the cover, exporters should get in-principle approval of the ECGC and obtain the premium rates well before concluding contracts. If the terms and conditions undergo any change subsequently, the ECGC should be kept informed of the same.

Specific policies are issued if the ECGC approves proposals, which are to be made on the forms specified for the purpose. The entire premium is payable in advance. Installment facility may be granted for payment of a part of the premium if the contract value is very large and if the shipments are spread over a relatively long period, but the entire premium will have to be paid by the time the last shipment is made. Interest will be charged for the installment facility.

CONSTRUCTION WORKS POLICY

Construction Works Policy is designed to provide cover to an Indian contractor who executes a civil construction job abroad. The distinguishing features of a construction contract are that:

a. The contractor keeps raising bills periodically throughout the contract period for the value of work done between one billing period and another;

b. To be eligible for payment, the bills have to be certified by a consultant or supervisor engaged by the employer for the purpose; and

c. That, unlike bills of exchange raised by suppliers of goods, the bill raised by the contractor do not represent conclusive evidence of debt but are subject to payment in terms of the contract which may provide, among other things, for penalties or adjustments on various counts.

The scope for disputes is very large. Besides, the contract value, the estimate of the work to be done, the cost escalation, variation contracts, additional contracts, etc., can be disputed. It is, therefore, important that the contractor ensures that the contract is well drafted to provide clarity of the obligations of the two parties and for resolution of disputes that may arise in the course of execution of the contract. Contractors will be well advised to use the standard conditions of contract (International) prepared by the Federation International Des Ingenieurs conseils (FIDIC) jointly with the Federation International du Batiment et des Travaux Publics (FIBTP).

The Construction Works Policy of ECGC is designed to protect the Contractor from 85% of the losses that may be sustained by him or her due to the following risks:

i. Insolvency of the employer (when he or she is a non-government entity).

ii. Failure of the employer to pay the amounts that become payable to the contractor in terms of the contract, including any amount payable under an arbitration award.

iii. Restriction on transfer of payments from the employer's country to India after the employer has made the payments in local currency.

iv. Failure of the contractor to receive any sum due and payable under the contract by reason of war, civil war, rebellion, etc.

v. Failure of the contractor to receive any sum that is payable to him or her on termination or frustration of the contract if such failure is due to its having become impossible to ascertain the amount or its due date because of war, civil war, rebellion, etc.

vi. Imposition of restrictions on import of goods or materials (not being the contractor's plant or equipment) or cancellation of authority to import such goods or cancellation of export license in India, for reasons beyond his or her control.

vii. Interruption or diversion of voyage outside India, resulting in his or her incurring in respect of goods or materials exported from India, of additional handling, transport or insurance charges, which cannot be recovered from the employer.

Project exports are regarded as a key indicator of the technological maturity and industrial capability of a country. Such projects are of high value and exporters undertaking them should offer competitive credit terms in order to secure order from foreign buyers amid stiff international competition. India is viewed as a country offering international standards of project exports at prices lower than that offered by the western countries. In spite of its low share in world projects, project exports from India have potential and the success ratio of overseas bids is increasing.

In India, Larsen & Toubro, BHEL, Engineers India, KEC and a few others, dominate the project exports scenario. There has been no significant growth in the number of exporters catering to the global markets. The reasons are as follows:

a. Indian firms do not have strong balance sheets to take on additional exposure.

b. Resources are too thinly spread, a single failed contract would totally wipe out the year's profit or even make a serious dent in a company's net worth.

c. Inadequate flow of information, insufficient time for preparing bids, making presentations and availing lines of credit at short notice.

The above stated problems can be overcome by following adequate measures, which include (a) Companies entering into a consortium arrangement, (b) Government establishing a cell for monitoring global project activities, (c) Posting tender alerts on specific sites and providing information about the ongoing projects by other companies in the country could be given, and d) Indian embassies in various countries could be utilized for giving initial information before the tenders are floated.

The government needs to initiate the above steps to catalyze the existing structure, and the initial investments could definitely lead to a quantum jump in project exports.

Since the project exports business is getting more and more competitive, especially for tailor-made/capital goods sector, faster delivery alone provides an edge over other competing countries. Simplification of licensing procedures and flexibility in imports of inputs are required to boost physical as well deemed export contracts.

SUMMARY

- Term loans refer to loan availed by a borrower with a repayment facility in periodic installments over a pre-specified period. Repayment of the loan depends on the future income of the borrowing unit. Term loans are provided by financial institutions and commercial banks with a repayment period between seven to fifteen years.
- The term "project finance" is generally used to refer to a non-recourse or limited recourse financing structure in which debt, equity, and credit enhancement are combined for the construction and operation, or the refinancing, of a particular facility in a capital-intensive industry, in which lenders base credit appraisals on the projected revenues from the operation of the project, rather than on the general assets or the creditworthiness of the sponsor.

- Financing of international trade takes two forms – financing of imports and financing of exports.
- Import financing in a major way is done through letters of credit. Though a letter of credit, per se, is not a financing instrument, it is an important document, which facilitates financing.
- In export financing, commercial banks play a vital role since they become channels in the process of financing in one form or the other. As in the case of any business, commercial banks are predominantly involved in extending working capital finance to exporters. Project exports form the major section in export financing of banks.
- Project export is the term collectively used for export of engineering goods; Turnkey contracts on cash/deferred payment terms and; Overseas construction contracts.
- Exports where more than 10% of the value is realized beyond the prescribed period, i.e., 6 months from date of shipment, are treated as Deferred Payment Exports.
- The international project financing in Indian scenario is dominated by EXIM bank and commercial banks. International Projects Group, Inc., can assist exporters in arranging financing that provides the payment terms their buyers demand while delivering immediate cash to the seller.
- The EXIM Bank provides financial assistance to promote Indian exports through direct financial assistance, overseas investment finance, term finance for export production and export development, pre-shipping credit, buyer's credit, lines of credit, re-lending facility, export bills rediscounting, refinance to commercial banks.
- The ECGC has been playing a crucial role in project exports. ECGC provides a range of credit risk insurance covers to exporters against loss in export of goods and services, and also offers guarantees to banks and financial institutions to enable exporters obtain better facilities from them. The ECGC offers the following cover for the project export facilities: (i) Guarantee cover to the bank (ii) Policy cover to exporters.
- Therefore while appraising a Term Loan proposal; Bank must see that the Project must meet the following: (a) Estimated Project cost is reasonable and complete and has fair chance of materializing. (b) The financial arrangements are complete and comprehensive. (c) Estimate of earnings an cost of production is realistic.

Annexure I

Model Project Appraisal Check List Followed by Lenders

A comprehensive appraisal of a project needs to cover the under noted aspects:

i. Technical
ii. Managerial
iii. Economical
iv. Financial.

Technical

– Feasibility of Technical Process and its suitability.
– Adequacy of the scale of operation and adequacy of the machinery.
– Whether the technology is up-to-date.
– Arrangements for securing technical know-how.
– Effluent disposal and By-products.
– Suitability of site location and availability of infrastructure.
– After sales service/reliability of suppliers.

Economical

– Whether in line with national policy.
– Whether import substitution.
– Whether Foreign-exchange earner.
– Regulatory Controls in regard to pricing, raw materials, production etc.

Managerial

– Marketing, Financial, Technical Experience.

Financial

– Analysis of past years (For existing units)
– Financial plan
– Capital Structure
– Availability of other resources
– Projection of Cash Flow during construction and also during operation.
– Rate of Return.
– Debt Equity Ratio.
– Debt Service Ratio.

The Basic Data Required for Financial Analysis

– Cost of the Project (whether additional or new).
– Cost of Production and Profitability.
– Cash Flow estimates (sources and uses of cash during the currency of the loan).
– Balance Sheet for the last three years.

Cost of Project

A comprehensive and critical review is necessary to ascertain,

– The reasonableness and flexibility of estimates.
– Arrangement to raise fund to finance the project as a whole.
– The project is on acceptable proposition generally.
– The modification required.

Cost of Production and Profitability

- Break-even analysis to ascertain profit margin (value and volume).
- General tendency is to show low production cost.
- Ensure all important elements of cost are taken.
- Demand gap – reasonableness of price in competition.
- Quality of the product.

Cash Flow Estimate

- To ensure when the cash is needed.
- What are the sources of cash.
- To ensure repayment of loans and interest from cash accruals.
- For this Debt Service Coverage Ratio to be commented upon.
- The emphasis here is that it is not enough to show profit on paper but there should be accrual of cash itself.

Debt-Service Coverage Ratio is arrived at:

$$\frac{\text{Cash Accruals}}{\text{Total Interest} + \text{Loan Installmen due during the year}}$$

(Cash Accruals =Net Profit (after tax and after providing Interest on all long term borrowings) + Depreciation added back.

This ratio as also the Cash Flow estimate will provide information about:

- Margin of safety to lending institution
- The time when repayment should start.
- Total period of repayment.

(The emphasis here should be not to impose any strain on the unit but reasonable flexibility should be shown keeping in view, however, the margin of safety).

Here again the Return on Investment or the Rate of Return has to be considered. The minimum rate of return on Investment (Equity) should not show less than what would have been earned in long term investment of fund in a Bank.

Balance Sheet

- For expansion, last three years with comparative Profit and Loss Account.
- For new units, projected, balance sheets.
- Balance Sheet-comparison of Figures to ascertain trade trends.
- Comparison of Return earned by similar industries.
- Quality of Management.
- After the comparison is made and indications received:

1st Step	Preparation of Projected Profit and Loss for next – 4/5 years.
2nd Step	Preparation of Cash Flow for next – 4/5 years.
3rd Step	Preparation of Projected Balance Sheet for the next 4/5 years – the figutres of cash flow statement being the basis and link.

The Projected Balance Sheet will give information about,

- Adequacy of Debt: Equity
- Adequacy of Current Ratio.

Annexure II

Model Appraisal Memorandum followed by the Lending Bank in India

Branch:

Name of the applicant Company:

Project:

MTL/DPG Rs.

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1. **Proposal:** Briefly mention what the proposal is.
2. **Brief History: State Briefly**

(A) a. How the company came into being

b. The promoters and their standing

c. How the company grew to its present position

d. What are the important activities of the company

(B) **Present management set up**

List of Board of Directors/their addresses.

(C) **Whether** the company's Memorandum & Articles of Association contain any clauses prejudicial to the Bank's interests – if so – the action taken in respect thereof.

Whether there are limitations to the company's borrowing powers.

(D) **The company's subsidiaries** – if any – their activity – the company's interest in them etc.

3. **Past Performance** (for existing companies)
   a. Licenced/installed/operating capacity
   b. Sales
   c. Operating profit and net profit

   Comment about:
   a. The declining trends, if any, over the years
   b. Any strikes/lockouts etc. during the least 3 years – the steps taken by the company in this regard.
   c. The company's divided policy
   d. Any scheme of capital expenditure implemented during the last 3 years & how they were financed.

Indicate whether the company's past performance has been generally satisfactory.

4. **Present Financial Position**
   a. Attach the company's latest audited Balance Sheet & P&L A/c together with comparative abstract of B/S's
   b. Comment on
      i. Company's financial position
      ii. Company's capital structure
      iii. Large shareholders and the extent of their shareholding
      iv. Company's tax assessment
      v. Depreciation method
      vi. Contingent method
      vii. Suits, if any, filed by or against the company – their details
      viii. The Auditor's report on the company – if qualified/adverse

5. **Project**

   a. **Description:** of the project for which assistance is required by the company – who has prepared the project report.

   b. **Collaboration Agreement:** Briefly summarize the collaboration agreements – both technical and financial

      – the collaborator's standing/experience

      – any restrictive/prejudicial clause in the agreement

      – royalty payable

      – Govt's approval.

c. **Cost of the Project**

Rupee cost	Rupee equivalent of FE cost	Total

   i. Land

   ii. Buildings

   iiii. **P & M**

      – Cost (CIF)

      – + ST, Octoral

      – + Import duty etc.

      – + Erection charges.

   iv. **Other Fixed Assets**

   v. **Technical knowhow fee**

      Engineering fee

   vi. **PROE**

      Preliminary expenses

      Preoperative expenses

   vii. **Contingencies**

      Capital Cost ____________________

   viii. **W/C Margin**

   Total cost of ____________________

   Project ____________________

6. **COMMENT** in detail on various items of **Cost of Project**

A. **Land:**

   – its location, extent, it adequacy for present & future.

   – if lease hold – the term of lease etc.

   – whether the price payable is reasonable.

   (cost to include all preparatory/development expenses & registration charges)

B. **Building:**

	List out separately
i. Factory	**Comment on**
ii. Administrative Office	Floor space, its adequacy, the need, who has prepared the estimates are the reasonable–
iii. Laboratory	– who will undertake construction work
iv. Godown	– his experience/skill/past performance his acceptability for the proposed work – are the quotations reasonable/acceptable.
v. Staff Quarters	– any legal impediment
	– has the plan been approved by the appropriate Municipal/Town/Panchayat/Authorities
	– any subsidy/grant available from Govt.

C. **Plant & Machinery**

i. Are the company's requirements of P&M estimated properly?

ii. Are the P&M suitable, essential and adequate for their needs?

iii, Who are the suppliers – their standing/quality?

iv. If imported – who are the overseas suppliers? – has the import been cleared by Govt. – Import Licence.

v. If second hand – are the P&M in good condition – what is their further useful life – (should be at least equal to the currency of Bank's TL/DPG) – is the price paid reasonable – Any expert (Valuer's) opinion report obtained on its condition/capacity.

vi. Whether the supply contracts (for P&M) provide for any performenace guarantee

– are the prices quoted firm

– what are the arrangements for after sales service of the P&M

vii. Who will undertake erection of the machinery

– are they competent/acceptable

viii. Are the estimates furnished by the company

– reasonable and inclusive of all duties/insurance/freight/tax/ cleaning, transport & erection charges/?

– Any provision for price escalation?

D. **Other Fixed Assets** – their need/adequacy/cost – are they reasonable? Do they take care of items like Railway siding/ laboratory/Water effluent treatment plants, vehicles, furniture, fixtures etc.

E. **Technical Know how & Engineering Fees**

Are they realistic/reasonable and provided for inte collaboration agreement.

F. **Preliminary & Preoperative Expenses**

Preliminary & capital issue expenses

Preoperative expenses	(i) Interest on borrowings/guarantees/ deferred payments (ii) Mortgage expenses (iii) Working expenses

Are these all reasonable & comprehensive?

G. **Provision for contingencies –** explain the basis and its adequacy

H. **Margin for working capital –** indicate the basis of the computation and its adequacy.

I. **General –** State whether the total cost of the project is comprehensive and reasonable (Wherever necessary, get the figures corroborated through independent enquiries and comparative studies)

7. **Means of Financing**

	Rupee	Rupee cost equivalent of FE cost	Total
i. Share capital – ordinary Preference			
ii. Debenture			
iii. Term Loans			
iv. Deferred Payments (including preoperative but excluding amounts due upto start up of production)			
v. Unsecured loans & deposits			
Internal cash accruals			
Total Sources			

Briefly comment on:

a. Share capital	–	Terms of issue armaments made for underwriting. Promoter's contribution and their percentage to total cost
b. Debentures	–	Terms of issue – rate of interest – date of redemption – security – underwriting arrangements
c. Terms Loans	–	Details of tie up
d. Unsecured Loans & deposits	–	Source/rate of interest/terms of repayments
e. Deferred payments	–	Terms of Bank guarantee, if any, Security terms etc.
f. Internal Cash accruals	–	Are the figures assumed reasonable/realistic? What is the company's current profitability? Have all the company's commitments been taken into account?
In general	–	comment whether scheme of financing is in order and the debt/equity gearing is in order.

8. **Production Factors**

a. **Process**

– briefly describe the process

– is it suitable to the activity chosen?

– is it under any patent arrangement?

b. **Raw materials**

– What are they? – requirements of the company

– how many suppliers are there

– if imported is import license available & valid?

– are the arrangements for procurement of raw materials adequate?

c. **Utilities**

Requirements and availability of power/fuel/water/transport

– are they reasonable and adequate?

d. **Operating Organization**

i. Who will manage execution of the project?

ii. Who will operate the plant?

Do they have the required knowledge/ability/skill?

9. **Project Implementation Schedule**

Indicate the schedule of

i. Construction of building
ii. Erection of P&M
iii. Start up
iv. Trial production
v. Commercial production

Is it acceptable?

10. **Working Capital Requirements**

Comment on

i. the basis of computation – its reasonableness and acceptability
ii. are the stocks subject to directives like Inventory Norms/SCC etc. – if so, have these been taken into account? Are any deviations (from these directives) being considered? If so why and for how long?
iii. is the company confining its entire banking business to us? if not why?
iv. has the margin W/C/R been included in Cost of Project?

11. **Marketing**

This is a very crucial area and requires to be examined in depth and with utmost care.

a.

Sale prospects	**They depend upon**
Product Mix	Pricing
Market Share	After sales service
Competition	Selling arrangements
quality of Product	Marketing Strategies

Therefore carefully –

– study the assumptions made by the company in estimating extent of market
– refer to the information/data available with Bank/Branch and get the assumptions corroborated.
– validate eh market survey, if any, conducted by the company directly or though others.
– indicate the demand – principal buyers
– the supply position – the number of sources
– examine the prospects of the buyer (who manufactures the final end product) if our company's product is an intermediate
– take into account the status/extent of competition
– examine tariff protection if any, available

State whether the marketability he product as assumed by the company is assured and reasonable/acceptable.

b. **Selling price:** Has the price trend been stable? Are there Govt. Controls?

What is the company's pricing policy? Has the company taken into account all the costs involved?

c. **Export prospects**

Is the company under any export obligation as per Govt. stipulations? What are the prospects for exports? Are the prices quoted by the company for exports competitive and at the same time remunerative?

Any subsidies duty/draw backs available from Govt.?

d. **Marketing Organization**

What are the arrangements made by the company for marketing its products through distributors/agents/stockiest etc.

12. **Commercial Viability**

This is an equality important aspect in the appraisal of any Term Loan proposal.

The figures/assumption/estimates should be checked and doubly checked to ensure against any over ambitious and unrealistic projections.

Particularly the following areas need to be highlighted and focused on:

Sales	Quantity	–	is it realistic and in line with the installed plant capacity, operating capacity and past trends.
	Value	–	depends on quantity of sales and selling price

Are these realistic and acceptable?

b. **Cost of Production**

i. Classification of costs to be proper.

ii. Costs to be verified in relation to total production and aggregate sales.

Are these costs – both variable and fixed-realistic?

iii. Other major items of costs like depreciation and interest on borrowings – to be verified. Is depreciation charge in conformity to the Companies Act requirements and those of Income Tax Rules?

Similarly, interest calculations to be checked and it should be ensured that interest obligations on all borrowings-institutional and non-institutional – including the proposed loans and working capital finance – have been taken into account.

iv. Is the provision for taxation adequate?

c. **Profitability**

Compare the Net Profit

WITH Sales, equity and capital employed

Is the position satisfactory and in tune with the industry level?

Indicate the position – viz., DSCR year-wise for the entire period of currency of the loan.

13. **Cash Flow**

    Examine the cash flow statement –

    Are the assumptions underlying the statement realistic?

    Will the company's cash generation be adequate to meet all its commitments – at least as long as our Bank's loan is outstanding?

    Is it necessary to place any restriction on the company's disposition of the cash/accrual towards dividend/expansions/repayment of unsecured loans etc.

14. **Repayment Programme**

    Briefly indicate the proposed schedule of replacement of the Bank's Term Loan and the necessity for a start-up period.

15. **Govt. and other Consents**

    Indicates the present status of Governmental and other consents for example, Industrial Licence, clearance for import of P&M, approval for collaboration and its terms, approval for deferred payment terms for P&M, clearance for tax exemptions, approval from State Govt./Municipal/Town authorities.

16. **Management**

    Comment on the quality of company's management:

    - particularly Finance/Purchase/Production/Personnel/Sales.
    - organizational set-up and systems of control.
    - Is the company employing any Management Consultants
    - if so their reputation.

17. **Subsidiaries**

    Furnish (as annexure) a brief review of the financial position of each of the subsidiaries – comment particularly on:

    a. their current working and outlook for future.

    b. their dependence on parent company, and others for financial assistance.

    c. their borrowing arrangements, if any, with the Bank – Are these connections satisfactory?

    d. do you consider it necessary to stipulate special covenants relating to the applicant company's further investment in the subsidiaries or repayment of loans raised form them.

18. **Security & Margin**

    Give complete details of the security offered for the Bank's assistance.

    Primary

    Security

    Collateral (Including third party guarantee)

    Indicate the location, extent, ownership, value or worth and type of charge. In case of reduced margins (<50%) supporting arguments need to be furnished. Comment whether security is considered adequate.

19. **Special terms and Conditions**

    Indicate whether any special terms and conditions will require to be stipulated.

20. **Recommendations**

    In a nutshell – highlight the strengths and weaknesses of the project/scheme and finally give your recommendations for the grant of the assistance.

Chapter III

Project Initiation and Resource Allocation

After reading this chapter, you will be conversant with:

- Identification of Opportunities
- Process of Resource Allocation at the Corporate Level
- Process of Resource Allocation at the Business Unit Level
- Generation of Project Ideas and Creativity

Every firm should have a strategic plan, if it should succeed in the long run. The strategic plan should be laid out carefully, keeping all variables in view. Once it is done, all subsequent actions of the firm, particularly those relating to allocation of substantial amounts of resources, should conform to the plan. Only luck can help a firm whose strategies are aimed in one direction while its resources are deployed in another direction. Wise allocation of resources or wise capital expenditure decisions are the stepping stones for any firm's success.

Resource allocation is generally done at two levels: One, at the firm or corporate level. At this level, the distribution of resources among various departments or business units is considered. Two, at the department or business unit level. At this level, how the department or unit should utilize the resources allocated to is decided.

RESOURCE ALLOCATION AT THE CORPORATE LEVEL

Resource allocation by a corporate may be made in different ways. It may be on the basis of business functions (marketing, finance, production, etc.) or geographical areas (as in the case of a multinational firm) or according to the importance of the service rendered (like in public service). The basis chosen should always be such that it results in the optimal allocation of resources. This, in turn, depends on how best the firm can be divided into divisions, in such a way that each division's contribution to the achievement of the strategic objectives of the firm can be identified and measured.

The pattern of allocation of resources generally depends on two factors: the need for a change in the existing pattern of allocation, in the perception of the management and how centralized the decision making process is. In addition, it also depends on whether the resources of the firm are growing or declining and whether a change is called for in the overall resources and their pattern of deployment. Let us now discuss how resource allocation takes place in various situations. The same has been depicted in a summary form in figure 1.

Figure 1

Need for Change

Extent of Central Control		Low	High
	High	Formula	Imposed Priorities
	Low	Free Bargaining	Open Competition

Source: Exploring Corporate Strategy by Johnson and Scholes, 3/e, Prentice Hall India, p.314.

Growth in the Resources

When the resources are increasing it is easy to bring about a change in their relative distribution. It can be achieved by simply directing fresh inflows to the areas where they are required. An alternative method is to have a central pool of funds and make allocations from the pool. When there is growth in the resources, and central control is strong, allocation is generally imposed by the center. On the other hand, it may be competitive bidding by the divisions – whichever division offers highest returns will get the funds first.

If the need for change in the present pattern of allocation is not felt strongly, the allocation is made based on a predetermined formula or on the existing pattern. If the central control is not strong enough, then funds will be allocated by free bargaining between the divisions and the center.

Decline in the Resources

When there is a declining trend in the resources available, no firm can allow resource allocation based on a formula or free bargaining. Allocation is made either by centrally imposed priorities or competitive bidding. There are two interesting techniques that are commonly followed in such circumstances. One is amalgamation of one or more divisions. Savings in resources made by the amalgamation of two or more hitherto separate divisions, including the surplus staff, are put into the new venture proposed. Two, is reducing the resources of all other units a little. The total of the amount reduced is pooled and invested in a separate unit. If the objective is to provide resources to one of the units, the newly created unit will be eventually merged with the other unit. Otherwise, the new unit continues to be separate.

Few Changes in Resources

If the firm feels that new investments to be made or the strategy to be implemented do not call for a change in the overall pattern of allocation of resources, the allocation will again be based on either a formula or free bargaining. The formula may be, for example, that 5% of the total revenues of the firm should be used for capital investments, and they should be shared among different units in predetermined proportions. The formula method, generally, does not satisfy all the divisions. Objections may be raised about the validity and also the fairness of the formula. The other extreme of a formula is free bargaining, where the allocation to each unit is started at zero and increased based on its requirements. In practice, many firms follow a middle path. The allocations are first made based on a formula and then adjustments are made to the allocations through free bargaining.

RESOURCES ALLOCATION AT THE BUSINESS UNIT LEVEL

If resources are allocated to different units of a firm based on formula, then the units have to think of the best ways to deploy them. If allocation is based on open competition or free bargaining, units will have to be ready with their investment plans. In small firms where there is only one unit, there is only one level of allocation. But, whatever may be the levels of allocation, the investment needs of a unit depend on two factors: one, whether it can identify investment opportunities from its environment and two, whether it has the strategic abilities to take up the opportunities. Analysis of its strategic abilities itself may often lead the unit to the identification of areas where it can invest and where it should not. So, identifying investment alternatives can be described in two steps:

1. Analysis of the environment
2. Analysis of the strategic capabilities.

All ideas which arise outside the framework of these two analyses will have to be tested to see whether they are feasible considering these two. There is no point in allocating resources to something that is not feasible in the environment of the firm or which is beyond the capabilities of the firm.

Analysis of the Environment

There are various techniques and models put forth to analyze the various components or factors in the environment. In this section, we will discuss two most popular models among them, namely the PEST model[1] and Michael Porter's five force model.

1 Exploring corporate strategy by Johnson and Scholes, 3/e, Prentice Hall India, P.82.

PEST ANALYSIS

In this model, the environment is assumed to consist of four components:

1. Political/Legal factors
   - Stability of the government
   - Labor legislations
   - Tax laws
   - Foreign trade regulations
   - Monopolies legislations
   - Environmental protection laws.
2. Economic factors
   - Interest rates
   - Business cycles
   - Trends in GNP
   - Money supply
   - Inflation
   - Unemployment
   - Disposable income levels
   - Availability of fuel and its cost.
3. Socio-cultural factors
   - Changes in lifestyle
   - Attitudes towards work and leisure time and changes in them
   - Prevalence of consumerism
   - Population demographics
   - Income distribution
   - Social mobility
   - Levels of education.
4. Technological factors
   - New discoveries and developments
   - Levels of government spending on research
   - Speed of technology transfer
   - Rates of obsolescence.

Analysis on these lines will generally throw light on whether a firm should invest in a particular area, or not. If levels of personal disposable income are falling and interest rates are rising, a firm producing consumer durables should think twice before increasing its capacity. A firm with a strong research and development base may choose without hesitation a product in which technological obsolescence rate is high.

MICHAEL PORTER'S MODEL

This is a very popular model for analyzing the competitive position of a firm. It has been developed by Michael Porter and this discussion on the model draws extensively from his book 'Competitive Advantage'. The model is based on a set of five forces which according to him determine the competitive position. Let us now briefly discuss each of the forces.

Threat of Entry

'Threat of Entry' indicates how likely is the entry of more and more competitors into the market, which can threaten the position of the firm. The likeliness of entry of more players is influenced by how easy or difficult it is to enter into the market. There are certain factors in each market which make entry difficult to newcomers. Such factors are known as entry barriers. Following is a list of such entry barriers:

- Economies of scale, which give advantage to larger players (eg. Cement Industry)
- Minimum capital required to set-up a profitable venture in that industry (eg. Petrochemical Industry)
- Access to channels of distribution (eg. Pharmaceuticals)
- Cost advantages to one or more of the existing players due to possession of proprietory technology, etc.
- Expected retaliation from the existing firms (eg. Soft Drinks Industry)
- Legislations governing entry into the market, licensing requirements, etc. (eg. Cigarettes)
- Level of differentiation of the product, i.e. whether consumers have any reason to prefer the product to be produced by a specific firm among all those present in the market. (eg. Branding of products such as wheat flour, etc.)

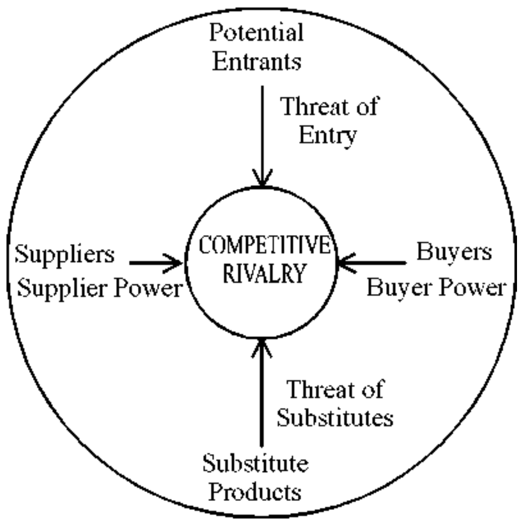
All these factors may never be present in a single market. But, looking out for all of them will provide a comprehensive view of the likelihood of entry of new firms.

Bargaining Power of Buyers

If the buyers have strong bargaining power, the producer can never be sure of getting a fair price for his product. The bargaining power of buyers will be high when:

- The buyers are few and volumes are high
- Alternative sources of supply are available
- The material cost makes up a substantial part of the total cost (low value addition)
- Backward integration by the buyers is not difficult.

Figure 2



Source: Competitive Strategy by Michael Porter, Macmillan Publishing Co.

Bargaining Power of Suppliers

The circumstances under which suppliers of the firm will have strong bargaining power can be deduced from those relating to bargaining power of the buyers:

- The suppliers are few
- Alternative sources of supply are not available
- Switching from one supplier to another is difficult or expensive
- Suppliers have strong brand image
- Forward integration by the suppliers is not difficult.

The Threat of Substitutes

The threat of substitute products may take different forms. Telephone may be substituted by Fax. Retail items like household furniture, cookers, televisions, videos can substitute each other, as, depending on the amount available, the householder may buy one rather than the other. That is, if the householder has a saving of Rs.10,000, and cannot get a television for it (which he wants), he may buy other items such as furniture for his house, that are also equally necessary for him.

The availability of substitute products can almost act as a ceiling on the price at which the product can be sold. The principal issues in evaluating the substitute products are:

- Whether the substitute product provides a higher value than the product of the firm.
- Ease or difficulty for the consumer in switching from the original product to the substitute product.

Extent of Competitive Rivalry

Competitive rivalry will be high in an industry where the threat of entry is high, both buyers and suppliers exercise tight control and substitute products abound. Apart from these, there are also other factors which can increase the competitive pressure:

- The relative sizes of the players. If all are of equal size competition will be high.
- Stagnation, for a long time.
- High fixed costs, leading to a scramble to sell the break even quantity.
- High exit barriers.

Analysis of Strategic Capabilities

The importance of analysis of strategic capabilities has already been discussed. In this section, we will discuss the steps in the analysis:

RESOURCE AUDIT

As a first step, the firm considers what are all the resources available to it. A list is made of all the resources available, classifying wherever possible into those that are readily available and those that can be obtained when required. Both quality and quantity of the resources is taken note of.

Resources are generally classified into physical, human, financial and intangible resources. All physical assets, such as land and building, plant and machinery are classified as physical resources while personnel constitute the human resources. Intangible resources are intangible assets like goodwill, etc.

VALUE CHAIN ANALYSIS

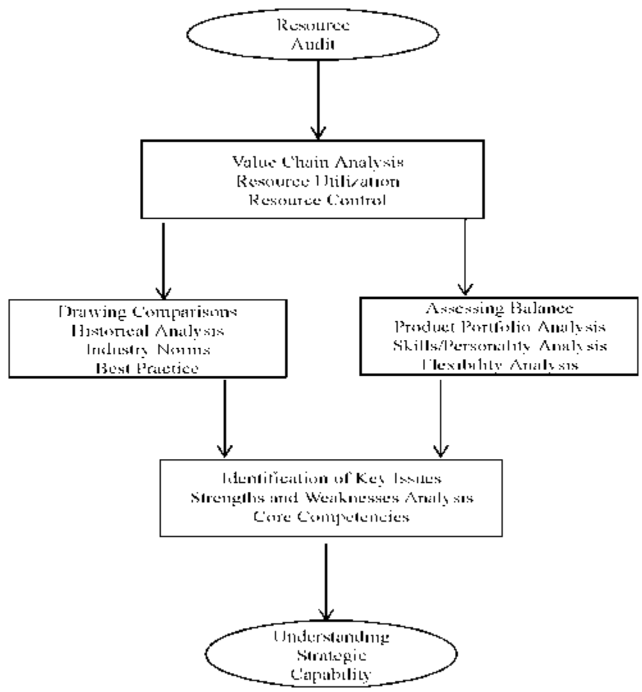
Value analysis, another wonderful tool developed by Michael Porter, is aimed at identifying the activities of the firm that are contributing value to the firm and those that are not. This is also a structured tool like the five force model.

In this model, all the activities of a firm are grouped into two: primary activities and support activities. The primary activities are in turn made into five groups.

These five groups are as follows:

i. *Inbound Logistics:* Activities like receiving, storing, and distributing inputs, transportation of inputs, etc.

Figure 3: A Framework for Analysis of Strategic Capabilities



Source: Exploring Corporate Strategy by Johnson and Scholes, 3/e, Prentice Hall India

ii. *Operations:* Activities that convert the inputs into the final product like machinery, assembling, packaging, etc.

iii. *Outbound Logistics:* Activities related to collecting, storing and distributing the final product.

iv. *Marketing and Sales:* Activities relating to creation of consumer awareness about the product and sale of the product, like sales administration, advertising, sales campaigns, etc.

v. *Service:* Activities aimed at enhancing or maintaining the value of a product.

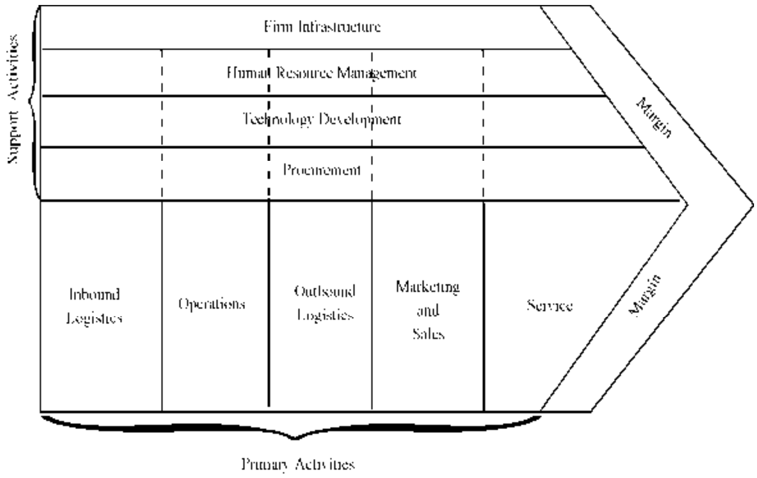
Each of these groups of primary activities is related to the support activities. Support activities make up the following four groups:

i. *Procurement:* Activities relating to purchase of inputs to the primary activities.

ii. *Technology Development:* Activities relating to acquisition or development of technology, whether the technology relates to a product or process or just a raw material.

iii. *Human Resource Management:* This group consists of activities such as recruiting, training, developing and rewarding the people in an organization.

Figure 4: A Graphical Depiction of the Value Chain



Source: 'Competitive Advantage' by Michael Porter

iv. *Infrastructure:* This group consists of the development and maintenance of various structures and functional routines in an organization.

Resource Utilization

Once the value activities – primary and support are identified and their inter-linkages are established, the next step is to identify the activities and linkages that create value to the firm.

The factors that create and sustain the competitive advantage of a firm are the critical factors and they are called the cost drivers or value drivers. For example, a firm's competitive advantage may be its low cost of transportation consequent to its proximate location to both its suppliers and consumers. In such a case, a strategy of geographical expansion or shifting the location is unadvisable to the firm.

Sometimes, value may be created by linkages between different primary activities. For example, keeping more inventory will reduce the tightness of production schedules and enable faster reaction to customers' demands. But higher inventories will result in increased storage costs. A trade-off has to be made between the two. An assessment of whether the value added by keeping more inventories is higher than the additional cost should be made. If it is more, the linkage becomes a value driver for the firm.

Similarly, linkages may also exist among support activities and between primary activities and support activities. All these activities and their linkages have to be carefully nurtured. Only they sustain the firm in the marketplace.

DRAWING COMPARISONS OR COMPARATIVE ANALYSIS

In the foregoing discussion on the value chain analysis, we have seen how various primary and support activities and linkages between them can add value to a firm and what these activities are. The value chain system of analysis encourages (or rather enables) the firm to take a critical look at the various activities undertaken by it. However, it is also necessary to study how the value system of the firm has evolved over the years and why the firm has chosen to allocate its resources in a particular manner and not in any other manner. This provides valuable insights into the desirability or otherwise of changes in the resource base to be made in future.

The analysis of the past resource base is generally done in three ways: one, study of the changes in the resource base and its deployment over the past; two, comparison of the performance of the firm with the performance of the industry as a whole; and three, comparison with the best practice outside the industry in which the firm operates.

Study of the changes in the resources of a firm over the years is called historical analysis. Historical analysis may reveal trends which are not otherwise very clear. For instance, a stock broking firm may find that over the years the proportion of its capital getting locked in investments has increased substantially. In other words, the firm has changed its focus from stock broking to investments. The revelation of the change in its area of business should make the firm reassess its strategies thoroughly.

Historical analysis can often be made more meaningful by comparing it with the performance of the industry as a whole and with the performance of similar companies. That is because, it is the relative position of the firm that matters the most. Care should be taken, while performing industry comparison, to check whether the industry as a whole is losing to competitors from other countries. In such a situation, it may be of no use even if the firm does better than the rest of the industry.

In best practice analysis, benchmarks (standard values for comparison) are arrived at based on the performance of those firms which are considered the best in each particular value activity. For instance, distribution is one of the value activities of a firm. The benchmark to be used by this firm is the distribution cost of the firm that is considered the best in distribution, not just in that industry to which the firm belongs, but all industries put together. This will enable the firm to overcome the drawback we have seen earlier in comparing its performance within the industry.

ASSESSMENT OF THE BALANCE OF RESOURCES

In the previous sections, we have seen how analysis of the strategic capabilities can be carried out through study of value activities and their inter-linkages and how the activities and linkages create and maintain value. There is, however, another issue of no lesser importance that should be considered by firms – whether the resources of the firm as a whole are well balanced or not. Study of this aspect involves three factors:

i. Whether the activities carried out by various business units are complementary to each other or not (called portfolio analysis).

ii. Whether the stock of skills (or personalities) is well balanced or not.

iii. Whether the resources are flexible and adaptable to future needs or not.

Portfolio Analysis

The BCG Matrix (named after the Boston Consultancy Group which developed it) is one of the first models of portfolio analysis. In this model, all the business units are classified into four different categories based on two criteria: whether the market share is high or low and whether the growth of the market in which the unit operates is high or low. The following table shows the classification and the names given to each type of unit based on the two criteria.

Figure 5: Classification of Business Units

		Market Share	
		High	Low
Market Growth	High	Stars	Question Marks
	Low	Cash Cows	Dogs

The implications of the above classification for the resource allocation question are as follows:

i. The cash cow produces a lot of surplus, but has no potential for reinvestment as the growth of its market is low. Therefore, the surplus generated by cash cows should be invested in stars and question marks which offer high growth potential. But, at the same time the heart burn that may be caused among the employees of the cash cow if the surplus is diverted to other units should also be considered.

ii. Question marks and stars are very demanding – not just in terms of financial resources, but also in terms of creative talent. Converting the growth potential offered by them into a useful opportunity calls for considerable amount of attention and creativity on the part of the managers. Firms should, therefore, make sure that their inventory of talented personnel is also adequate before pumping funds into them.

iii. Dogs, which is the name used for units which neither have a good market share at present nor promise growth in future, should be sold off immediately and the proceeds should be diverted to stars and question marks. However, if the dog proposed to be sold off is the brainchild of one of the powerful persons in the organization, selling it off can be politically troublesome. This should also be considered before proposing to sell off a dog.

Analysis of Balance of Skills

It is essential for organizations to make sure that they have stock of the right skills in the right proportions. The skills required for managing the production and marketing, as well as the finances and the personnel should be available in the required quantities. The skills required, obviously, change with the position in the hierarchy and also with the nature of work in the department. An ideal machinist may be an introvert, tense for most of the time that something may go wrong and always concerned with doing things in an orderly manner. The supervisor of a team of machinists, on the other hand is required to be extroverted and dominant, one who always concentrates on the achievement of the goals and one who can put people into the job they can do right. He need not have original thinking, which is an essential feature for a chief executive. Not only the availability of various skills, but the relationships between different personalities should also be taken stock of. The relationships between different departments are more important in professional organizations in which rivalry between different groups with their own specialized skills can be very serious.

Flexibility Analysis

The resources available with an organization should be flexible enough to enable it to modify its strategy in the face of any uncertainty. For analyzing an organization’s position from this angle, the first step is to identify the areas which present uncertainty. The second step is to identify the impact of an adverse happening in the areas presenting uncertainty. The third step is to design the tactical and strategic changes the organization may have to undertake to overcome the possible problems. Then, the final step is to study how far the resources available at present permit the changes required to meet the situation. For example, an area of concern for a company may be hike in the cost of raw materials by the present supplier/s. The impact of this happening could be a forced hike in the selling price. The company may to avoid a hike in selling price, have to use alternative raw materials or switch suppliers. Are other suppliers available? Does the presently available machinery permit changeover to a new raw material? Flexibility analysis culminates in finding answers to these questions.

Identification of Key Issues

The foregoing four analyses should enable the firm to identify its core competencies. A core competency is an ability of the firm that gives it an edge over its competitors. The firm would also have come to know the activities that fit best into its strategic design and the activities that do not. The firm should match its competencies and value drivers with its strategy and arrive at a conclusion on the areas and activities in which it should invest or expand. The firm should ultimately spend its resources on activities thus selected.

IDENTIFICATION OF OPPORTUNITIES

Until now, we have seen how analysis of the activities, resources, environment, etc. can provide firms with an idea of their areas of strength, and activities in which they can make investment. However, it is not necessary that investment opportunities be identified only through the methods described in the earlier sections. The idea that an investment opportunity is present in a given situation may occur to an entrepreneur in any of the following ways as well:

- **Study of the inputs and outputs of various industries**

  If the inputs used by the industries in an area are being transported from long distances, they can be produced locally.

- **Import substitution**

  Items that are now being imported, if the level of consumption is high enough, can be produced in the domestic market. Similarly, items that are in use in other countries, but not known in the domestic market can also be produced locally.

- **Reports of studies conducted by institutions**

  Financial institutions carry out studies on various industries. Such studies also help in identifying opportunities.

- **Revival of sick industries**

  There are many other methods in which one can get ideas or opportunities. Their number is limited only by the creativity of the person wanting the opportunity. It is only the person with a creative mind that can identify the opportunity or mould a situation into an opportunity for himself.

A Brief Note on Creativity and Idea Generation[2]

Creativity is the ability to create what does not already exist. It is the ability to combine, or synthesize the available information and experience to see new patterns and possibilities.

Creativity is one of the resources that firms under utilize. Though on the face of it every one in every organization welcomes creative ideas, there are many hurdles to creative ideas too:

- Creative ideas often call for changing the way things are being done at present. People are inherently averse to change.
- People in the higher positions of power hate to admit that there is a better way of doing things than what they have been doing all along.
- Trying out new methods is risky – managers always want to avoid risk.

But, in spite of all these, it is only the organizations that can accept creative ideas, cope with change, and innovate their business processes and products that will survive in the long run.

INDIVIDUAL CREATIVITY

Creativity, it is said, is a function of the right hemisphere of the brain. To make the right half of the brain work, there is a series of steps, which may help.

- First, believe that all the objects, procedures, and systems are inadequate to meet our needs.
- Then, decide on the criteria or specifications that the new idea we now want to generate should meet.
- Finally, go on generating ideas. The focus while generating ideas should only be on the quantity and not on quality.

2 This section draws extensively from Project Management by Jack R. Meredith and Samuel J. Mantel Ur, 2/e, John Willy & Sons.

Though there is no laid down technique to enable someone in creative thinking, the following techniques have been found to be of help:

i. *Attribute listing:* In this method, the attributes that can be attached to the final product are listed. The design of the product is then made based on the attributes.

ii. *Checklist:* A checklist consisting of a set of questions that suit a given situation is developed. Solution to the problem is sought to be found by finding answers to the questions.

iii. *Black Box:* The available and required inputs as well as the desired outputs are listed in this method. Then, an attempt is made to envision how the outputs are possible from the inputs.

iv. *Directed Dreaming:* The problem solver tries to go to sleep while thinking of the problem, with the hope that the subconscious will throw up a solution.

GROUP CREATIVITY

When it is felt that the knowledge or experience of one person is not sufficient to solve a problem, group techniques are used. It is not that the creativity will increase with knowledge or experience, but it is generally felt that more is better than less. However, having more and more knowledge may result in over-emphasis on certain constraints and cause inhibition. The following are some of the popular group creativity techniques:

i. *Brainstorming:* This is the most widely known and practiced technique. A group of people sit together and go on generating solutions to the problem on hand. Improving on the ideas of others and synthesizing two or more ideas given by others is welcomed, but criticism or evaluation of the ideas generated by others is prohibited.

ii. *Delphi:* This technique has already been discussed in the chapter on 'Market and Demand Analysis'.

iii. *Nominal Group Technique:* It is a structured technique administered by the co-ordinator. It consists of the five steps:
   - Silent idea generation
   - Round-robin presentation
   - Idea classification
   - Voting and ranking
   - Discussion of results.

The ideas generated in the process are ranked and the best is chosen. It may be conducted many times if the results obtained in the first round are not satisfactory.

All the techniques apart, it is the encouragement and recognition given to creative thinkers that will bring in creative ideas. The environment in the organization is also a significant factor, as creative ideas almost never arise in a highly stressful situation.

SUMMARY

- Before the project is started, it is essential that resources should be allocated properly so as to ensure optimal utilization and timely availability of resources for each activity. For resource allocation, a strategic plan is required. The strategic plan distributes the resources among various departments or business units and also decides how the department and business units will use the resources. It is also essential to study various factors of environment like political, economic factors, socio-cultural and technological factors to decide in which areas the firm should invest. The Michael Porter Model helps in deciding the competitive force of the organization. The different opportunities available should be found and examined through various techniques like creativity, studies conducted by organizations, or study of inputs and outputs of various industries.

Chapter IV

Market and Demand Analysis

After reading this chapter, you will be conversant with:

- Identification of the Target Market
- Choice of the Market Strategy
- Projection of Demand using Primary Data and Secondary Data
- Projection of Demand using Qualitative Models

The success of any project depends on the demand for the output produced by it. As marketing experts say, one should either identify a need and fill it or create a need and fill it. Either way, catering to an unfulfilled need should be the ultimate objective of commercial projects, if they should succeed. Identifying the need, or more simply put, the potential demand for the product is the main subject of this chapter.

There are various aspects of a market that should be studied before one can say he or she knows the market and feel confident about the success or failure of a product or a brand in the market.

IDENTIFYING THE MARKET

Study of the market involves a detailed analysis of:

- Whether the consumers in the market can be classified best on the basis of income groups, age groups, industries, geographical distributions, sex or any combination of these or any other factors, called the market structure. From the structure, the component of the market which should be targeted should also be identified.
- The nature of demand, whether it is determined by monsoons, personal disposable income, prices, fashion, or any other factor.
- Based on the nature of the target segment chosen and the pattern of demand, the size of the market. In case of an existing product, the present market share of the company, that of its main rivals and if the market share should be increased, the hurdles likely to be faced.
- If the presently known market is not attractive enough, whether any other markets (say export market) offer potential for selling the product.

Deciding the Market Strategy

With the knowledge of these factors, the next step is to decide on the marketing strategy to be followed. For laying down a clear cut marketing strategy, the following aspects have to be considered.

- The channels of distribution to be used keeping in view those used by the competitors and their efficacy and whether any innovative channels can be identified.
- When, where and how to advertise without spending too much and losing out to the competitors, while making the desired impact on the target market.
- In case of a new product, whether introduction of the same product under a well established brandname will adversely affect the sales and if yes, how to counter such an event.
- The price at which the product can be sold, considering the prices of competitors' products and the ability of the venture to withstand a price war.
- The nature and frequency of the after sales service required to support the product.

Having studied the market and decided on the marketing strategy, the next step is to review the product itself thoroughly. The suitability of the product should be studied keeping in view the target segment, the competitive position and the core competencies of the company.

CONDUCTING A MARKET STUDY

It is easy, however, to say that the above study should be made and often, very difficult to organize the study and get the relevant information. Information, as statisticians define it, is to classify data into a usable form. Collecting data is the most difficult part of the entire exercise. There are various methods to collect data and data is of two types, based on whether it has been collected solely for a particular purpose by the user of data (primary data) or data collected already by somebody else is being used (secondary data). Collecting primary data is not only a tricky job, but can also be very expensive. Let us now study the various steps in conducting a market study with primary data.

Market Research with Primary Data

STATEMENT OF OBJECTIVES

It is always necessary to clearly state the output required from the study in precise terms before starting the process of data collect. Lack of clarity at this stage may lead to collecting the irrelevant data, resulting in waste of time, effort and money.

SPECIFICATION OF DATA REQUIREMENT

The data requirement depends on the objectives. For example, suppose a company is planning the launch of a new brand of toothpaste. If it wants to know in which color the toothpaste should be, then the required data will be on the color which the consumers like their toothpaste to be in. If, on the other hand, the company is thinking of launching a tooth paste of a foreign brand, which is purple in color, it needs data on whether consumers like a purple colored toothpaste. Collecting data on color preferences of consumers is not necessary in the latter case.

DESIGN OF THE SAMPLE

It may be sometimes possible, and desirable to collect data from each and every consumer in the target market. For instance, a company planning to produce highly sophisticated medical equipment which can be afforded only by the top few hospitals in the country will be well advised to contact all the hospitals in the country and gauge the levels of interest in the equipment before starting off on the project. But for a company producing a small daily use article like soap it is neither cost effective nor necessary to contact all the consumers in the target market. In such case, a sample, which is considered to be representative of the target market should be studied. There are different standard techniques of obtaining a sample that are explained in any standard work on statistics.

MODE OF COLLECTING DATA

Data collection can be done in different methods. Some types of data, like the number of vehicles passing over a bridge, can be collected by observation. Some other types of data can be obtained only by asking others directly or indirectly. For example, number of cigarettes smoked by a smoker in a day.

Collecting data from the consumers may be done either by orally asking, telephonic interviews or requesting them to fill up questionnaires. Telephonic interviews and questionnaires are suitable when the information required is either lengthy or is delicate to ask orally. In a face to face questioning and telephonic interviews the questions to be asked and their order may either be left to the person collecting the data (unstructured interview) or may be decided in advance (structured interview). A questionnaire is also a structured form of questioning.

CONDUCTING THE SURVEY AND OBTAIN DATA

One of the common difficulties encountered in the conduct of a survey is that some of the constituents of the sample do not respond. Even if the non-responding consumers are replaced by others when conducting a sample survey, it does, nevertheless, affect the accuracy of the study. The problem of non-response is generally higher in questionnaires sent by mail than other methods.

It should be ensured that the interviewers are properly trained and briefed. Occasional checking of the information collected by the interviewers should be done to ensure that the interviewers carried out their job diligently.

ANALYSIS AND CONCLUSION

The data collected should be edited to eliminate responses that are wrong or dishonest outright before tabulation. If the questions posed to the respondents are open ended, it becomes difficult to analyze them and tabulate them. Care should be taken to avoid this. Tabulation should be done keeping in view the type of data collected and in a manner that facilitates the interpretation of the results of the tabulation. At this stage, it is also necessary to look out for other factors that were ignored earlier, but show up now to be important. Such factors should be analyzed by collecting data afresh, if necessary, otherwise the whole study becomes incomplete defeating the purpose.

Advantages of Primary Data

i. The accuracy of the study will be high.

ii. Analysis will be easier, as data specifically required is collected.

Problems in collecting primary data:

i. Sampling involves sacrificing a part of the accuracy to reduce the costs.

ii. When the response required is a question of opinion rather than fact, the reliability tends to be lower.

iii. Respondents may not fully understand the questions posed and may answer from what they understand, vitiating the result of the survey. To avoid this, it is wise to test the questionnaire on insiders before the survey.

iv. When the information asked is confidential or embarrassing, respondents may refuse to answer or answers may not reflect truth.

v. The appearance and manners of the interviewer and the presence of a third person may also affect the responses.

vi. Respondents may find it difficult to answer some questions because they do not know the answer. For example, if questions relating to a buying decision, the respondent may fail to give clear and convincing reasons because he never consciously analyzed his own decision-making pattern. A respondent may say that he buys a particular brand of coffee because it is priced lower, when, in fact, he has no knowledge of other cheaper brands of better quality, which are, perhaps, not available at the store where he habitually buys.

Market Research with Secondary Data

SOURCES OF SECONDARY DATA

Secondary data can be obtained from two basic types of sources: internal and external.

Internal

The past records of an organization offer substantial information. In particular, the information relating to the trends in sales of the organization can be used to get first a broad idea of the market condition. Primary information collected earlier for some other purpose may also sometimes come in handy.

External

i. *Market Research Organizations:*

There are many professional market agencies such as Market Analysis and Research Group (MARG), which researches various markets and offers both standard and custom-made reports. Organizations like Audit Bureau of Circulation have membership of publishers and advertisers and monitor the circulation, readership, etc. of publications almost on a continuous basis. Center for Monitoring Indian Economy (CMIE) has developed commercial databases of industrial and corporate information.

ii. *Trade Associations:*

Trade and industry associations such as Federation of Indian Chambers of Commerce and Industry (FICCI) carry out studies on industries. However, their studies are generally limited in scope and may be of limited use. Similarly, research institutions promoted by industrial associations (like Tobacco Institute of India) also provide data relating to that particular industry.

iii. *Government Research Organizations:*

Organizations of the central government, the Central Statistical Organization, RBI and the finance ministry routinely compile and publish data on the economy. The CSO publishes data on all important aspects of the country – not just the economy.

Advantages of Secondary Data

i. It is available easily and saves time.

ii. It may be cheaper than collecting it first hand, if the data required is standard data like sales trends in an industry. Also, information relating to, say, the demographic trends in the country is almost impossible for an individual or private organization to collect and compile, while that done by the government can be accessed cheaply.

iii. Data collected by professional research organizations may be more accurate and reliable than that collected by individual users, as these organizations are generally higher on the learning curve.

Disadvantages of Secondary Data

i. For providing highly user-specific information, research organizations charge heavily.

ii. The user can often have no direct check on the quality of the data collection process of the research agency.

iii. The plans of the user to enter into a specific area of the market may not remain confidential.

If the research organization or agency or other sources analyzes the data, and provides with the conclusions the user needs on the market, there is nothing else the company needs to do to form an opinion of the market. But, if only data is available, then the data will have to be analyzed and the user will have to make his own forecasting, using forecasting models. Some of the commonly used forecasting models are discussed in the next section.

Forecasting Models

Forecasting models are generally classified into three categories:

A. Time Series Projection Models

B. Cause and Effect Models

C. Quantitative Models.

A. TIME SERIES MODELS

Used when the variable being studied exhibits a steady trend over a period of time. In these models, a pattern of change in the variable over time is identified and the same rate of change is assumed to hold good in future as well. Projection is then made on this trend. These models are the most popular and widely used, but their use is generally made only for short-term forecasting, though they can be used equally well for longer range forecasting, if the trend can be established reliably.

Moving Average Models

a. Simple Moving Average

In this model, a simple average of a pre-determined number of past periods is used as the forecast for the next period. The average of past periods is intended to even out or (smoothen) the random changes. Moving averages are ideally suited when the average value remains the same with random variation over time. The time periods over which the average should be calculated depends on the magnitude of the variations. The following illustration should make the concept more clear.

Illustration 1

The Lifeline Oxygen Co. supplies medical oxygen to around 50 hospitals in and around Hyderabad. To be successful in that business, it is necessary to be very prompt in supplies. With competition increasing, the manager of the company wanted to make sure that he has enough vehicles and drivers to make quick deliveries. But, for this, he needed to make a forecast of what the demand is likely to be in the next quarter. The statistician of the company feels that a moving average of the last three quarters' sales is a good indicator of the future demand. The sales in number of cylinders in the past three years have been as follows:

Year	Quarter	Number of Cylinders
1	Q I	1200
	Q II	900
	Q III	1000
	Q IV	750
2	Q I	1100
	Q II	500
	Q III	750
	Q IV	1300
3	Q I	1100
	Q II	900
	Q III	1200
	Q IV	1000

Assuming that now we are at the beginning of the first quarter of year 4, the moving average of the last three quarters will be:

$$MA = \frac{900 + 1,200 + 1,000}{3} = 1,033 \text{ Cylinders}$$

Were we at the beginning of year 3, it would have been the average of the last three quarters of year 2. That is,

$$MA = \frac{500 + 750 + 1,300}{3} = 850$$

If, instead of three quarters, the statistician preferred an average of five quarters, the moving average for the first quarter of year 4 will be:

$$MA = \frac{1,300 + 1,100 + 900 + 1,200 + 1,000}{5}$$

$$= 1,100 \text{ cylinders}$$

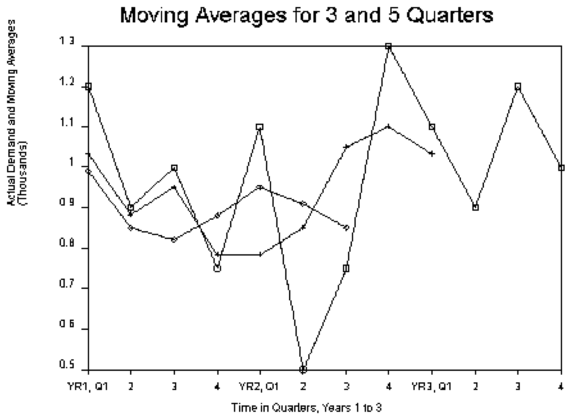
The moving three quarter and five quarter averages for all quarters have been calculated in the table below:

Year	Quarter	Number of Cylinders	Three Quarter Average	Five Quarter Average
1	Q I	1,200	–	–
	Q II	900	–	–
	Q III	1,000	–	–
	Q IV	750	1,033	–
2	Q I	1,100	883	–
	Q II	500	950	990
	Q III	750	783	850
	Q IV	1,300	783	820

Year	Quarter	Number of Cylinders	Three Quarter Average	Five Quarter Average
3	Q I	1,100	850	880
	Q II	900	1,050	950
	Q III	1,200	1,100	910
	Q IV	1,000	1,033	850

The averages get more smooth with increase in the number of periods. The same is illustrated in the following graph:

Figure 1



Legend:

Actual demand :

Three Quarter Moving Average :

Five Quarter Moving Average : x x

It can be seen that the five quarter moving average line is smoother. It is not out of place to stress that moving averages do not reveal trends caused by specific factors and are useful only to smoothen random variations.

b. Weighted Moving Average

In weighted moving average, weights are attached to the most recent data. This is used when it is felt that most recent of the block of periods chosen have a higher likelihood of being repeated than the earlier ones.

Illustration 2

If the Lifeline Oxygen Supply Co. in Illustration 1 wants to attach 60 percent weightage for the last quarter of year 3, 30 percent for the third quarter and 10 percent for the second, the three quarter average will be:

M A = 1,000 x 0.60 + 1,200 x 0.30 + 900 x 0.10 = 1,050

ii. *Exponential Smoothing:*

The exponential smoothing model is a variant of the weighted moving average. But, it reacts more to the recent changes in the value of the variable than the averages. And, it does not require large amounts of historical data. It is highly useful when there is some amount of change in the trend (e.g., seasonal variations) than just random variations and is considered to be reasonably accurate. The simplicity of calculations in the model adds to its reputation.

The data required for forecasting using this model is just three values: the actual demand for the current period (D_t), the forecast for the current period (F_t) and an adjustment factor (μ). Given these, the forecast for the next period (F_{t+1}) can be calculated using the formula:

$$F_{t+1} = \mu D_t + (1 - \mu) F_t$$

Illustration 3

In Illustration 1, if the statistician felt that the forecast for the next quarter should be based on the forecast for the previous quarter and the actual demand, and he calculates the adjustment factor to be 0.20, the forecast will be as follows:

Let us assume that the forecast for the last quarter of year 3 was 1200 cylinders. Now,

F_t = 1200

D_t = 1000

= 0.20

F_{t+1} = 0.20 x 1000 + (1– 0.20) 1200

= 1160.

Notice that what we have calculated is a weighted average of the forecast and demand values for the latest period, the weights being 0.20 and 0.80 for actual and forecast figures respectively. The smoothing effect of this model is directly dependent on the adjustment factor used. Higher the factor, more is the sensitivity to actual changes in demand and less is the smoothing effect.

If we forecast the values for the data in Illustration 1 using two values of adjustment factor = 0.30, and = 0.50, the values look as follows:

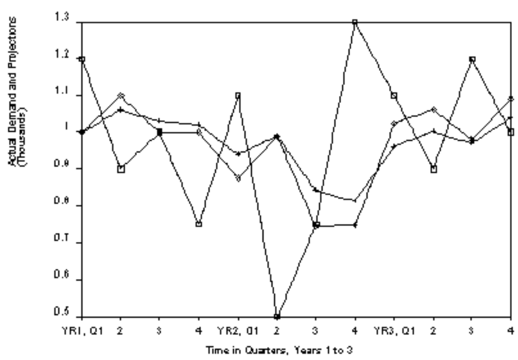
Year	Quarter	Demand (No. of Cylinders)	Forecast (μ = 0.30)	Forecast (μ = 0.50)
1	Q I	1200	1000*	1000*
	Q II	900	1060	1100
	Q III	1000	1030	1000
	Q IV	750	1021	1000
2	Q I	1100	940	875
	Q II	500	988	988
	Q III	750	842	744
	Q IV	1300	814	747
3	Q I	1100	960	1024
	Q II	900	1002	1062
	Q III	1200	971	981
	Q IV	1000	1040	1091

* Assumed

Projection for = 0.30 and = 0.50

Figure 2

Projection for μ = 0.30 and μ = 0.50



Legend:

Actual demand :

Smoothing with μ = 0.50 :

Smoothing with μ = 030 :

The greater sensitivity of the forecast with = 0.50 to changes in actual demand can be observed from the above graph. When the changes are negligible a small value of is good enough. Substantial changes in the actual demand will call for a higher value of, if the forecast should be accurate.

iii. *Adjusted Exponential Smoothing:*

The exponential smoothing model can be modified to reflect seasonal trends as well by adding a trend factor. The formula for calculating the adjusted forecast is:

$$AF_{t+1} = F_{t+1} + T_{t+1}$$

Where,

F_{t+1} is the forecast without adjustment, and

T_{t+1} is the adjustment factor.

The adjusment factor is calculated as:

$$T_{t+1} = B(F_{t+1} - F_t) + (1 - B)\, T_t$$

where

T_t is the trend factor for year t

B is the adjustment factor for trend

B. THE CAUSE AND EFFECT MODELS

These models should be used when there are random variables over a period of time of due to the influence of one or more factors other than time. These models forecast the value of the variable based on one or more factors, other than passage of time, which are supposed to have a significant impact on the changes in the value of the variable. For example, the sale of woollen goods depends on the intensity of winter (quantified as temperature), sale of electronic consumer goods depends significantly on the appeal and frequency of the advertisement. Demand for housing changes with population and disposable income, prices of food grains depend at least partly on the prices of fertilizers. Cause and effect models enable us to predict variables not only using factors that have a direct impact, but also through their impact on other factors, not only those that change concomitantly with the variable, but also those that lead or lag. Cause and effect models are accurate and versatile, but complicated and call for significantly more data.

Regression Models

Simple Regression:

This statistical model is used when there is only one factor that effects the changes in the variable. The relationship between the two is expressed as an equation in the form of y = a + bx. The least squares method is generally used to derive the equation. The regression models can also be classified as time series models as they can be used to predict using a time based trend by taking time as the independent or causal factor.

In the regression equation, the value of b is calculated using the formula:

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

The value of a is then calculated as:

$$a = \overline{Y} - b\overline{X}$$

where

X	=	value of independent factor
Y	=	value of the dependent variable
n	=	Number of values of the independent factor and the dependent variable used
$\overline{Y}$	=	average value of Y
$\overline{X}$	=	average value of X

The following illustration will elucidate the application of this model.

Illustration 4

Tilde Computers Ltd. is going strong. Its computer sales have been increasing steadily for the last few years. The management of the company feels that the demand for the company's computers has a strong linear relationship with the number of new software companies established in the city. The number of companies established and sales in the last few years are as follows:

Year	No. of Companies	No. of Computers Sold
I	15	1050
II	20	1200
III	27	1325
IV	32	1500
V	42	1650
VI	55	1700
VII	70	2100

The company wants to make a forecast of the demand assuming 85 new companies will come up next year.

The values of a and b in the regression equation can be calculated as follows:

X	Y	XY	X^2
15	1050	15750	225
20	1200	24000	400
27	1325	35775	729
32	1500	48000	1024
42	1650	69300	1764
55	1700	93500	3025
70	2100	147000	4900

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

$$= \frac{7 \text{ x } 4,33,325 - 261 \text{ x } 10525}{7 \text{ x } 12067 - 261^2}$$

$$= 17.51$$

$$a = \overline{Y} - b\overline{X} \quad \frac{10,525}{7} - 17.51 \text{ x } \frac{261}{7}$$

$$= 850.70$$

The regression equation is 850.70 + 17.51x, where x is the number of new companies.

If the number of new companies is 85, the projected sales will be

850.70 + 17.50 x 85 = 2339.

A caution on the use of regression models is now in order. Regression models by themselves do not establish relationships between variables. A regression equation can be obtained, for example, between the number of deaths of politicians in road accidents and number of Indian women participating in beauty pageants overseas, which are unconnected by any stretch of imagination. A causal relationship should first be established between the independent factor and the variable in question. Only then can regression be applied.

Multiple Regression:

In the above illustration, the company considered only the number of new software companies. But, there are other equally important factors such as new computer training institutes and colleges being set-up and changes in prices of computers. When there are many independent factors that affect a variable, a similar technique called multiple regression is applied. The model is expressed as:

$$Y = B_0 + B_1X_1 + B_2X_2 + \dots\dots\dots + B_nX_n$$

where,

B_0 = intercept

$B_1 \dots\dots B_n$ = parameters representing weightages of different factors

$X_1 \dots\dots X_n$ = independent factors

Multiple regression is more flexible than linear regression in that it can accommodate almost any number of independent factors. But it is very complex to solve and the complexity increases with increase in the number of independent factors. Such equations are generally solved using a computer program.

Chain Ratio Method

When the demand of a product is influenced by a chain of factors, the chain ratio method is useful.

The first step in this method is to identify all the factors and their interlinkages quantitatively.

In the second step, the ultimate impact on the demand for the product under study can be determined.

Illustration 5

A gymnasium expects that its customers will be men in the age group of 10 to 35 years, mainly from areas that are within a radius of 10 km of its location. It estimates that out of a total population of 2,000,000 of the city, 2 percent live in the area and the composition of men is 55 percent. Out of men, 75 percent are estimated to be in the age group of 10 to 35 years and not more than one percent go to a gymnasium regularly.

The daily demand for the gym can be estimated to be:

$$20{,}00{,}000 \text{ x } \frac{2}{100} \text{ x } \frac{55}{100} \text{ x } \frac{75}{100} \text{ x } \frac{1}{100} = 165$$

The major strength of this method is that all the major demand drivers are identified and the impact on the demand is derived. However, difficulty in obtaining the required data limits its application.

End Use Method

The demand of products in industries such as auto components, industrial chemicals, machine tools, etc. depends on the demand conditions of the industry which uses the product. In such cases, the demand will have to be estimated basing on the demand conditions in the user industry and the market share targeted. First, the production of each of the user industries should be determined. Then, the number of units of the products consumed per each unit produced by the user industries. This gives the total demand for the product. The proportion of the total demand expected to be captured gives the demand projection for the firm.

Econometric Method

The demand for many products such as steel, cement, power, etc. depends on the general economic activity. To forecast the demand in such industries, a model consisting of all the major economic factors should be developed. The impact of the variables can be found out using multiple regression. Though the models tend to be complicated to develop and use, they are reliable if built carefully.

For instance, a multiple regression model may be as follows:

$$D = @X_1 + BX_2 + rX_3 + e$$

where

D is the demand

X_1, X_2, and X_3 are the factors affecting demand

@, B, r are the weightages of factors X_1, X_2 and X_3 respectively

e is the random error.

Though multiple regression is commonly used in econometric models, such models can also be developed by other methods, such as chain ratio method. Econometric models require input of a lot of data. Even if the data is available, the accuracy depends on how well the model portrays the reality. And, the models are expensive in terms of both time and money.

Consumption Level Method

Often, the consumption of goods, particularly consumer goods depends directly on the income levels of the consumers and changes in price. The impact of these two factors can be gauged using the income elasticity of demand and price elasticity of demand methods respectively.

i. **Income Elasticity of Demand Method:** In this method, the effect of the change in the demand as a proportion to change in the income is estimated and the same change is applied to the future, assuming that all other factors remain constant. The proportion, called income elasticity of demand, is calculated as:

$$\frac{\text{Change in demand}}{\text{Change in income}} = \frac{Q_2 - Q_1 / \frac{1}{2}(Q_1 + Q_2)}{I_2 - I_1 / \frac{1}{2}(I_1 + I_2)}$$

Where Q_2 = demand after change

I_2 = income after change

Q_1 = demand before change

I_2 = income before change

Illustration 6

Suppose that per capita annual income level of the residents of Hyderabad was Rs.12,000 a year back and is Rs.14,000 now. The consumption of milk is at present 300 ml per head per day and was 250 ml a year back. The income elasticity of demand for milk is:

$$\frac{300 - 200}{300 + 250} \text{ x } \frac{12{,}000 + 14{,}000}{14{,}000 - 12{,}000} = 2.36$$

The income elasticity is 2.36. Once the elasticity is determined using historical data, the same elasticity is used to project future demand, using the formula:

Projected demand = 300ml x (1 + change in income x income elasticity)

Supposing that per capita income increases to Rs.14,750 by next year,

Change in per capita income $= \dfrac{14{,}750 - 14{,}000}{14{,}000 + 14{,}750} = 0.026$

Projected per capita demand = 300 ml (1 + 0.026 x 2.36) = 726.41 ml

The total demand in the city can be estimated by multiplying the projected per capita demand with projected population.

Note that the assumption we made at the beginning of this method, that all other factors remain constant, makes this method unsuitable for long-term forecasting and is generally used only for the short-term.

ii. **Price Elasticity of Demand Method:** This method is similar to the income elasticity method excepting that instead of income, we consider the price. Price elasticity of demand is the change in the demand as a proportion to the change in price.

Price elasticity of demand is calculated as:

$$= \frac{\text{Change in demand}}{\text{Change in price}} = \frac{Q_2 - Q_1 / \frac{1}{2}(Q_1 + Q_2)}{P_2 - P_1 / \frac{1}{2}(P_1 + P_2)}$$

Where, Q_2 = demand after change

P_2 = price after change

Q_1 = demand before change

P_2 = price before change

Illustration 7

Let the per capita consumption of onions in Hyderabad be 400 gm per head per day a year ago and is 250 gm now. The price was Rs.3.50 per kg a year ago and is Rs.8.00 per kg now.

Price elasticity of onions $= \dfrac{400 - 250}{400 + 250} \text{ x } \dfrac{3.50 + 8.00}{8.00 - 3.50}$

$= 0.59$

Once the elasticity is known, demand can be projected the same way as in the above illustration.

C. QUALITATIVE MODELS

It is not always possible to apply the quantitative methods because:

i. There may not be enough time to make a quantitative estimation.

ii. The data required for a quantitative estimation may not be readily available or may be too expensive.

In such circumstances, qualitative methods, which involve estimating the demand subjectively, are used. These methods are quick and simple, but the element of subjectivity, which is their principal defect, should be kept in view while using them. In this section, we will discuss the most popular among the qualitative methods.

Field Sales Force Method

In this method, the salesmen of the company are asked to estimate the potential for sales during the forecast period in their territory. All the forecasts from each territory are then pooled up and the sales forecast of the entire firm is arrived at. The biggest advantage of this method, apart from its quickness is that sales people, who are in touch with the market continuously, know better about the changes in the demand pattern and will be able to provide a reliable forecast without spending money on collection of data and application of forecasting models.

The drawbacks of this method are:

i. When salesmen's incentives are based on realization of targets, they tend to underestimate demand.

ii. If allocation of scarce resources is based on demand projections, there may be a tendency to overestimate demand.

Users' Expectations

Instead of the opinions of the salesmen, the buying plans of the customers may be found out directly from them. Customers may be contacted by sending questionnaires or through telephonic interviews. Though the bias of the salesmen does not color the output in this method, the forecast is still influenced by the subjectivity, errors and changes in buying plans of the customers. Moreover, this method calls for a large staff to carry out the survey for a large organization. On the positive side, this method gives first hand knowledge of the customers' expectations, possible improvements and competitiveness of the product in terms of quality and price, etc.

Delphi Method

In this method, estimates are called from a group of people considered to be experts in the field. But, the group (called panel of experts) is not allowed to meet and discuss or debate each others opinion. Individual experts are asked to give their estimates independently. This is aimed at avoiding those who are dominant influencing the opinion of the others. As different experts, based on their knowledge and experience may give divergent views, a panel co-ordinator carries out the job of reconciling the views of all of them. First, the co-ordinator solicits opinions from all the experts. Then, those whose opinions are well off the average are asked to explain the rationale of their position. A second round of questionnaire is sent to them. When a reasonable consensus is arrived at, the co-ordinator sums up the outcome of the exercise and calculates the demand. The main drawback of this method is its complexity. Considerable skill and tact are required on the part of the co-ordinator in handling the experts and bringing out a consensus. However, this is a good method to use when the forecast depends on subjective elements such as forecasting various scenarios and the condition of an economy in each of the scenarios.

Jury of Executive Opinion Method

This method is a variation of the Delphi method. A group of managers is asked to sit together and arrive at a forecast. This method is popular because:

i. It is quick

ii. The viewpoints of all the people can be taken into account

iii. It is more interesting to managers compared to trend projection methods.

This method has a couple of serious limitations:

i. The opinion of the managers may be biased

ii. It is sometimes difficult to arrive at consensus quickly.

Even at the cost of overemphasizing, it should be said once again that it is essential to carry out the entire study and analysis of the market meticulously. Errors made at any stage – identifying the target market, designing the marketing strategy or estimating the quantity of demand – can have a devastating effect on the viability of the project. It is, therefore, essential to have a thorough knowledge of what the market is and how it can be exploited before starting a project.

SUMMARY

- A project can be successful only if the output produced by it has sufficient demand to cover the cost and earn reasonable margins. Therefore, it is essential to identify the potential market for the product, the nature for demand and competition in the market. For all this, the firm is required to do a market study and market research. The market research may be done with primary data or secondary data. The data collected may be analyzed through an external agency or different forecasting models can be used. The market and demand analysis should be done very carefully to decide whether the project is viable or not.

Chapter V

Technical Analysis

After reading this chapter, you will be conversant with:

- Project Procurement Management
- Solicition
- Vendor Selection
- Contract Administration
- Purchasing Equipment and Materials
- Plant Location
- Project Design
- Work Schedule

In this chapter, we will study the technical (or engineering) aspects of setting up a project. Starting with who should select the technology and how, we will move on to acquisition of technology, purchasing the materials and equipments, selecting the site and the layout of facilities on the site and finally discuss briefly about pollution and effluent disposal.

Promoters often depend on consultants for selecting the appropriate technology. Even in large organizations, matters relating to technology are generally left to the 'specialists'. Managers who do not have a technical background rarely interfere in technological matters. This practice has its roots in the feeling that technical matters are best handled by the specialists. Generalists have an impression that it requires years of study to acquire enough knowledge to evaluate technologies. They also hesitate to ask and find out what they need to know, but do not, for fear of betraying wild ignorance and getting ridiculed. This may often lead to wrong technological decisions, as the technical experts often lack the strategic vision required to make good technological decisions. A wrong decision can have far reaching implications for the viability of a project because:

i. Technological decisions are generally irreversible,

ii. They call for a big outlay of investment, and

iii. They directly affect the competitiveness.

PROJECT PROCURMENT MANAGEMENT

Project Procurement Planning

This document details the manner in which other procurement processes will be managed i.e., starting from the solicitation planning till the contract closing. Project procurement planning is the process of discovering the needs of the project that can be satisfied by acquiring products and services from firms external to the project organization. The request for the products has to go through a procurement process, starting from solicitation planning to contract closure. The project manager should take the help of professionals in contracting and procurement, if required. Procurement planning basically answers the questions like what to procure? how to procure? and when to procure? The procurement process is effective if it contributes to organizational profits through discounts on bulk purchases of quality products and services. If the procurement practices of an organization are centralized, then profitability is enhanced because centralization leads to standardization and minimizes the cost of paperwork involved. The primary objective of a procurement planning process is to decide and plan for acquiring all products and services from vendors single or multiple vendors. Some of the inputs required to prepare the procurement plan are:

i. Scope statement

ii. Product or service description

iii. Procurement resources

iv. Market conditions

v. Make or buy analysis

vi. Expert judgment.

Procurement Resources

Procurement resources gives a description of the resources (systems and personnel) needed to procure the products and services from the market as per the specifications given in the product or service description document. If the organization doesn't have a formal procurement team, then it is the responsibility of the project manager and his team to manage the procurement process. However, when projects are complex and technical in nature, and depend heavily on the external market for sourcing raw materials or services, then the presence of a formal procurement team to manage the activities would be extremely helpful.

Market Conditions

Market conditions play a vital role in the process of procurement planning. While planning for procuring goods and services from vendors, the project or purchase manager should be aware of the products or services available in the market. He should also be aware of the terms and conditions on which various vendors supply these products or services. Macro economic factors like inflation rates, interest rates and government regulations influence procurement plans. And there are other factors that need to be kept in mind while planning procurements, such as quality management, cash flow statements, risk management, staffing, initial ordering costs and the work breakdown structure. There are certain parameters that are taken for granted while planning procurement. But, at the same time, there are some aspects that confine the scope of the vendee's choices and most often it is the financial constraint.

Make or Buy Analysis

Once the project manager has the required information on the required product and the market conditions, he has to decide whether to source these products from within the organization or from outside vendors. If the organization has free machine time and infrastructure that can satisfy the need of the project in a cost effective manner, then it is better to make the product from within the organization than to source it from external vendors. But if the costs, the infrastructure and other resources are not appropriate, then it is better to buy it from external vendors. The make-or-buy decision should consider both direct and indirect costs. For instance, while buying a product from external sources, the project manager should take into account the indirect cost of maintaining the procurement process apart from the product cost, such as the ordering cost, transportation cost and so on. The make-or-buy analysis document should contain the project organization's point of view and the immediate needs of the project.

Expert Judgment

Expert judgment is used to analyze and judge the inputs of the procurement process. It is provided by a single individual or a group of individuals who are experts in specific fields. The sources for seeking professional and expert help are from personnel within the departments of the organization, consulting firms, professional, technical and industrial associations (All India Engineers Association, Society for Indian Automobile Manufacturers' Association).

Selecting the Appropriate type of Contract

Selection of a contract type is influenced by the project manager's level of uncertainty. While entering into a contract, the vendee (the procuring organization) would always like to transfer the maximum risk of performance to the vendor and at the same time reward him with perks for effective and efficient performance. On the other hand, the vendor would like to minimize his level of risk and maximize his profit. Generally there are five major categories of contracts namely:

i. Fixed-Price (FP) contracts

ii. Cost-Plus-Fixed-Fee (CPFF) or Cost-Plus- Percentage-Fee (CPPF) contracts

iii. Guaranteed-Maximum and Shared Savings (GMSS) contracts

iv. Fixed-Price -Incentive-Fee (FPIF) contracts

v. Cost-Plus-Incentive-Fee (CPIF) contracts

Statement of Work

It is a detailed description of the product or service to be procured, for the vendor to decide on his potential to serve the project organization with the product or service that matches their expectations. The details vary depending on the nature of the product or service to be procured, the requirements of the project organization and the type of contract to be administered.

The statement of work is continuously reviewed and evaluated as it progresses across the procurement process because the vendor may suggest an alternative cost effective product or service to substitute the one planned originally. This document should be transparent, complete and precise. It should also mention its expectations from the vendor especially when it requires any special services like after sales service of the product being procured. For some industries, there can be a specific detail and format for statement of work.

Solicitation Planning

Solicitation planning is the process of developing the documents that are needed to support solicitation. It involves preparing the procurement management plan, the statement of work, standard forms and expert evaluation that forms the procurement documents and criteria for judging the vendor. These documents support solicitation.

Procurement Document

This is a document that is used to invite proposals from eligible vendors. The procurement document uses terms like "bid" and "quotation", when the vendor selection is price sensitive, and the term "proposal" when the vendor selection is more dependent on non-financial aspects like technical skills. The term proposal is used while procuring the services of a consultant or an architect. The procurement documents are also known as Invitation for Bid (IFB), Request for Proposal (RFP), Request for Quotation (RFQ), Invitation for Negotiation (IFN) and Vendor Initial Response (VIR). Of all these types of procurement documents the RFP is the most expensive for the vendor, especially when the contract involved is so large that the proposal needs to present different sections covering various factors like cost, technical performance, background of the management, quality of the processes, infrastructure support, management of subcontractors and so on.

Procurement documents should contain a format that should get out as much of information as possible from eligible vendors. The documents should seek the depth, the accuracy and completeness of the information provided. It should also contain a statement of work, description of the response sheet and any other additional documents required like confidential statements or agreements. There are strict regulations pertaining to the format and content of procurement document when it is prepared by or for a government organization. An ideal procurement document should be balanced by two factors i.e., on the one hand, it should be rigid in seeking responses that are corresponding and comparable but on the other hand, it should be flexible to encourage suggestions from the vendor so as to enhance ways of satisfying the need.

Criteria for Judging the Vendor

This involves evaluating the various proposals received from different prospective vendors, by rating them. The criteria can be objective or subjective in nature and they have to be clearly mentioned in a procurement document. When the organization has the list of approved vendors from whom the product can be readily sourced, then the criteria for judgment is usually narrowed down to the price of the product. But in the absence of such a vendor list, cost effective and reliable criteria for judgment should be developed and documented. The following should be the factors to evaluate under such circumstances:

i. Need interpretation – as given by the vendor.

ii. Total cost of procurement (purchasing costs + operational costs).

iii. Can the particular vendor deliver the product or service at the lowest possible cost?

iv. Technical expertise – Is the vendor technically competent and can he adopt the technology needed to produce the required output?

v. Management style – Does the vendor have the substantial management practices to complete the project?

vi. Financial position – Is the vendor financially capable of carrying on with the procurement project?

SOLICITATION

Solicitation is a process of obtaining quotations, bids, offers or proposals from all prospective vendors. The process involves handling the procurement documents, Short listed vendor list, Vendor meetings, and Advertising and Accepting proposals. The short listed vendor list contains all information pertaining to their expertise in different functional areas. These lists are usually available with the organization. But in the absence of the list, it is the project team's responsibility to develop their own source. Vendor meetings are meetings with prospective vendors before they present the proposals. These are conducted to make sure that all the vendors understand the requirements from all perspectives and advertising is a tool used by the project organization to invite proposals in the form of sealed bids from prospective vendors. There is no bargaining involved in this kind of solicitation. The vendors' pricing is influenced by market forces and the contract is bagged by the vendor quoting the minimum price.

VENDOR SELECTION

Vendor selection is a process of receiving quotations or proposals from prospective vendors and evaluating these proposals to choose the right vendor. Though this is a complex and difficult task, a properly documented vendor proposal makes the process simple. Although price is the primary selection factor for readily available products, bidding at lowest possible prices does not guarantee the contract if the vendor fails to supply the products on time. In order to simplify the process, the proposals received are classified into two disciplines namely technical and commercial to evaluate each of these separately. Also it is advantageous to seek proposals from multiple vendors if the nature of the product is technically complex. The tools and techniques used for selecting a vendor are as follows:

i. Contract negotiation

ii. Weighing system

iii. Screening system

iv. Developing independent estimations.

CONTRACT ADMINISTRATION

Contract administration is the process of making sure that the vendor's performance satisfies the project needs mentioned in the contract. If the project is so large that it requires multiple vendors to satisfy its needs, then the major area of concentration should be on handling the interfaces among the multiple vendors. Since the contracts signed are also the legal documents, the project team should keep in mind that any action taken by them makes them legally accountable. To be precise, contract administration is about applying the project management practices like project planning and implementation, Progress reporting, Quality management, change management and financial management to the vendor-vendee relationship and integrating the results of these practices back into the project. Information collected during the project planning and implementation phase gives the status of the vendor's job such as the tasks that have been completed and the ones that have not been, the degree of quality being matched, the expenditure incurred and so on.

During the process of execution of contractual obligations there are chances for minor to major changes. Any changes to be made to the terms and conditions of the contract or to the product or service specifications are covered in the statement for change request. Further, if the job done by the vendor fails to impress the contract administrator and the project manager, then the decision to terminate the contract can also be treated as a requisition for change. But if there is a disagreement between the vendor and the vendee on accepting the change, then such a situation can lead to conflicts and claims.

With the constant need for change and adaptation the project and contract performance is set to be alert at process continuity and to avoid unacceptable deviations. The method adopted for this purpose is called as Progress Reporting System. Progress reporting system is the process that keeps the project organization updated on the performance of the vendor i.e., the way in which he is achieving the objectives of the contract. An effective progress reporting system demands frequent interaction between the contract administrator and the project manager. To enhance the efficiency of the project communication system, it is advisable for the project manager and the contract administrator to integrate the functions of contract progress reporting system with that of the project progress reporting system.

Managing Vendor Payments

The vendor should ensure timely and periodic submission of bills to the contract administrator for payments for the completed work (or as agreed in the contract). The billing documents should contain all supporting statements as mentioned in the contract.

Once the vendor submits the bill, the contract administrator has to check and revise all the components of the billing system, as agreed upon in the contract. And after seeking approval from the contract administrator, the invoice should then be put on to the accounts payable system of the project organization. The project manager has to approve the invoice.

Contract Closing

Contract closing is a process involving verification of the product along with updating all the project documents with the final results and storing all project information for future retrieval. The contract closing procedure may also be mentioned in the terms and conditions of the contract. The process of contract closing usually involves four steps: Contract documentation, Procurement audits, Contract files, Formal acceptance and closing.

The project organization has the authority to put an end to a continuing contract at any point of time depending on the nature of the contract and the terms and conditions. But when the contract has to be terminated at a time which the vendor has already incurred some expenditure in the process of delivering the product, then the project organization has to reimburse the vendor the money spent on contract activities.

Ethics in Project Procurement

As a result of increasing emphasis on quality and cost minimization, procurement departments have come under pressure to acquire the highest quality products at the lowest price possible. Apart from such pressures from top management, procurement departments also have to deal with vendors who may try to push their inferior products by trying to bribe the department personnel.

Vendors may behave in an unethical manner when estimating costs for submitting bids. If the vendor is to be paid on a cost-plus basis that allows fee hikes in some special situations, some vendors may try to bag the contract by submitting a bid that underestimates the costs. But once the project starts, the vendor may try to find some reason for hiking the costs.

Such unethical behavior can also be seen during negotiations. Assume a firm has requested an external vendor to develop a software application for a specific function. If the firm is not familiar with the process of software development, the vendor may misguide the firm to raise the costs.

The involvement of project personnel in procurement function may enable them to receive benefits from vendors as they are under continuous pressure from both the project organization and the vendor. Procurement department personnel should not accept, either directly or indirectly, any favors or gifts from anyone in any form. By offering a favor, an individual or vendor organization;

- Is trying to obtain a contract or other financial gain from the project organization,
- Is indicating that it has interests that can be satisfied by the efficiency or inefficiency of the individual accepting the favor,
- Is trying to affect the employee's profession.

Project procurement personnel are also prohibited from seeking free lunches and dinners, or accepting any item or service from the vendor. But it is not against the code of ethics to accept common business courtesies and promotional material like diaries, planners, etc. To be considered ethical, project procurement personnel should;

- Prevent the appearance of compromising and unethical practices in their actions, relationships and communication.
- Show loyalty towards the employer by strictly following the legal guidelines issued by the employer.
- Abstain from any kind of private and professional activity that can lead to a conflict between personal and organizational goals.
- Abstain from accepting money, loans, credits, discounts or favors in the form of gifts, entertainment, or services that have an impact on procurement decisions.
- Maintain confidentiality of information concerning the employer, the client or the vendor.
- Develop conducive vendor relationships through courteous and impartial behavior during all the phases of the procurement cycle.
- Avoid reciprocal agreements which inhibit competition.
- Learn and abide by the legal framework governing the procurement function.
- Help develop all segments of society by showing support and concern for small businesses.
- Enhance the proficiency and stature of the purchasing profession by acquiring and maintaining current technical knowledge and the highest standards of ethical behavior.

Procurement in international markets should be done as per the legal formalities, customs and practices prevalent in that region.

Sourcing the Technology

Information regarding technology is available from consultants, other companies that are already using the technology, research laboratories and the government. The Department of Industrial Development of the Ministry of Industry maintains a Technology Data Bank containing the details of various technologies and their suppliers. But most of the technologies are highly labor-oriented. Therefore, they must be evaluated carefully keeping in view the costs – the cost of the technology and the cost of the product. There are many national laboratories established by the central government that have developed or indigenized technologies. If a foreign technology is required that has already been imported by someone else, it can be acquired under the Central Government's 'scheme for avoidance of repetitive import' with the permission of the supplier, if the earlier importer is not a competitor.

While evaluating various technological options provided by the supplier, the following matters should be taken care of:

i. The technology should be well proven and tested. It is always preferable to choose a technology that the supplier himself or a market leader is using.

ii. The technology should be of recent origin. If very old technology is chosen, there will be the risk of either the technology or the product getting obsolete very soon. Therefore, the nature of the product planned to be produced and the trends in its consumption should be the base for selecting the technology.

iii. The technology acquired must be such that the product of the desired quality can be produced at the lowest possible cost. The quality and cost should give a competitive edge to the company.

Elements of Technology Transfer

The process of technology transfer has three elements: transfer of documents, assistance in implementation and technology update from time to time.

Documentation: The documents passed on during a technology transfer should contain all the information that is required to enable the transferee to execute the entire project through all the phases. Specifically, the most important information to be transferred is:

i. Specifications for design and development of plant and equipment, process of manufacture and the final product.

ii. Operation and maintenance manuals, techniques, of quality management.

iii. Information on how modifications can be made.

iv. Design codes and standards.

Implementation: Implementing a technology calls for skills on modifying it to suit the local conditions. To ensure that the technology does not fail due to poor implementation, the collaborator generally sends his personnel to implement it. If the collaborator does not offer to send his personnel, the buyer should ask for them and make it a part of the technology transfer agreement. But there should not be excessive dependence on the collaborator's personnel. The agreement should also provide for training of the buyer's personnel, preferably at the collaborator's facilities. It must be ensured that training is imparted in both operational and maintenance aspects. The buyer should check the quality of training by calling for periodical reports from his personnel on what they have learnt.

Technology update: The collaborator, either through his experience or further research, may identify pitfalls and inefficiences in the technology. He may develop revised versions of the technology provided by him which may be cheap or call for lower amounts of inputs. If the revised version is sold in the market, the later entrants will get an advantage over the earlier buyers. To avoid this, it must be made sure at the time of buying technology that the seller will provide the revised version to the first buyer at a nominal cost.

PURCHASING EQUIPMENT AND MATERIALS

In turnkey projects, the technology provider will supply all the machinery, install the machinery and also provides his personnel to operate in the initial stages. In other types of projects, the collaborator may only provide the designs and the specifications about the equipment required.

In such cases, the purchasing function should be handled carefully. Otherwise it will result in either time overruns or cost overruns or both. For large projects, generally a separate purchasing department is set-up. It takes care of all the aspects of purchasing the equipment, machinery and materials required for the project: excepting those that are highly technical. Purchasing technical equipment which is specialized is generally entrusted to the project engineering department. When it is not economical to handle procurement independently or the items to be procured are so complex that the project engineering department also cannot handle them efficiently, or the project is not large enough to have a separate project engineering department, procurement may be entrusted to procurement agents.

Procurement Process

The procurement process can be described in five steps:

i. Listing

ii. Coding

iii. Placing Orders

iv. Expediting

v. Taking Delivery.

i. **Listing:** The first step in the procurement process is listing. All the materials and equipment required for the project are listed to make sure that none of the required items is lost sight of.

ii. **Coding:** The second step is to assign codes to them for easy identification and reference. Codes are assigned to indicate the nature of the material and the phase of the project the material or equipment is required in.

iii. **Placing Orders:** The next step is to place orders. The materials have to be grouped so that tenders for similar items can be called for at one time. If reliable suppliers who supply at competitive rates are known, orders can be placed by directly negotiating with them, saving time and effort in calling for tenders and evaluating them. Calling for tenders is also not necessary when there are only a few well-known suppliers. Deals can be struck with them through negotiations. Before placing orders in bulk, it is the general practice to visit the factory of the supplier. This is necessary to make sure that the supplier has the required capabilities and is not acting as a middleman to someone else. There are two important points to be kept in mind while placing orders – one, scheduling the deliveries and two, scheduling of the orders. The delivery schedules should be bid down first, based on the work schedules, keeping sufficient buffer time. Then, the order schedule should be worked out depending on the delivery schedule required and the time required by the suppliers. This should be done carefully. Otherwise, either the material will be supplied earlier than required and will result in storage costs and earlier than expected payments to suppliers, or the supply gets delayed and the works get held up.

iv. **Expediting:** The fourth step is expediting or follow up. Depending on the relationship with the supplier and his dependability, occasional visits to his plant may be made. A few days before the delivery is due, he should be contacted to check whether the material is reaching on time or not. If there is a delay, alternative arrangements should be tried out, depending on the urgency, costs involved and availability. Sometimes, a 'risk purchase' clause is included in the purchase contract. Under the clause, if there is a delay in supply due to the negligence of the supplier, the purchaser is enabled to buy the materials from whichever source, and at whatever cost they may be available, at the risk of the negligent supplier. When the suppliers' dependability is doubtful, it is necessary to include this clause.

v. **Taking Delivery:** The final step is taking delivery and inspection. Delivery can be asked for at the project site, if the time of delivery is close to the time when the material is required. Otherwise, delivery should be taken at the storehouse. Everything, of course, depends on the terms of the contract. Once delivery is taken, it is essential to inspect the material to see whether it meets the quality standards agreed on at the time of entering into the contract. If not, the material should be returned, and depending on the works schedule, alternative arrangements should be thought of, if the same supplier is unable to rectify the material. Care should be taken to see that the project does not fail on account of poor quality materials and equipment.

Types of Materials

The requirements of a project can be broadly classified into materials and equipment. Materials are what go directly into the project work like bricks, sand, pebbles, cement, steel, etc. used for construction and include consumable items like wires, nuts, bolts, etc. Equipments are those that are used in the setting up of the project such as pumps, motors, cranes, etc. Materials that are used in bulk like cement, steel, etc. are called bulk materials. Bulk materials are generally ordered for on a rough estimate and adjustments are made later, depending on actual requirements. When the construction activity is contracted out, generally the contractor buys the consumables though it again depends on the terms of the contract.

Some of the equipments may be readily available with sellers (bought out equipments) while others may have to be made to specifications (custom – made). Some others may be designed and made by the user himself. Even when the work is contracted out, it is better for the project to have some equipment, at least one of each kind. This is especially true of expensive equipment if it must be ensured that the project does not suffer due to the deficiencies of the equipment used by the contractor. In fact, it is a common practice to buy some expensive and essential equipment and hire them out to the contractor.

This brings us to the end of our discussion on material procurement. The next technical factor we will discuss is plant location.

PLANT LOCATION

Inputs/Market plant location is closely linked with the strategic decisions of the firm. The firm should first decide on whether it should be located closer to the target market or close to the raw materials and other inputs, or whether it should be located around the same place where all its competitors are located. If the location is proximate to the target market, cost of transporting the inputs may be high. But if the location is close to raw materials, but away from the target market, though savings may be made in transportation costs, the time lag in responding to the demands from the customers will increase. To reduce the time lag, the firm may have to open outlets closer to the market, which will again push up the costs. The firm should, therefore, identify whether it is most efficient in organizing transporting raw materials cheaply, or in running retail outlets and should base its location on the costs involved. But, not all firms get a chance to choose a location. For example, a fire fighting service can only choose from where its operations can be controlled – it cannot choose the actual place of service. In contrast, manufacturing firms can choose their location – where to process each stage and where to sell.

Even at the risk of overemphasizing, it must be said that there are basically two aspects that are effected by the location: costs and competitiveness. Purchasing industrial land takes up a substantial part of the project outlay. And it permanently affects the costs of transporting inputs, finished products and men. If an expensive site is purchased, it takes up a lot more money that warranted and results in the project outlay being higher, and as a consequence, the profit to be made by the venture will also have to be higher, thus affecting competitiveness. But, if an unsuitable site is purchased because it is cheap, the transportation costs will be higher, thus depressing the profits. A bad location decision can seal the fate of a project at the very beginning. A growing firm will face the location decision with some frequency – it may first operate from rented premises, then acquire a small premises and then, as business expands further, go for a bigger building of its own. It is necessary to take the right decision each time the location is changed, if the growth should continue.

The next logical question, after understanding the importance of a location decision, is how best to choose a site. There are five basic factors to be considered while selecting a project site:

i. Location of markets

ii. Transportation costs

iii. Availability of labor

iv. Availability of infrastructure

v. Intangible factors.

i. **Location of Markets**

For some activities which are basically service-oriented, it is essential to be as close as possible to the market. Even for manufacturing ventures, being closer to the target market saves costs of transporting finished goods. But, this is applicable only if the market is concentrated in or around a defined area. If the market is spread out over a large area, like the market for a consumer product such as soaps, location of the plant is not so important, unless only a part of the total market is targeted. If a firm is operating in an industry in which locating close to the target market is essential, then the firm will also have to set-up its operations alongside the competitors if there are any. The success of such a firm, surrounded by competitors, depends on the effectiveness of the firm's Unique Selling Proposition (USP). If the firm is unable to design a USP, it will be better advised to avoid the market and choose another in which the competitors are few and demand is adequate.

ii. **Transportation Costs**

As already discussed, transportation costs not only vary depending on the distance, but also based on the location. That is, for the same distance, shipping costs will vary depending on the port used. And, while choosing a location, the firm should compare the input transportation costs with the output transportation costs. For firms where inputs are bulky, it may be better to locate near the raw materials (material-oriented location), if the cost of transporting them is less than the cost of transporting the end product, such as in mining.

iii. **Availability of Labor**

Apart from transportation costs, labor costs also play a crucial role in location decisions. Availability of trained and disciplined manpower at competitive rates, should also be considered while deciding the project site.

iv. **Availability of Infrastructure**

Availability of infrastructure facilities such as road and railway lines, telecommunications and power is also a key factor in determining the plant site. If the proposed site is too far off from the existing road and railway line, the firm may have to spend heavily in laying the same, or wait till they are laid by the government.

v. **Intangible Factors**

There are many rules and regulations made by the central and state governments on the location of industries. There are many concessions available to industries set-up in certain notified areas. Availing such concessions can save a substantial amount of the project cost. An equally important intangible factor is environmental pollution. While choosing project site, care must be taken to see that there is adequate possibility of releasing hazardous chemical, say, large waste land, river, etc. If neither is there around or if the wastes are so hazardous that they cannot be dumped on land or into rivers or released into the air, effluent treatment plants should be set-up. The necessity of effluent treatment plants should be decided based on whether any human population or ecological balance will be seriously effected due to the effluents, if they are released without treatment. And, irrespective of pollution, the attitudes of people towards industries and their work culture should be studied well. If the people are hostile to industries and have bad work culture, it is very difficult to get a good labor force in that area. Last, but not the least, plans for future expansion should be kept in mind while selecting the site. If a site is chosen in an area which is already crammed, there will be no scope for acquiring more land in future to expand.

Facility Layout

The arrangement of the various machines and equipments on the shop floor is called facility layout. Facility layout should be designed keeping in view the nature of the manufacturing process and the volumes involved.

For example, imagine a supermarket. Suppose that all the goods have been classified and each class of goods has been arranged in an island. Then, the supermarket should have one salesman at each island. If salesmen are appointed only at a few islands, then sales at the other islands become difficult, as salesmen will have to jump from one island to another. If salesmen are few and customers are going to be many, then it is better to arrange all the goods in rows or columns so that salesmen can move freely. The same applies to a shopfloor as well. The movements of people and materials have to be visualized before designing the layout.

There are three basic types of layouts: process layout, product layout and fixed position layout.

Process Layout

In process layout, all machines are arranged according to the process or function they perform. For example, all drilling machines are arranged at one place, all lathe machines are arranged at another place, and all milling machines are arranged together at another place. As the arrangement is based on the function, this layout is also called functional layout. This layout is best suited for factories where production is intermittent (batch production) and different items of varied sizes and shapes are produced. In this layout, the workers will be confined to only one particular class of machines and will be able to acquire considerable skill in operating that type of machines. Therefore, they will be able to handle any type of job that requires that particular machines. Thus, the main advantage of this layout is its flexibility. On the other side of the coin, as the workers are conversant with only one particular type of machine, they sit idle when there is no work on that machine. This leads to avoidable labor costs.

Product Layouts

Product layouts are also called 'assembly lines.' In this type of layout, all the machines are arranged in a line, and the sequence of the machines depends on the sequence of the operations to be performed for producing a particular product. The name 'assembly lines' is because such layout is most frequently used for assembling operations. The term product layout arises from the fact that the layout is based on the operations required for a particular product. This layout is suitable for producing items of mass production or repetitive production processes for which the demand is stable and the volumes are high enough. The main advantage of this type of layout is that the production process is highly efficient and easy to operate and control. The main disadvantage is this layout is highly inflexible. A major change in the design of the item to be produced calls for rebuilding the entire assembly line.

Fixed Position Layout

This type of layout is used when the item to be produced is fragile, or too bulky to move around. For example, it is used in ship building, aircraft building, etc. In this layout, the item being produced remains at a fixed location all through the production process while men and machines are moved from place to place. The workers will be highly specialized in the tasks they have to carry out. Often, the machines used are leased, as they are used for very short periods. The main advantage, obviously, is that large structures that cannot be processed in process or product layout can be handled in this layout.

PROJECT DESIGN

What we have seen until now is basically the arrangement of machines that are actually required for the processing done in a factory. But along with the layout of machines, the layout of all the other paraphernalia should also be decided: the layout of the transportation facilities, communication systems, utilities like water and power, etc. Specifically, the most important layouts, other than the plant layout that have to be decided in advance are:

i. **General Functional Layout:** In this layout, the relationship of the buildings and civil works and the equipments is shown. This layout is designed in such a way that the entire process of receiving raw materials, processing and the outward movement of the finished goods takes place smoothly and efficiently.

ii. **Transport Layout:** In this layout, the distances between various facilities outside the production line and the modes of transport between them are shown.

iii. **Utilities Layout:** The points of availability and consumption of each utility at each point are shown in this layout.

iv. **Communication Layout:** It shows the communication lines between the various divisions – the mode (say telephone lines) and their numbers.

v. **Organizational Layout:** The number of people required, their requirement at each part of the project site, and their hierarchical relationship are shown in this layout.

All layouts are designed before starting construction and installation of the machinery. They greatly facilitate installation of machinery and other facilities.

WORK SCHEDULE

The schedule of the construction works and installation of the facilities is called work schedule. This schedule enables the project management to make sure that all the works are synchronized. That is, the civil structure required for installing a machine should be ready by the time the machine is delivered at the project site. If the timings of these two do not match, problems of storing the received machinery (storage space, deterioration of quality) will arise. Similarly, power, and raw materials should be available in the required quantity by the time the plant is ready for commissioning. If they are not available, the plant will be idle and if they are received much earlier than required, storing them can be problematic. According to Dr. Prasanna Chandra[1], work schedules are prepared to:

- anticipate problems likely to arise during the installation phase and suggest possible means for coping with them.
- establish the phasing of investments taking into account the availability of finances.
- develop a plan of operations covering the initial period.

A good work schedule will go a long way in making the construction, installation and the commissioning process smooth.

SUMMARY

- The selection of technology is a very important aspect of project management because it involves a huge investment, which is irreversible in nature. The promoters take the services of external consultants for deciding the technology to be used. The technology may be purchased from the technology provider through turnkey project or the design and specification about the equipment may be obtained to purchase the technology. The selection of a project site is very important and it should be finalized only after considering the location of markets, transportation costs, availability of labor and availability of infrastructure. The layout of various machines, equipment is also done after planning carefully. The design of project and work schedule is also finalized to make the technical aspect of the project complete.

1 Projects: Planning, Analysis, Selection, Implementation and Review by Dr. Prasanna Chandra, Tata McGraw Hill Publishing Co. Ltd.

Chapter VI

Time Value of Money

After reading this chapter, you will be conversant with:

- Why Money has Time Value?
- Process of Compounding
- Process of Discounting
- Future Value of a Single Flow
- Future Value of Multiple Flows
- Future Value of Annuity
- Present Value of a Single Flow
- Present Value of Uneven Multiple Flows

We have seen that to keep pace with the increasing competition, companies are always going in for new ideas being implemented through new projects: be it for expansion, diversification or modernization.

A project is an activity that involves investing a sum of money now in anticipation of benefits spread over a period of time in the future. How do we determine whether the project is financially viable or not? Our immediate response to this question will be to sum up the benefits accruing over the future period and compare the total value of the benefits with the initial investment. If the aggregate value of the benefits exceeds the initial investment, the project is considered to be financially viable.

While this approach *prima facie* appears to be satisfactory, we must be aware of an important assumption that underlies our approach. We have assumed that irrespective of the time when money is invested or received, the value of money remains the same. Put differently, we have assumed that: value of one rupee now = value of one rupee at the end of year 1 = value of one rupee at the end of year 2 and so on. We know intuitively that this assumption is incorrect because money has time value. How do we define this time value of money and build it into the cash flows of a project? The answer to this question forms the subject matter of this chapter.

We intuitively know that Rs.1,000 on hand now is more valuable than Rs.1,000 receivable after a year. In other words, we will not part with Rs.1,000 now in return for a firm assurance that the same sum will be repaid after a year. But we might part with Rs.1,000 now if we are assured that something more than Rs.1,000 will be paid at the end of the first year. This additional compensation required for parting with Rs.1,000 now is called 'interest' or the time value of money. Normally, interest is expressed in terms of percentage per annum e.g.12% p.a. or 18% p.a. and so on.

WHY MONEY HAS TIME VALUE?

Why should money have time value? Here are some important reasons for this phenomenon:

- Money can be employed productively to generate real returns. For instance, if a sum of Rs.100 invested in raw material and labor results in finished goods worth Rs.105, we can say that the investment of Rs.100 has earned a rate of return of 5 percent.
- In an inflationary period, a rupee today has a higher purchasing power than a rupee in the future.
- Since future is characterized by uncertainty, individuals prefer current consumption to future consumption.

The manner in which these three determinants combine to determine the rate of interest can be symbolically represented as follows:

Nominal or market interest rate

= Real rate of interest or return + Expected rate of inflation + Risk premiums to compensate for uncertainty

There are two methods by which the time value of money can be taken care of – compounding and discounting. To understand the basic ideas underlying these two methods, let us consider a project which involves an immediate outflow of say Rs.1,000 and the following pattern of inflows:

Year 1: Rs.250

Year 2: Rs.500

Year 3: Rs.750

Year 4: Rs.750

The initial outflow and the subsequent inflows can be represented on a time line as given below:

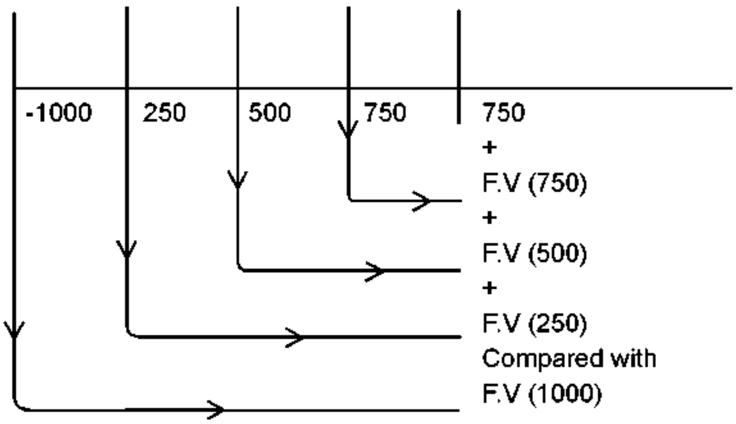
Figure 1: Time Line

Yr:	0	1	2	3	4
Rs.:	–1000	250	500	750	750

PROCESS OF COMPOUNDING

Under the method of compounding, we find the future values (FV) of all the cash flows at the end of the time horizon at a particular rate of interest. Therefore, in this case we will be comparing the future value of the initial outflow of Rs.1,000 as at the end of year 4 with the sum of the future values of the yearly cash inflows at the end of year 4. This process can be schematically represented as follows:

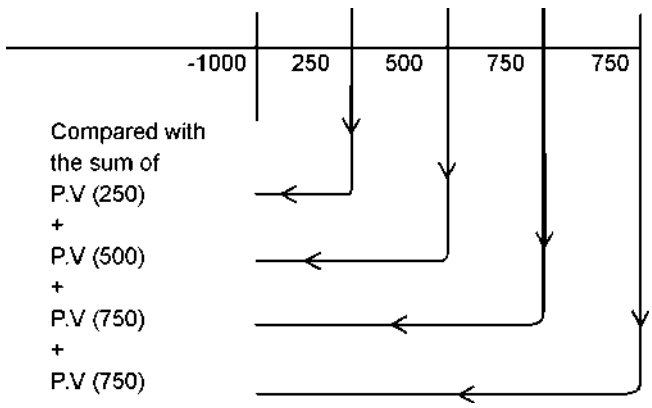
Figure 2: Process of Compounding



PROCESS OF DISCOUNTING

Under the method of discounting, we reckon the value of money now, i.e. at time 0 on the time line. So, we will be comparing the initial outflow with the sum of the present values (PV) of the future inflows at a given rate of interest. This process can be diagramatically represented as follows:

Figure 3: Process of Discounting



How do we compute the future values and the present values? This question is answered in the later part of the chapter. But before that, we must draw the distinction between the concepts of compound interest and simple interest.

We shall illustrate this distinction through the following example:

Illustration 1

If X has a sum of Rs.1,000 to be invested, and there are two schemes, one offering a rate of interest of 10%, compounded annually, and other offering a simple rate of interest of 10%, which one should he opt for assuming that he will withdraw the amount at the end of (a) one year, (b) two years, and (c) five years? Assume that the interest is paid only at the time of maturity.

Solution

Given the initial investment of Rs.1,000, the accumulations under the two schemes will be as follows:

End of year	Compounded Interest Scheme	Simple Interest Scheme
1.	1000 + (1000 x 0.10) = 1100	1000 + (1000 x 0.10) = 1100
2.	1100 + (1100 x 0.10) = 1210	1100 + (1000 x 0.10) = 1200
3.	1210 + (1210 x 0.10) = 1331	1200 + (1000 x 0.10) = 1300
4.	1331 + (1331 x 0.10) = 1464	1300 + (1000 x 0.10) = 1400
5.	1464 + (1464 x 0.10) = 1610	1400 + (1000 x 0.10) = 1500

From this table, it is clear that under the compound interest scheme interest earns interest, whereas interest does not earn any additional interest under the simple interest scheme. Obviously, an investor seeking to maximize returns will opt for the compound interest scheme if his holding period is more than a year. We have drawn the distinction between compound interest and simple interest here to emphasize that in financial analysis we always assume interest to be compounded.

FUTURE VALUE OF A LUMP SUM (SINGLE FLOW)

The above table illustrates the process of determining the future value of a lump sum amount invested at one point of time. But the way the future value has been calculated will prove to be cumbersome if the future value over long maturity periods of 20 years or 30 years is to be calculated. A generalized procedure for calculating the future value of a single cash flow compounded annually is as follows:

$$FV_n = PV(1 + k)^n$$

where FV_n = future value of the initial flow n years hence
PV = initial cash flow
k = annual rate of interest
n = life of investment

In the above formula, the expression $(1 + k)^n$ represents the future value of an initial investment of Re.1. (one rupee invested today) at the end of n years at a rate of interest k referred to as Future Value Interest Factor (FVIF, hereafter). To simplify calculations, this expression has been evaluated for various combinations of k and n and these values are presented in Appendix II at the end of this book. To calculate the future value of any investment for a given value of 'k' and 'n', the corresponding value of $(1 + k)^n$ from the table has to be multiplied with the initial investment.

Illustration 2

The fixed deposit scheme of ABC Bank offers the following interest rates.

Period of Deposit	Rate Per Annum
46 days to 179 days	10.0%
180 days to < 1 year	10.5%
1 year and above	11.0%

An amount of Rs.10,000 invested today will grow in 3 years to

$FV_n = PV(1 + k)^n$

$= 10{,}000\ (1 + 0.11)^3$

$= 10{,}000\ (1.368)$

$=$ Rs.13,680

Doubling Period

A frequent question posed by the investor is, "How long will it take for the amount invested to be doubled for a given rate of interest''. This question can be answered by a rule known as "rule of 72''. Though it is an approximate way of calculating this rule says that the period within which the amount will be doubled is obtained by dividing 72 by the rate of interest.

For instance, if the given rate of interest is 6%, then doubling period is 72/6 = 12 yrs.

However, an accurate way of calculating doubling period is the "rule of 69", according to which, doubling period = $0.35 + \dfrac{69}{\text{interest rate}}$

Illustration 3

The following is the calculation of doubling period for two rates of interest i.e., 6% and 12%.

Rate of interest	Doubling Period
6%	0.35 + 69/6 = 0.35 + 11.5 = 11.85 yrs.
12%	0.35 + 69/12 = 0.35 + 5.75 = 6.1 yrs.

Growth Rate

The compound rate of growth for a given series a period of time can be calculated by employing the future value interest factor table (FVIF).

Illustration 4

Years	1	2	3	4	5	6
Profits (in lakh)	95	105	140	160	165	170

How is the compound rate of growth for the above series determined? This can be done in two steps:

a. The ratio of profits for year 6 to year 1 is to be determined i.e., 170 / 95 = 1.79

b. The $FVIF_{kn}$ table is to be looked at. Look at a value which is close to 1.79 for the row for 5 years.

The value close to 1.79 is 1.762 and the interest rate corresponding to this is 12%. Therefore, the compound rate of growth is approximately 12%.

Increased Frequency of Compounding

In the above illustration, the compounding has been done annually. Suppose we are offered a scheme where compounding is done more frequently. For example, assume you deposit Rs.10,000 in a bank which offers 10% interest per annum compounded semi-annually which means that interest is paid every six months.

		Rs.
Now, Amount in the beginning	=	10,000
Interest @ 10% p.a. for first six months $10{,}000 \times \dfrac{0.1}{2}$	=	500
Amount at the end of six months	=	10,500
Interest for second 6 months = $10{,}500 \times \dfrac{0.1}{2}$	=	525
Amount at the end of one year	=	11,025

Instead, if the compounding is done annually, the amount at the end of the year will be 10,000 (1 + 0.1) = Rs.11,000. This difference of Rs.25 is because under semi-annual compounding, the interest for first 6 months earns interest in the second 6 months.

The generalized formula for these shorter compounding periods is

$$FV_n = PV \left(1 + \frac{k}{m}\right)^{m \times n}$$

where FV_n = Future value after 'n' years

PV = Cash flow today

K = Nominal interest rate per annum

m = Number of times compounding is done during a year

n = Number of years for which compounding is done.

Illustration 5

Under the Vijaya Cash Certificate scheme of Vijaya Bank, deposits can be made for periods ranging from 6 months to 10 years. Every quarter, interest will be added on to the principal. The rate of interest applied is 9% p.a. for periods from 12 to 23 months and 10% p.a. for periods from 24 to 120 months.

An amount of Rs.1,000 invested for 2 years will grow to

$$FV_n = PV \left(1 + \frac{k}{m}\right)^{mxn}$$

Where, m = frequency of compounding during a year

$$= 1{,}000 \left(1 + \frac{0.10}{4}\right)^{2 \times 4}$$

$$= 1{,}000\ (1.025)^8$$

$$= 1{,}000 \times 1.218 = \text{Rs.}1{,}218$$

Effective vs. Nominal Rate of Interest

We have seen earlier that the accumulation under the semi-annual compounding scheme exceeds the accumulation under the annual compounding scheme by Rs.25. This means that while under annual compounding scheme, the nominal rate of interest is 10% per annum, under the scheme where compounding is done semi-annually, the principal amount grows at the rate of 10.25 percent per annum. This 10.25 percent is called the effective rate of interest which is the rate of interest per annum under annual compounding that produces the same effect as that produced by an interest rate of 10 percent under semi-annual compounding.

The general relationship between the effective and nominal rates of interest is as follows:

$$r = \left(1 + \frac{k}{m}\right)^{mxn} - 1$$

Where r = effective rate of interest

k = nominal rate of interest

m = frequency of compounding per year

Illustration 6

Find out the effective rate of interest, if the nominal rate of interest is 12% and is quarterly compounded?

Effective rate of interest

$$r = \left(1 + \frac{k}{m}\right)^{mxn} - 1$$

$$r = \left(1 + \frac{0.12}{4}\right)^{4} - 1$$

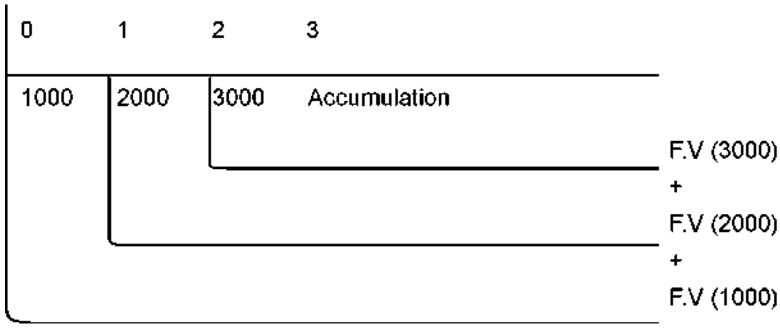
$= (1 + 0.03)^4 - 1 = 1.126 - 1$

$= 0.126 = 12.6\%$ p.a. compounded quarterly.

FUTURE VALUE OF MULTIPLE FLOWS

Suppose we invest Rs.1,000 now (beginning of year 1), Rs.2,000 at the beginning of year 2 and Rs.3,000 at the beginning of year 3, how much will these flows accumulate to at the end of year 3 at a rate of interest of 12% per annum? This problem can be represented on the time line as follows:

Figure 4: Compounding Process for Multiple Flows



To determine the accumulated sum at the end of year 3, we have to just add the future compounded values of Rs.1,000, Rs.2,000 and Rs.3,000 respectively[1].

F.V. (Rs.1,000) + F.V. (Rs.2,000) + F.V. (Rs.3,000)

At k = 0.12, the above sum is equal to Rs.1,000 x FVIF(12,3) + 2,000 x FVIF(12, 2) Rs.3,000 x FVIF(12,1)

= Rs.[(1,000 x 1.405) + (2,000 x 1.254) + (3,000 x 1.120)] = Rs.7,273

Therefore, to determine the accumulation of multiple flows as at the end of a specified time horizon, we have to find out the accumulations of each of these flows using the appropriate FVIF and sum up these accumulations. This process can get tedious if we have to determine the accumulation of multiple flows over a long period of time, for example, the accumulation of a recurring deposit of Rs.100 per month for 60 months at a rate of 1% per month. In such cases a short-cut method can be employed provided the flows are of equal amounts. This method is discussed in the following section.

FUTURE VALUE OF ANNUITY

Annuity is the term used to describe a series of periodic flows of equal amounts. These flows can be either receipts or payments. For example, if you are required to pay Rs.200 per annum as life insurance premium for the next 20 years, you can classify this stream of payments as an annuity. If the equal amounts of cash flow occur at the end of each period over the specified time horizon, then this stream of

1 Candidates who would like to know whether there is any short-cut for evaluating $(1 + k)^n$ for values of 'k' not found in the table, are informed that there is no short-cut method except using logarithms or the X^Y function found in scientific calculations.

cash flows is defined as a regular annuity or deferred annuity. When cash flows occur at the beginning of each period the annuity is known as an annuity due.

The future value of a regular annuity for a period of n years at a rate of interest 'k' is given by the formula:

$FVA_n = A(A + k)^{n-1} + A(+ k)^{n-2} + A(1 + k)^{n-3} +..+ A$

which reduces to

$$FVA_n = A\left[\frac{(1+k)^n - 1}{k}\right]$$

Where, A = amount deposited/invested at the end of every year for n years.

k = rate of interest (expressed in decimals)

n = time horizon

FVA_n = accumulation at the end of n years.

The expression, $\left[\frac{(1+k)^n - 1}{k}\right]$ is called the Future Value Interest Factor for Annuity (FVIFA, hereafter) and it represents the accumulation of Re.1 invested or paid at the end of every year for a period of n years at the rate of interest 'k'. As in the case of the future value of a single flow, this expression has also been evaluated for different combinations of 'k' and 'n' and tabulated in Appendix II at the end of this book. So, given the annuity payment, we have to just multiply it with the appropriate FVIFA value and determine the accumulation.

Illustration 7

Under the recurring deposit scheme of the Vijaya Bank, a fixed sum is deposited every month on or before the due date opted for 12 to 120 months according to the convenience and needs of the investor. The period of deposit, however, should be in multiples of 3 months only. The rate of interest applied is 9% p.a. for periods from 12 to 24 months and 10% p.a. for periods from 24 to 120 months and is compounded at quarterly intervals.

Based on the above information the maturity value of a monthly installment of Rs.5 for 12 months can be calculated as below:

Amount of deposit = Rs.5 per month

Rate of interest = 9% p.a. compounded quarterly

Effective rate of interest per annum

$$= \left(1 + \frac{0.09}{4}\right)^4 - 1 = 0.0931$$

Rate of interest per month = $\frac{0.0931}{12}$ = 0.78%

Alternative Method

Rate of interest per month

$$= (r + 1)^{1/m} - 1$$

$$= (1 + 0.0931)^{12} - 1$$

$$= 1.0074 - 1 = .0074 = .74\%$$

Maturity value can be calculated using the formula

$$FVA_n = A\left\{\frac{(1+k)^n - 1}{k}\right\}$$

$$= 5\left\{\frac{(1+0.0078)^{12} - 1}{0.0078}\right\}$$

$$= 5 \text{ x } 12.53 = \text{Rs.}62.65$$

If the payments are made at the beginning of every year, then the value of such an annuity called annuity due is found by modifying the formula for annuity regular as follows:

$$FVA_n(\text{due}) = A\ (1 + k)\ FVIFA_{k,\ n}$$

Illustration 8

Under the Jeevan Mitra Plan offered by Life Insurance Corporation of India, if a person is insured for Rs.10,000 and if he survives the full term, then the maturity benefits will be the basic sum of Rs.10,000 assured plus bonus which accrues on the basic sum assured. The minimum and maximum age to propose for a policy is 18 and 50 years respectively.

Let us take two examples, one of a person aged 20 and another a person who is 40 years old to illustrate this scheme.

The person aged 20, enters the plan for a policy of Rs.10,000. The term of policy is 25 years and the annual premium is Rs.41.65. The person aged 40, also proposes for the policy of Rs.10,000 and for 25 years and the annual premium he has to pay comes to Rs.57. What are the rate of returns enjoyed by these two persons?

Rate of Return enjoyed by the person of 20 years of age

Premium	=	Rs.41.65 per annum
Term of Policy	=	25 years
Maturity Value	=	Rs.10,000 + bonus which can be neglected as it is a fixed amount and does not vary with the term of policy.

We know that the premium amount when multiplied by FVIFA factor will give us the value at maturity.

i.e., $P \text{ x } (1 + k)^2\ FVIFA\ (k, n) = MV$

Where
P = Annual Premium
n = Term of policy in years
k = Rate of return
MV = Maturity Value

Therefore $41.65 \text{ x } (1 + k)\ FVIFA\ (k, 25) = 10{,}000$

$(1 + k)\ FVIFA\ (k, 25) = 240.01$

From the table A.2 at the end of the book, we can find that

$(1 + 0.14)\ FVIFA\ (14, 25) = 207.33$

i.e. $(1.14)\ FVIFA\ (14, 25) = 1.14 \text{ x } 181.871 = 207.33$

and

$(1 + 0.15)\ FVIFA\ (15,25) = 244.71$

i.e. $(1.15)\ FVIFA\ (15,25) = 1.15 \text{ x } 212.79 = 244.71$

By interpolation

$$k = 14\% + (15\% - 14\%) \text{ x } \frac{240.01 - 207.33}{244.71 - 207.33}$$

$$= 14\% + 1\% \text{ x } \frac{32.68}{37.38}$$

$$= 14\% + 0.87\% = 14.87\%$$

2 As the payments to Jeevan Mitra occurs at the beginning of the year, it is an annuity due and the future value of such payments is equal to $(k+k)\ FVIFA_{(k,n)}$

Rate of return enjoyed by the person aged 40

Premium	=	Rs.57 per annum
Term of Policy	=	25 years
Maturity Value	=	Rs.10,000

Therefore, 57 x (1 + k) FVIFA (k, 25) = 10,000

(1 + k) FVIFA (k, 25) = 175.44

From the table A.2, we can find that

(1 + k) FVIFA (13,25)	=	175.87
i.e. (1.13) (155.62)	=	175.87
i.e. k	=	13%(appr.)

Here we find that the rate of return enjoyed by the 20-year old person is greater than that of the 40-year old person by about 2% in spite of the latter paying a higher amount of annual premium for the same period of 25 years and for the same maturity value of Rs.10,000. This is due to the coverage for the greater risk in the case of the 40-year old person.

Now that we are familiar with the computation of future value, we will get into the mechanics of computation of present value. But, before that, let us look at one more application of the principle of compounding.

Sinking Fund Factor

We have the equation

$$FVA = A\left[\frac{(1+k)^n - 1}{k}\right]$$

We can rewrite it as

$$A \quad = FVA\left[\frac{k}{(1+k)^n - 1}\right]$$

The expression $\frac{k}{(1+k)^n - 1}$ is called the Sinking Fund Factor. It represents the amount that has to be invested at the end of every year for a period of "n" years at the rate of interest "k", in order to accumulate Re.1 at the end of the period.

PRESENT VALUE OF A SINGLE FLOW

Discounting as explained earlier is an alternative approach for reckoning the time value of money. Using this approach, we can determine the present value of a future cash flow or a stream of future cash flows. The present value approach is the commonly followed approach for evaluating the financial viability of projects.

If we invest Rs.1,000 today at 10% rate of interest for a period of 5 years, we know that we will get Rs.1,000 x FVIF (10,5) = Rs.1,000 x 1.611 = Rs.1,611 at the end of 5 years. The sum of Rs.1,611 is called the accumulation of Rs.1,000 for the given values of 'k' and 'n'. Conversely, the sum of Rs.1,000 invested today to get Rs.1,611 at the end of 5 years is called the present value of Rs.1,611 for the given values of 'k' and 'n'. It therefore follows that to determine the present value of a future sum we have to divide the future sum by the FVIF value corresponding to the given values of 'k' and 'n' i.e., present value of Rs.1,611 receivable at the end of 5 years at 10% rate of interest

$$= Rs.\frac{1611}{FVIF(10,5)} = \frac{1611}{1.611} = Rs.1,000$$

In general, the present value (PV) of a sum (FV_n) receivable after n years at a rate of interest (k) is given by the expression.

$$PV = \frac{FV_n}{FVIF(k,n)} = \frac{FV_n}{(1+k)^n}$$

The inverse of FVIF (k,n) is defined as PVIF (k,n) (Present Value Interest Factor for k,n). Therefore, the above equation can be written as:

$$PV = FV_n \times PVIF_{(k,n)}$$

Therefore, to determine the present value of a future sum, we have to just locate the PVIF factor for the given values of k and n and multiply this factor value with the given sum. Since $PVIF_{(k,n)}$ represents the present value of Re.1 receivable after n years at a rate of interest k, it is obvious that PVIF values cannot be greater than one. The PVIF values for different combinations of k and n are given in Appendix II at the end of this book.

Illustration 9

The cash certificates of Andhra Bank is a term deposit scheme under reinvestment plan. Interest on deposit money earns interest as it is reinvested at quarterly rests. These deposits suit depositors from lower and middle income groups, since the small odd sums invested grow into large amounts over a period of time.

Given an interest rate of 12% p.a. on a certificate having a value of Rs.100 after 1 year, the issue price of the cash certificate can be calculated as below:

The effective rate of interest has to be calculated first.

$$r = \left(1+\frac{k}{m}\right)^m - 1$$

$$r = \left(1+\frac{0.12}{4}\right)^4 - 1 = 12.55\%$$

The issue price of the cash certificate is

$$PV = \frac{FV_n}{(1+k)^n}$$

$$= \frac{100}{(1+0.1255)^1} = Rs.88.85$$

Illustration 10

Pragati cash certificate scheme of Syndicate Bank is an ideal scheme for all classes of people under different income groups. A small odd sum can be invested for a period ranging from 1 to 10 years. The certificates are issued in convenient denominations of Rs.25, Rs.100, Rs.1,000, and Rs.1,00,000. The rate of interest is 12% p.a. compounded quarterly.

To calculate the issue price of a certificate of Rs.1,00,000 to be received after 10 years, the following formula can be used

$$PV = \frac{FV_n}{(1+k)^n}$$

Firstly, the effective rate of interest has to be calculated

$$r = \left(1+\frac{0.12}{4}\right)^4 - 1 = 12.55\%$$

The issue price of the cash certificate can now be calculated as:

$$PV = \frac{FV_n}{(1+k)^n}$$

$$= \frac{1,00,000}{(1+0.1255)^{10}} = Rs.30,658$$

PRESENT VALUE OF MULTIPLE FLOWS

Suppose a project involves an initial investment of Rs.10 lakh and generates net inflows as follows:

Year	Cash Flow
1	Rs.2 lakh
2	Rs.4 lakh
3	Rs.6 lakh

What is the present value of the future cash inflows? To determine the present value, we have to first define the relevant rate of interest. The relevant rate of interest as we shall see later, will be the cost of the funds invested. Suppose, we assume that this cost is 12% p.a., then we can determine the present value of the cash flows using the following two-step procedure:

Step 1

Evaluate the present value of cash inflow independently. In this case, the present values will be as follows:

Year	Cash Flow (Rs.in lakh)	Present Value (Rs.in lakh)
1	2	2 x PVIF (12,1)
		= 2 x 0.893 = 1.79
2	4	4 x PVIF (12,2)
		= 4 x 0.797 = 3.19
3	6	6 x PVIF (12,3)
		= 6 x 0.712 = 4.27

Step 2

Aggregate the present values obtained in Step 1 to determine the present value of the cash flow stream. In this case the present value of the cash inflows associated with the project will be Rs.(1.79 + 3.19 + 4.27) lakh = Rs.9.25 lakh.

A project is said to be financially viable if the present value of the cash inflows exceeds the present value of the cash outflow. In this case, the project is not financially viable because the present value of the net cash inflows (Rs.9.25 lakh) is less than the initial investment of Rs.10 lakh. The difference of – Rs.75 lakh is called the net present value.

Like the procedure followed for obtaining the future value of multiple cash flows, the procedure adopted for determining the present value of a series of future cash flows can prove to be cumbersome, if the time horizon to be considered is quite long. These calculations can, however, be simplified if the cash flows occurring at the end of the time periods are equal. In other words, if the stream of cash flows can be regarded as a regular annuity or annuity due, then the present value of this annuity can be determined using an expression similar to the FVIFA expression.

PRESENT VALUE OF AN ANNUITY

The present value of an annuity 'A' receivable at the end of every year for a period of n years at a rate of interest k (PVA_n) is equal to

$$PVA_n = \frac{A}{(1+k)} + \frac{A}{(1+k)^2} + \frac{A}{(1+k)^3} + \ldots\ldots \frac{A}{(1+k)^n}$$

which reduces to

$$PVA_n = A \text{ x } \left[\frac{(1+k)^n - 1}{k\,(1+k)^n}\right]$$

The expression $\left[\frac{(1+k)^n - 1}{k(1+k)^n}\right]$ is called the PVIFA (Present Value Interest Factor for an Annuity) and it represents the present value of a regular annuity of Re.1 for the given values of k and n. The values of PVIFA (k, n) for different combinations of 'k' and 'n' are given in Appendix II given at the end of the book. It must be noted that these values can be used in any present value problem only if the following conditions are satisfied: (a) the cash flows are equal; and (b) the cash flows occur at the end of every year. It must also be noted that PVIFA (k, n) is not the inverse of FVIFA (k, n) although PVIF (k, n) is the inverse of FVIF (k, n). The following examples illustrate the use of PVIFA tables for determining the present value.

Illustration 11

The Swarna Kalash Yojana at rural and semi-urban branches of SBI is a scheme open to all individuals/firms. A lump sum deposit is remitted and the principal is received with interest at the rate of 12% p.a. in 12 or 24 monthly installments. The interest is compounded at quarterly intervals.

The amount of initial deposit to receive a monthly installment of Rs.100 for 12 months can be calculated as below:

Firstly, the effective rate of interest per annum has to be calculated.

$$r = \left(1+\frac{k}{m}\right)^m - 1$$

$$r = \left(1+\frac{0.12}{4}\right)^4 - 1 = 12.55\%$$

After calculating the effective rate of interest per annum, the effective rate of interest per month has to be calculated which is

$$\frac{0.1255}{12} = 0.01046$$

The initial deposit can now be calculated as below:

$$PVA_n = A\left[\frac{(1+k)^n - 1}{k\,(1+k)^n}\right]$$

$$= 100\left[\frac{(1+0.01046)^{12} - 1}{0.01046\,(1+0.01046)^{12}}\right]$$

$$= 100\left[\frac{0.133}{0.01185}\right] = 100 \text{ x } 11.22 = \text{Rs.}1122$$

Illustration 12

The annuity deposit scheme of SBI provides for fixed monthly income for suitable periods of the depositor's choice. An initial deposit has to be made for a minimum period of 36 months. After the first month of the deposit, the depositor receives monthly installments depending on the number of months he has chosen as annuity period. The rate of interest is 11% p.a. which is compounded at quarterly intervals.

If an initial deposit of Rs.4,549 is made for an annuity period of 60 months, the value of the monthly annuity can be calculated as below:

Firstly, the effective rate of interest per annum has to be calculated which is:

$$r = \left(1+\frac{k}{m}\right)^m - 1$$

$$= \left(1 + \frac{0.11}{4}\right)^4 - 1 = 11.46\%$$

After calculating the effective rate of interest per annum, the effective rate of interest per month has to be calculated which is

$$\frac{0.1146}{12} = 0.00955$$

The monthly annuity can now be calculated as

$$PVA_n = A\left[\frac{(1+k)^n - 1}{k\,(1+k)^n}\right]$$

$$4549 = A\left[\frac{(1+0.00955)^{60} - 1}{0.00955\,(1+0.00955)^{60}}\right]$$

$$A = \text{Rs.}100$$

Capital Recovery Factor

Manipulating the relationship between PVA_n, A, k and n we get an equation:

$$A = PVA_n\left[\frac{k(1+k)^n}{(1+k)^n - 1}\right]$$

$\left[\frac{k(1+k)^n}{(1+k)^n - 1}\right]$ is known as the capital recovery factor.

Illustration 13

A loan of Rs.1,00,000 is to be repaid in five equal annual installments. If the loan carries a rate of interest of 14% p.a. the amount of each installment can be calculated as below:

If R is defined as the equated annual installment, we are given that

$$R \times PVIFA\,(14,5) = \text{Rs.}1{,}00{,}000$$

$$\text{Therefore,}\quad R = \frac{\text{Rs.}1{,}00{,}000}{PVIFA(14,5)}$$

$$= \frac{\text{Rs.}1{,}00{,}000}{3.433} = \text{Rs.}29{,}129$$

Notes:

1. We have introduced in this example the application of the inverse of the PVIFA factor which is called the capital recovery factor. The application of the capital recovery factor helps in answering questions like:
   - What should be the amount that must be paid annually to liquidate a loan over a specified period at a given rate of interest?
   - How much can be withdrawn periodically for a certain length of time, if a given amount is invested today?
2. In this example, the amount of Rs.29,129 represents the sum of the principal and interest components. To get an idea of the break-up of each installment

between the principal and interest components, the loan repayment schedule is given below:

Year (A)	Equated annual installment (B) (Rs.)	Interest content of (B) (C) (Rs.)	Capital content of (B) [(D) = (B – C)] (Rs.)	Loan outstanding after payment (E) (Rs.)
0	–	–	–	1,00,000
1	29,129	14,000	15,129	84,871
2	29,129	11,882	17,247	67,624
3	29,129	9,467	19,662	47,962
4	29,129	6,715	22,414	25,548
5	29,129	3,577	25,552	–

The interest content of each installment is obtained by multiplying interest rate with the loan outstanding at the end of the immediately preceding year.

As it can be observed from this schedule the interest component declines over a period of time whereas the principal component increases. The loan outstanding at the end of the penultimate year must be equal to the principal content of the last installment but in practice there will be a marginal difference on account of rounding-off errors.

3. The equated annual installment method is usually adopted for fixing the loan repayment schedule in a hire purchase transaction. But the financial institutions in India like IDBI, IFCI and ICICI do not follow this scheme of equal periodic amortization. Instead, they stipulate that the loan must be repaid in equal installments. According to this scheme, the principal component of each payment remains constant and the total debt-servicing burden (consisting of principal repayment and interest payment) declines over time.

Present Value of a Perpetuity

An annuity of an infinite duration is known as perpetuity. The present value of such perpetuity can be expressed as follows:

$$P_\infty = A \text{ x } PVIFA_{k\infty}$$

where P_∞ = Present value of a perpetuity

A = Constant annual payment

$PVIFA_{k\infty}$ = Present value interest factor for a perpetuity

Therefore, The value of $PVIFA_{k\infty}$ is

$$\sum_{t=1}^{\infty} \frac{1}{(1+k)^t} = \frac{1}{k}$$

Therefore, we can say that PV interest factor of a perpetuity is simply one divided by interest rate expressed in decimal form. Hence PV of a perpetuity is equal to the constant annual payment divided by the interest rate.

Students who are interested in knowing the derivation of the formulae for PVIFA and FVIFA may refer the Appendix to this chapter.

SUMMARY

- The financial viability of the project requires comparing the future benefits accruing from the project with the cost of the project. As the time value of cash flows received in future is lower than the value of money today, it is necessary to cover the future cash flows in terms of today's value. For this, an appropriate discount rate is used. A comparison of discounted cash flows with cost of capital, help in making a better judgment whether the expected inflows will be more than the cost of the project or not. So, the time value of money is an important aspect of project management.

Appendix

Formulae for future value and present value of Annuity.

The derivation of the formulae for the future value and present value of an annuity makes use of the following symbols.

Symbols used in FVIFA and PVIFA Formulae

A	=	constant periodic flow
K	=	interest rate per period
n	=	duration of the annuity
FVA_n	=	future value of a regular annuity with a duration of n time periods
PVA_n	=	present value of a regular annuity with a duration of n time periods.

Future Value of an Annuity

In terms of the symbols defined in the table above, the future value of a regular annuity can be expressed as follows:

$$FVA_n = A(1 + k)^{n-1} + A(1 + k)^{n-2} + \ldots..+A \qquad \ldots\ldots(1)$$

Multiplying equation (1) by (1 + k) on both sides, we get

$$FVA_n = (1 + k) = A(1 + k)^n + A(1 + k)^{n-1} + \ldots\ldots+ A (1 + k) \qquad \ldots... (2)$$

Subtracting equation (1) from equation (2), we get;

$$FVA_n\ k = A(1 + k)^n – A$$

or $FVA_n\ k = A\ [(1 + k)^n – 1]$

i.e., $FVA_n = A \left[\dfrac{(1+k)^n - 1}{k}\right]$

If the annuity is not a regular annuity but is an annuity due – annuity where cash flows occur at the beginning of each period – the future value can be obtained as follows:

$$FVA_n = \quad A\ (1 + k)^n\ A\ (1 + k)^{n-1} +.....+ A\ (1 + k) \qquad \ldots... (3)$$

Dividing equation (3) by (1 + k) on both sides, we get

$$\frac{FVA_n}{(1+k)} = A\ (1 + k)^{n-1}\ A\ (1 + k)^{n-2} +.....+ A \qquad ... (4)$$

Subtracting equation (4) from equation (3) we get

$$\left[1 - \frac{1}{1+k}\right]FVA_n \quad = \quad A\ (1 + k)^n – A$$

$$\text{i.e., } \frac{K}{1+k}\ FVA_n \quad = \quad A\ [(1 + k)^n =1]$$

$$FVA_n \quad = \quad A\left[\frac{(1+k)^n - 1}{k}\right](1 + k)$$

Therefore, the future value of an annuity due can be expressed as the product of the future value of a regular annuity and the factor (1 + k).

Present Value of an Annuity

The present value of a regular annuity can be represented in terms of the symbols defined in the table as follows:

$$PVA_n = \frac{A}{(1+k)} + \frac{A}{(1+k)^2} +\ldots\ldots + \frac{A}{(1+k)^n} \qquad \ldots... (5)$$

Multiplying equation (5) by (1 + k) on both sides, we get

$$PVA_n\,(1 + k) = A + \frac{A}{(1 + k)} + ... + \frac{A}{(1 + k)^{n-1}} \qquad ....(6)$$

Subtracting equation (5) from equation (6), we get

$$PVA_{n\,K} = A - \frac{A}{(1+k)^n}$$

$$= A\left[1 - \frac{1}{(1+k)^n}\right]$$

$$= A\left[\frac{(1+k)^n - 1}{(1+k)^n}\right]$$

$$PVA_n = A\left[\frac{(1+k)^n - 1}{k(1+k)^n}\right]$$

The present value of an annuity due can be expressed as follows:

$$PVA_n = A\ \frac{A}{(1 + k)} + \frac{A}{(1+k)^2} + ... + \frac{A}{(1+k)^{n-1}} \qquad ....(7)$$

Multiplying equation (7) by $\frac{1}{(1+k)}$ on both sides, we get

$$\frac{PVA_n}{(1+k)} + \frac{A}{(1+k)} +. \frac{A}{(1+k)^2} + ... + \frac{A}{(1+k)^n} \qquad ....(8)$$

Subtracting equation (8) from equation (7), we get

$$PVA_n = \left[1 - \frac{1}{1+k}\right] = A - \frac{A}{(1+k)^n}$$

$$\text{i.e., } PVA_n\left[\frac{k}{1+k}\right] = A\left[\frac{(1+k)^n - 1}{(1+k)^n}\right]$$

$$\text{i.e., } PVA_n = A\left[\frac{(1+k)^n - 1}{k(1+k)^n}\right](1 + k)$$

Thus, we find that the present value of an annuity due is equal to the product of the present value of a regular annuity and the factor (1 + k).

Chapter VII

Cost of Capital

After reading this chapter, you will be conversant with:

- The Meaning of Cost of Capital
- Costs of Different Sources of Finance
- Weighted Average Cost of Capital
- Weighted Marginal Cost of Capital Schedule

MEANING OF COST OF CAPITAL

Now, as we are familiar with the different sources of long-term finance, let us find out what it costs the company to raise these various types of finance.

The cost of capital to a company is the minimum rate of return that it must earn on its investments in order to satisfy the various categories of investors who have made investments in the form of shares, debentures or term loans. Unless the company earns this minimum rate, the investors will be tempted to pull out of the company, leave alone participate in any further capital investment in that company. For example, equity investors expect a minimum return as dividend based on their perception of the risk they are undertaking, on the company's past performance, or on the returns they are getting from shares of other companies they have invested in.

A company's cost of capital is the weighted arithmetic average of the cost of various sources of finance that have been used by it. Let us look at a simple example. A company has a total capital base of Rs.500 lakh in the ratio of 1:1 of debt-equity[1] i.e., divided equally between debt and equity; Rs.250 lakh of debt and Rs.250 lakh of equity. If the post-tax costs of debt and equity are 7% and 18% respectively, the cost of capital to the company will be equal to the weighted average cost i.e.,

$$= \frac{250}{500} \text{ x } 7\% + \frac{250}{500} \text{ x } 18\% = 12.5\%.$$

Assumptions

Given this definition of cost of capital, it must be noted that the use of this measure for appraising new investments will depend upon two important assumptions: (a) the risk characterizing the new project under consideration is not significantly different from the risk characterizing the existing investments of the firm, and (b) the firm will continue to pursue the same financing policies. Put differently, there will be no deviation from the debt-equity mix presently adopted by the firm.

For calculating the cost of capital of the firm, we have to first define the cost of various sources of finance[2] used by it. The sources of finance that are typically tapped by a firm are: (a) debentures, (b) term loans, (c) preference capital, (d) equity capital, and (e) retained earnings.

The mechanics involved in computing the costs of these sources of finance are discussed in the following section.

COSTS OF DIFFERENT SOURCES OF FINANCE

Cost of Debentures

The cost of a debenture is defined as that discount rate which equates the net proceeds from issue of debentures to the expected cash outflows in the form of interest and principal repayments i.e.,

$$P = \sum_{t=1}^{n} \frac{I\,(1-t)}{(1+k_d)t} + \frac{F}{(1+k_d)^n} \qquad ....(1)$$

where,

k_d = post-tax cost of debenture capital
I = annual interest payment per debenture capital
t = corporate tax rate
F = redemption price per debenture
P = net amount realized per debenture

1 This ratio is called the Debt-Equity Ratio which will be covered in detail later in this chapter.

2 The cost of a source of finance is defined as the rate of discount which equates the present value of the expected payments to that source of finance with the net proceeds received from that source of finance. The formulae discussed in this section for obtaining the costs of the different sources have been derived using this definition.

and n = maturity period.

The interest payment (I) is multiplied by the factor (1 – t) because interest on debt is a tax-deductible expense and only post-tax costs are considered.

An approximation formula as given below can also be used.

$$k_d = \frac{I(1-t) + \frac{F-P}{n}}{\frac{F+P}{2}} \qquad ....(2)$$

The following example illustrates the application of this formula.

Illustration 1

Ajax Limited has recently made an issue of non-convertible debentures for Rs.400 lakh. The terms of the issue are as follows: each debenture has a face value of Rs.100 and carries a rate of interest of 14 percent. The interest is payable annually and the debenture is redeemable at a premium of 5 percent after 10 years.

If Ajax Limited realizes Rs.97 per debenture and the corporate tax rate is 50 percent, what is the cost of the debenture to the company?

Solution

Given I = Rs.14, t = 0.5, P = Rs.97 and n = 10 years, F = Rs.105. The cost per debenture (k_d) will be:

$$k_d = \frac{14(1-0.5) + \frac{105-97}{10}}{\frac{105+97}{2}} = 7.7 \text{ percent}$$

Note: When the difference between the redemption price and the net amount realized can be written off evenly over the life of the debentures and the amount so written-off is allowed as a tax-deductable expense, the above two equations can be changed as follows:

Equation (1) becomes

$$P = \sum_{t=1}^{n} \frac{I(1-t) - \frac{(F-A)T}{n}}{(1+k_d)t} + \frac{F}{(1+k_d)^n}$$

Equation (2) becomes

$$k_d = \frac{I(1-t) + \left(\frac{F-P}{n}\right)(1-t)}{\frac{F+P}{2}}$$

Cost of Term Loans

The cost of the term loans will be simply equal to the interest rate multiplied by (1 – tax rate). The interest rate to be used here will be the interest rate applicable to the new term loan. The interest is multiplied by (1 – tax rate) as interest on term loans is also tax deductible.

Cost of Preference Capital

The cost of a redeemable preference share (k_p) is defined as that discount rate which equates the proceeds from preference capital issue to the payments associated with the same i.e., dividend payment and principal payments i.e.,

$$P = \sum_{t=1}^{n} \frac{D}{(1+k_p)^t} + \frac{F}{(1+k_p)^n} \qquad ....(3)$$

where

k_p = cost of preference capital

D = preference dividend per share payable annually

F = redemption price

P = net amount realized per share, and

n = maturity period

An approximation formula as given below can also be used.

$$k_p = \frac{D + \frac{F - P}{n}}{\frac{F + P}{2}} \qquad ....(4)$$

Illustration 2

The terms of the preference share issue made by Color-Dye-Chem are as follows: Each preference share has a face value of Rs.100 and carries a rate of dividend of 14 percent payable annually. The share is redeemable after 12 years at par. If the net amount realized per share is Rs.95, what is the cost of the preference capital?

Solution

Given that D = 14, F = 100, P = 95 and n = 12

$$k_p = \frac{14 + \frac{100 - 95}{12}}{\frac{100 + 95}{2}} = 0.148 \text{ or } 14.8 \text{ percent}$$

If the difference between the redemption price and the net amount realized can be amortized over the life of the preference shares, the formulae can be changed accordingly.

Cost of Equity Capital

Measuring the rate of return required by the equity shareholders is a difficult and complex exercise because the dividend stream receivable by the equity shareholders is not specified by any legal contract (unlike in the case of debenture holders). Several approaches are adopted for estimating this rate of return like the dividend forecast approach, capital asset pricing approach, realized yield approach, earnings-price ratio approach, and the bond yield plus risk premium approach.

According to the dividend forecast approach, the intrinsic value of an equity stock is equal to the sum of the present values of the dividends associated with it, i.e.,

$$Pe = \sum_{t=1}^{n} \frac{D_t}{(1 + k_e)^t} \qquad ....(5)$$

where

P_e = price per equity share

D_t = expected dividend per share at the end of year t, and

k_e = rate of return required by the equity shareholders.

If we know the current market price (P_e) and can forecast the future stream of dividends, we can determine the rate of return required by the equity shareholders (k_e) from equation (5) which is the cost of equity capital.

In practice, the model suggested by equation (5) cannot be used in its present form because it is not possible to forecast the dividend stream completely and accurately over the life of the company. Therefore, the growth in dividends can be categorized as nil or constant growth or super normal growth and the equation (5) can be modified accordingly. Cost of equity from the company's point of view is the rate at which the intrinsic value market price of the share is equal to the discounted value of the dividends. For instance, assume a constant growth rate (g) in DPS. Assuming a constant growth rate in dividends, the equation (5) can be simplified as follows:

$$P_e = \frac{D_t}{k_e - g} \qquad ....(6)$$

If the current market price of the share is given (P_e), and the values of D_t and g are known, then the equation (6) can be rewritten as $k_e = \frac{D_t}{P_e} + g$

The following example illustrates the application of this formula.

Illustration 3

The market price per share of Mobile Glycols Limited is Rs.125. The dividend per share expected a year hence is Rs.12 per share and the DPS is expected to grow at a constant rate of 8 percent per annum. What is the cost of the equity capital to the company?

Solution

The cost of equity capital (k_e) will be:

$$ke = \frac{D_t}{P_e} + g = \frac{12}{125} + 0.08 = 17.6 \text{ percent}$$

Realized Yield Approach

According to this approach, the past returns on a security are taken as a proxy for the return required in the future by the investors. The assumptions behind this approach are that: (a) the actual returns have been in line with the expected returns, and (b) the investors will continue to have the same expections from the security. As these assumptions generally do not hold good in real life, the results of this approach are normally taken as a starting point for the estimation of the required return.

The realized return over a n-year period is calculated

as $(W_1 \text{ x } W_2 \text{ x } \ldots\ldots\ldots\ldots W_n)^{1/n}$

Where W_t, referred to as the wealth ratio, is calculated as:

$$\frac{D_t + P_t}{P_t - 1}$$

and t = 1, 2.... n.

D_t = Dividend per share for year t payable at the end of year

P_t = Price per share at the end of year t.

Illustration 4

Year	1	2	3	4
DPS(Rs.)	1.50	2.00	1.50	2.00
Price per share at the beginning	10.00	12.00	11.00	12.00

The wealth ratios are

Year	1	2	3
Wealth ratio	1.35	1.08	1.23

Realized yield = $(1.35 \text{ x } 1.08 \text{ x } 1.23)^{1/3} - 1$

= 0.2149 or 21.5%

Capital Assets Pricing Model Approach

According to this approach, the cost of equity is reflected by the following equation:

$$k_i = R_f + \beta_i (R_m - R_f)$$

Where, k_i = rate of return required on security i

R_f = risk-free rate of return

β_i = beta of security i

R_m = rate of return on market portfolio

Bond Yield Plus Risk Premium Approach

The logic behind this approach is that the return required by the investors is directly based on the risk profile of a company. This risk profile is adequately reflected in the return earned by the bondholders. Yet, since the risk borne by the equity investors is higher than that of bondholders, the return earned by them should also be higher. Hence this return is calculated as:

Yield on the long-term bonds of the company + Risk premium.

This risk premium is a very subjective figure which is arrived at after considering the various operating and financial risks faced by the firm. Though these risks are already factored in the bond yield, since by nature equity investment is riskier than investments in bonds and is exposed to a higher degree of the firm's risks, these also have an impact on the risk-premium. For example, let us take two companies A and B, A having a net profit margin of 5% and B of 10% with other things being equal. Since company B faces less downside risk compared to company A, it will have to pay less interest to its bondholders. Hence, the risk of A company is already accounted for in the bondholders' return. Yet, when it comes to estimating the equityholders' risk premium, these risks are considered all over again because the equityholders will bear a larger part of these risks. In fact, these risks being taken into account for fixing the bondholders return will result in a multiple increase in the equityholders' risk. Hence, the equityholders of company A will receive a higher risk premium than those of company B.

Earnings Price Ratio Approach

According to this approach, the cost of equity can be calculated as E_1/P

Where, E_1 = expected EPS for the next year

P = current market price per share

E_1 can be arrived at by multiplying the current EPS by (1 + growth rate).

This ratio assumes that the EPS will remain constant from the next year onwards.

There are two parameters which have to be analyzed to see if this approach will provide an accurate result or not. They are dividend pay-out ratio and the rate of return the firm is capable of earning on the retained earnings. The results are accurate in the following two scenarios:

a. when all the earnings are paid out as dividends. Here the rate of return the firm is capable of earning becomes irrelevant. Or,

b. the dividend pay-out ratio is less than 100 percent and retained earnings are expected to earn a rate of return equal to the cost of equity.

In all other cases there is scope for this approach not giving an accurate estimate. The situation (a) is not normally seen in real life situations, while it is difficult to foresee the situation (b). This approach should hence be used with caution.

Cost of Retained Earnings and Cost of External Equity

Cost of external equity comes into the picture when there are certain floatation costs involved in the process of raising equity from the market. It is the rate of return that the company must earn on the net funds raised, in order to satisfy the equityholders' demand for return. Under the dividend capitalization model, the following formula can be used for calculating the cost of external equity:

$$K'_e = \frac{D_1}{P_0(1-f)} + g$$

Where

K'_e = cost of external equity

D_1 = dividend expected at the end of year 1

P_o = current market price per share

g = constant growth rate applicable to dividends

f = floatation costs as a percentage of the current market price.

For all other approaches, there is no particular method for accounting for the floatation costs. The following formula can be used as an approximation in such cases:

$$K'_e = \frac{k_e}{1-f}$$

Where k_e = rate of return required by the equity investors

K'_e = cost of external equity

f = floatation costs as a percentage of the current market price.

Illustration 5

Gamma Asbestos Limited has got Rs.100 lakh of retained earnings and Rs.100 lakh of external equity through a fresh issue, in its capital structure. The equity investors expect a rate of return of 18%. The cost of issuing external equity is 5%. The cost of retained earnings and the cost of external equity can be determined as follows:

Cost of retained earnings:

$k_r = k_e$ i.e. 18%

Cost of external equity raised by the company:

$$\text{Now} = K'_e = \frac{k_e}{1-f} = \frac{0.18}{1-0.05} = 18.95\%$$

WEIGHTED AVERAGE COST OF CAPITAL

To illustrate the calculation of the weighted average cost of capital, let us consider the following example:

Illustration 6

Ventura Home Appliances Ltd. has the following capital structure:

	(Rs. in lakh)
Equity Capital (10 lakh shares at par value)	100
12 percent preference capital (10,000 shares at par value)	10
Retained earnings	120
14% Non-convertible Debentures (70,000 debentures at par value)	70
14% term loan from APSFC	100
Total	400

The market price per equity share is Rs.25. The next expected dividend per share (DPS) is Rs.2.00 and the DPS is expected to grow at a constant rate of 8 percent. The preference shares are redeemable after 7 years at par and are currently quoted at Rs.75 per share in the stock exchange. The debentures are redeemable after 6 years at par and their current market quotation is Rs.90 per share. The tax rate applicable to the firm is 50 percent. Calculate the weighted average cost of capital.

Solution

We will adopt a three-step procedure to solve this problem.

Step 1: Determine the costs of the various sources of finance. We shall define the symbols k_e, k_r, k_p, k_d and k_i to denote the costs of equity, retained earnings, preference capital, debentures, and term loans respectively.

$$k_e = \frac{D_1}{P_0} + g$$

$$= \frac{2.00}{25} = 0.08 = 0.16$$

$$k_r = k_e = 0.16$$

$$k_p = \frac{D + \frac{F - P}{n}}{\frac{F + P}{2}}$$

$$= \frac{12 + \frac{100 - 75}{7}}{\frac{100 + 75}{2}} = 0.1780$$

$$k_d = \frac{I(1 - t) + \frac{F - P}{n}}{\frac{F + P}{2}}$$

$$= \frac{14(1 - 0.5) + \frac{100 - 90}{6}}{\frac{100 + 90}{2}} = 0.0912$$

$$k_i = 0.14\,(1 - 0.5) = 0.07$$

Note: Market price can be taken as a close substitute of the net amount realizable per share or debenture.

Step 2: Determine the weights associated with the various sources of finance.

One issue to be resolved before concluding this section relates to the system of weighting that must be adopted for determining the weighted average cost of capital. The weights can be used on: (i) book values of the sources of finance included in the present capital structure, (ii) present market value weights of the sources of finance included in the capital structure, (iii) proportions of financing planned for the capital budget to be adopted for the forthcoming period.

Let us follow the book value approach. The weights of a source of fund, according to book value approach is equal to the book value of that particular source divided by the total of the book values of all sources i.e. weight given to equity would be equal to Book Value of equity divided by book value of equity, retained earnings, debt, preference shares (if any). Similarly, the weights according to the market value approach is equal to the market value of a particular source divided by the market value of all sources. For instance, weight attached to equity is equal to the market value of equity divided by the market value of equity, debt, preference shares, if any.

We shall define the symbols W_e, W_r, W_p, W_d and W_i to denote the weights of the various sources of finance.

$$W_e = \frac{100}{400} = 0.25$$

$$W_r = \frac{120}{400} = 0.30$$

$$W_p = \frac{10}{400} = 0.025$$

$$W_d = \frac{70}{400} = 0.175$$

$$W_i = \frac{100}{400} = 0.25$$

Step 3: Multiply the costs of the various sources of finance with the corresponding weights and add these weighted costs to determine the weighted average cost of capital (WAC). Therefore,

$$\begin{aligned} \text{WAC} &= W_e k_e + W_r k_r + W_p k_p + W_d k_d + W_i k_i \\ &= (0.25 \text{ x } 0.16) + (0.30 \text{ x } 0.16) + (0.025 \text{ x } 0.1780) \\ &\quad + (0.175 \text{ x } 0.0912) + (0.25 \text{ x } 0.07) \\ &= 0.1259 \text{ or } 12.59 \text{ percent.} \end{aligned}$$

WEIGHTED MARGINAL COST OF CAPITAL SCHEDULE

At the time of developing the concept of cost of capital, we had assumed that the risk profile and financing policy of the firm does not change. Now the question arises that if these assumptions hold, does the weighted average cost of capital remain unchanged irrespective of the magnitude of financing? It does not. Normally, the WACC increases with the level of financing required. The supplies of capital generally require a higher return as they supply more capital. A schedule showing the relationship between additional financing and the weighted average cost of capital is referred to as the weighted marginal cost of capital schedule.

Determining the Weighted Marginal Cost of Capital Schedule

The following steps have to be followed for determining the weighted marginal cost of capital schedule:

1. The cost of each individual source of finance for various levels of usage has to be estimated.
2. Given the ratio of different sources of finance in the new capital structure, find out the levels of total new financing at which the cost of various sources would change. These levels, called breaking points, can be found out as follows:

   Breaking Point on Account of a Source

   $$= \frac{\text{Total new financing from that source at the breaking point}}{\text{Proportion of that financing source in the capital structure}}$$

3. Calculate the weighted average cost of capital for various ranges of total financing between the breaking points.
4. List out the weighted average cost of capital for each level of total new financing. This is the weighted marginal cost of capital schedule.

We can illustrate the preparation of the weighted marginal cost of capital schedule with the help of an example.

Consider the following data:

Crypton Limited is planning to raise equity, preference and debt capital in the following proportions:

Equity	:	0.50
Preference	:	0.20
Debt	:	0.30

The cost of the three sources of finance for different levels of usage has been estimated as below:

Source of Finance	Range of new financing from the source (Rs. in lakh)	Cost %
Equity	0-15	16.00
	15-25	17.00
	25 and above	18.00
Preference	0-3	14.00
	3 and above	15.00
Debt	0-20	8.00
	20 and above	10.00

Calculation of Breaking Point

Source of Finance	Cost %	Range of new Financing (Rs. in lakh)	Breaking Point (Rs. in lakh)	Range of Total new financing (Rs. in lakh)
Equity	16.00	0-15	15/0.5=30	0-30
	17.00	15-25	25/0.5=50	30-50
	18.00	25 and above	–	50 and above
Preference	14.00	0-3	3/0.2=15	0-15
	15.00	3 and above	–	15 and above
Debt	8.00	0-20	20/0.3=66.67	0-66.67
	10.00	20 and above	–	66.67 and above

Weighted Average Cost of Capital for Various Ranges of Total New Financing

Range of Total New Financing (Rs.in lakh)	Source of Finance	Proportion	Cost (%)	Weighted cost (%)
0-15	Equity	0.5	16	8.00
	Preference	0.2	14	2.80
	Debt	0.3	8	2.40
	Weighted Average Cost of Capital			13.20
15-30	Equity	0.5	16	8.00
	Preference	0.2	15	3.00
	Debt	0.3	8	2.40
	Weighted Average Cost of Capital			13.40
30-50	Equity	0.5	17	8.50
	Preference	0.2	15	3.00
	Debt	0.3	8	2.40
	Weighted Average Cost of Capital			13.90
50-60.67	Equity	0.5	18	9.00
	Preference	0.2	15	3.00
	Debt	0.3	8	2.40

Range of Total New Financing (Rs.in lakh)	Source of Finance	Proportion	Cost (%)	Weighted cost (%)
	Weighted Average Cost of Capital			14.40
66.67 and above	Equity	0.5	18	9.00
	Preference	0.2	15	3.00
	Debt	0.3	10	3.00
	Weighted Average Cost of Capital			15.00

Weighted Marginal Cost of Capital Schedule

Range of Total Financing (Rs. in lakh)	Weighted Marginal Cost of Capital (%)
0 – 15	13.2
15 – 30	13.4
30 – 50	13.9
50 – 66.67	14.4
66.67 and above	15.0

With this, we conclude our discussion on the cost of capital. It is essential to make sure that the concepts presented in this chapter have been grasped well before proceeding further, as these concepts will be applied extensively in the later chapters.

SUMMARY

- Calculating the cost of capital is necessary to know the discount rate, which is used for discounting future cash flows. There are various sources of finance like debentures, term loans, equity capital, preference capital and retained earnings. After calculating the cost of each of these sources, weights based on their proportion in total capital are used to determine the weighted average cost of capital. Before doing the appraisal of a project, calculating the cost of capital is necessary to compare the investment made and benefits derived from it.

Chapter VIII

Appraisal Criteria

After reading this chapter, you will be conversant with:

- Define the Cash Flows from Long-Term Equity and Total Funds Point of View
- Appraise a Project by Discounting and Non-Discounting Criteria
- Appraise Projects with Special Features

Having estimated the profitability figures a financial analyst would be interested to find the financial viability of a project. The financial appraisal of any project involves the following steps:

i. Estimating the investment to be made

ii. Estimating the income from the project either in terms of profits or cash flows

iii. Appraising the project by comparing the investment made and income derived from the project.

ESTIMATING CASH FLOWS

Estimating the income from the project, in terms of profits, can be measured either by profits before interest, depreciation and taxes or profits before interest and taxes or profit after taxes. But, for appraising the financial desirability, it is best to consider cash flows rather than accounting profits, which contain many estimates and are subjective (this point will be elaborated later). What do we mean by cash flows? Clearly, our indication is towards the income received in cash. There are three ways in which the cash flows from a project can be defined. Each of the methods depends on different viewpoints regarding who provides the capital for a project – is it only the equity shareholders, or is it equity shareholders and long-term lends or can we include the providers of short-term credit as well? Before we proceed to study the estimation of cash flows from different points of view, let us first understand the principles of estimation common to all the methods.

Estimating the income from the project in terms of cash flows is based on the following principles:

- All costs and benefits are to be measured in terms of cash flows. This implies that all non-cash charges (expenses) like depreciation which are considered for the purpose of determining the profit after tax, must be added back to profit after tax, to arrive at the net cash flows.
- The net cash flows for the firm are those which accrue to the firm after paying tax. Therefore, the cash flows for the purpose of appraisal must be defined in post-tax terms.
- The cash flows must be measured in incremental terms. In other words, the increments in the present level of costs and benefits that occur on account of the adoption of the project are alone relevant for the purpose of determining the net cash flows.

  The following are some of the implications of the above principle:

  – If the proposed project has a beneficial or detrimental impact on the other product lines of the firm, then such impact must be quantified and considered for ascertaining the net cash flows.

  – Sunk costs are to be ignored. For instance, the cost of the existing lands must be ignored because money has already been sunk in it and no additional or incremental money is spent on it for the purpose of this project.

  – Opportunity costs associated with the utilization of the resources available with the firm must be considered even though such utilization does not entail explicit cash outflows. For instance, while the sunk cost of land is ignored, its opportunity cost, i.e., the income it would have generated if it had been utilized for some other purpose or project must be considered.

  – The share of the existing overhead costs which is to be borne by the end product(s) of the proposed project must be ignored.

Long-term Funds Point of View

Cash flows are frequently estimated from the long-term funds point of view. As the name suggests, this method is based on the assumption that funds invested in a project come from both equity shareholders and long-term lenders.

Interest on long-term loans is not to be included for determining the net cash flows from the long-term funds point of view. The rationale for this is that the net cash flows are defined from the point of view of suppliers of long-term funds. Hence, the post-tax cost of long-term funds will be used as the interest rate for discounting. The post-tax cost of long-term funds obviously includes the post-tax cost of long-term debt. Therefore, if interest on long-term debt is considered for the purpose of determining the net cash flows, there would be an error due to double-counting.

The application of the principles in the measurement of the cash flows of a project is rendered more clear by the following illustration:

Illustration 1

A & B are planning to set-up a chemical factory for which the following is the estimation of the total outlay.

Plant & Machinery	–	Rs.39 lakh
Working Capital	–	Rs.27 lakh

The proposed scheme of financing is as follows:

Equity Capital	–	Rs.22 lakh
Term Loan	–	Rs.22 lakh
Trade Credit	–	Rs.10 lakh
Working Capital Advance	–	Rs.12 lakh

The expected life of the project is 10 years. Plant and Machinery will be depreciated at the rate of 33 1/3% p.a. as per the written down value method. The expected annual sales is Rs.89 lakh and the cost of sales (including depreciation but excluding interest) is expected to be Rs.57 lakh. The tax rate applicable is 50%. Term loan will carry 14% interest and is repayable in 5 equal installments beginning from the end of first year. Working capital advance will carry an interest rate of 17%.

The cash flows for the first three years from the long-term funds' point of view are defined as follows:

The net cash flows can be divided, based on the above principles, into three streams of flow: Initial Flow, Operating Flow and Terminal Flow.

Initial flow consists of funds committed to the project. As the cash flows are based on the long-term funds point of view, initial flow accounts for the long-term sources committed to the project and in the above project amounts to Rs.44 lakh i.e., equity capital of Rs.22 and term loan of Rs.22 lakh which are utilized to purchase the equipment of Rs.39 lakh and Rs.5 lakh for working capital. The balance of Rs.22 lakh of working capital, financed by trade credit and working capital advance, (both being short-term), is not included in the initial investment.

Based on the principles given, operating cash flow includes operating profits after tax (since after tax cash flows should be considered) to which depreciation (being the non-cash outflow) and interest on long-term funds (since the project is being looked at from the view point of long-term suppliers) are added. However, the interest added back to the operating flow should be in post-tax terms based on the principle of after tax profits.

Based on the above, the net cash flows can be computed as follows:

Solution

				(Rs. in lakh)	
	Year	0	1	2	3
A.	Investment	44.00	–	–	–
B.	Sales		89.00	89.00	89.00
C.	Operating Costs (excluding depreciation)		44.00	48.33	51.22
D.	Depreciation		13.00	8.67	5.78
E.	Interest on term Loan		3.08	2.47	1.85
F.	Interest on Working Capital Advance		2.04	2.04	2.04
G.	Profit Before Tax (PBT)		26.88	27.50	28.11
H.	Tax		13.44	13.75	14.06
I.	Profit After Tax (PAT)		13.44	13.75	14.06
J.	Initial Flow (= A)	44.00	–	–	–
K.	Operating Flow [= I + D + E(1 – T)]		27.98	23.65	20.76
L.	Net Cash Flow (= J + K)	44.00	27.98	23.65	20.76

In the above example, we have defined the cash flows only over the first three years of the project's life. But in practice cash flows are defined over the entire project life or over a specified time horizon (if the project life is too long). If the cash flows are defined over the entire life of the project, then the estimated salvage value of the investment in plant and machinery and working capital must be considered for determining the net cash flow in the terminal year. If the cash flows are defined over a specified time horizon, a notional salvage value is taken into account in the final year of the time horizon.

The assets, both current assets and fixed assets used for the project, are sold at the end of the life of the project. The sale value of current assets is generally taken as equal to the book value of the assets. However, estimation of sale value of fixed asset is a difficult task. It can either be taken as 5% of the original value of the asset or equal to the book value of the asset as on the date of sale. But, these two measures give unrealistic figures.

An approximate figure of sale value can be found out in the following way:

First, the compound annual growth rate in the market price of the asset over a five year period should be found out. Employing the same growth rate, market price of the asset at the end of the life of the project should be calculated. The ratio of the market price of the asset used for the period equal to the life of the project and the market price of the new machine has to be found out. Employing this ratio to the projected market price, sale value of the asset can be found out.

The above approach gives a more realistic figure than the other two estimates given.

Illustration 2

Consider another project, the cash outlays and sources of finance of which are as below:

	(Rs. in lakh)
Plant & Machinery	200
Working Capital	121
The proposed scheme of financing is as follows:	
Equity	120
Long-term loans	108
Trade Credit	38
Commercial Banks	55

The life of the project is 10 years. Plant and machinery are depreciated at the rate of 15% per annum as per the written down value method. The expected annual net sales is Rs.360 lakh. Cost of sales (including depreciation, but excluding interest) is expected to be Rs.200 lakh a year. The tax rate of the company is 50%. At the end of 10 years, plant and machinery will fetch a value equal to their book value and the investment in working capital will be fully recovered. The long-term loans carry an interest of 14% p.a. It is repayable in eight equal annual installments starting from the end of the 3rd year. Short-term advance from commercial banks will be maintained at Rs.55 lakh and will carry an interest at 18% p.a. It will be fully liquidated after 10 years. Trade credit will also be maintained uniformly at Rs.38 lakh and will be fully paid at the end of the 10th year.

The cash flow stream from the long-term funds point of view would be as follows:

Cash Flows from Long-term Point of View

Year	0	1	2	3	4	5	6	7	8	9	10
Investment Initial flow	–228.00										
Sales		360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00
Operating costs		170.00	174.50	178.33	181.58	184.34	186.69	188.69	190.38	191.83	193.05
Depreciation		30.00	25.50	21.68	18.42	15.66	13.31	11.31	9.62	8.17	6.95
Interest on long term		15.12	15.12	15.12	13.23	11.34	9.45	7.56	5.67	3.78	1.89
Interest on working capital		9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90
PBT		134.98	134.98	134.98	136.87	138.76	140.65	142.54	144.43	146.32	148.21
Tax		67.49	67.49	67.49	68.44	69.38	70.33	71.27	72.22	73.16	74.11
PAT		67.49	67.49	67.49	68.44	69.38	70.33	71.27	72.22	73.16	74.11
Operating flow*		105.05	100.55	96.73	93.47	90.71	88.36	86.36	84.67	83.22	82.00
Net salvage value of Fixed assets											39.37
Net recovery of working capital management											28.00
Total flow											67.37
Net cash flow	–228.00	105.05	100.55	96.73	93.47	90.71	88.36	86.36	84.67	83.22	149.37

* PAT + Dep + Interest on long-term (1–T)

Working Notes:

- Net salvage value of fixed assets will be equal to the salvage value of fixed assets less any income tax that may be payable on the excess of the salvage value over the book value. Likewise there will be a tax shield on the loss, if any, incurred at the time of disposing of the fixed assets. With the recent changes in the tax laws, the net salvage value of any individual item of plant and machinery has lost its significance and therefore, the impact of tax on the salvage value has been ignored. In other words, only the gross salvage value is taken into consideration.
- The depreciation rate assumed in this problem is not indicative of the current rates in force. (The depreciation rates currently applicable to plant and machinery under the Income Tax Act are 25%, 40% and 100%).
- In working out the cash flows, deduction available for the projects under Section 80 IA of the Income Tax Act etc. have been ignored.

The above examples have so far been focussed on estimating cash flows for a new project.

When defining cash flows for a replacement project, the cash flows that are considered are the incremental cash flows. Initial flow would be equal to the net investment made in the new machine/project after receiving the proceeds of the existing machine. Operating flow would be equal to the incremental profit after taxes + incremental depreciation. Similarly, the terminal flow would be equal to the cash realized from the sale of the new project over and above what would be received if the existing was sold at that point of time. Hence, the net cash flows comprise of incremental initial flow + incremental operating flow + incremental terminal flow.

The following example illustrates the estimation of cash flows for a replacement project.

Illustration 3

Sandals, Inc., is considering the purchase of a new leather cutting machine to replace an existing machine that has a book value of Rs.3,000 and can be sold for Rs.1,500. The estimated salvage value of the old machine in four years would be zero, and it is depreciated on a straight-line basis. The new machine will reduce costs (before tax) by Rs.7,000 per year, i.e. Rs.7,000 cash savings over the old machine. The new machine has a four year life, costs Rs.14,000 and can be sold for an expected amount of Rs.2,000 at the end of the fourth year. Assuming straight-line depreciation, and a 40% tax rate, define the cash flows associated with the investment. Assume that the straight line method of depreciation is used for tax purposes.

Solution

Year	0	1	2	3	4
Investment in New Machine	14000				
Sale value of Old Machine	1500				
Net Investment in New Machine	12500				
Savings in costs		7000	7000	7000	7000
Depreciation on Old Machine		750	750	750	750
Depreciation on New Machine		3000	3000	3000	3000
Incremental Depreciation		2250	2250	2250	2250
Incremental PBT		4750	4750	4750	4750
Incremental Tax		1900	1900	1900	1900
Incremental PAT		2850	2850	2850	2850
Incremental Initial Flow	12500				
Incremental Operating Flow		5100	5100	5100	5100
Incremental Terminal Flow					2000
Incremental NCF	12500	5100	5100	5100	7100

Working Notes:

1. Computation of depreciation:

   Existing leather-cutting machine = Rs.3,000/4 = Rs.750 p.a.

   New leather-cutting machine = Rs.12,000/4 = Rs.3,000 p.a.

   Incremental depreciation = Rs.2,250 p.a.

Until now, we have viewed the project from the long-term funds point of view. However, we can view the project from equity funds point of view and total funds point of view. The principles underlying the measurement of costs and benefits hold good in these two cases too, except that the project is looked from a different angle.

Equity Funds Point of View

If a project is looked from this point of view, the initial flow comprises of only equity funds as this is the only investment made by the equity holders. The operating flow during every year would be equal to the cash flows that would be received by the equity holders which is equal to the profits after taxes + depreciation – repayment of term loan and short-term borrowings (if any). The terminal flow would be equal to the funds that remain after repaying all the other sources. Thus terminal flow would be equal to the net salvage value of fixed assets + net salvage value of current assets – repayment of term loan – repayment of short-term borrowings.

Illustration 4

Consider the same example of project as in illustration 2. The net cash flows from equity funds would be calculated as follows:

Cash Flow from Equity Funds Point of View

Year	0	1	2	3	4	5	6	7	8	9	10
Investment	120.00										
Initial Flow	120.00										
Sales		360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00
Operating Costs		170.00	174.50	178.33	181.58	184.34	186.69	188.69	190.38	191.83	193.05
Depreciation		30.00	25.50	21.68	18.42	15.66	13.31	11.31	9.62	8.17	6.95
Interest (Long-term)		15.12	15.12	15.12	13.23	11.34	9.45	7.56	5.67	3.78	1.89
Interest on Working Capital Loan		9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90
PBT		134.98	134.98	134.98	136.87	138.76	140.65	142.54	144.43	146.32	148.21
Tax		67.49	67.49	67.49	68.44	69.38	70.33	71.27	72.22	73.16	74.11
PAT		67.49	67.49	67.49	68.44	69.38	70.33	71.27	72.22	73.16	74.11
NSV of Fixed Assets											39.37
NSV of Current Assets											121.00
Repayment of Term Loan		0.00	0.00	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50
Repayment of STBB*		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.00
Repayment of Creditors		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.00
Operating Flow**		97.49	92.99	75.67	73.36	71.54	70.14	69.08	68.33	67.83	–25.45
Total Flow											160.37
NCF	120.00	97.49	92.99	75.67	73.36	71.54	70.14	69.08	68.33	67.83	134.93

- Short-term Bank Borrowings
- PAT + Depreciation – Repayment of T L – Repayment of STBB

Total Funds Point of View

When a project is looked from the total funds point of view we mean to say that a project is looked from the point of view of suppliers of all funds and the total investment made in the firm would be the initial flow and the operating flow comprises of profits after taxes + depreciation + interest on long-term loans and short-term borrowings adjusted for taxes and the terminal flow would be equal to the total funds received by the firm i.e. funds received on sale of fixed and current assets.

Illustration 5

Consider the same project as in illustration 2. The net cash flows from this angle is calculated as given below:

Cash Flows from Total Funds Point of View

Year	0	1	2	3	4	5	6	7	8	9	10
Investment	–321.00										
Sales		360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00
Operating Costs		170.00	174.50	178.33	181.58	184.34	186.69	188.69	190.38	191.83	193.05
Depreciation		30.00	25.50	21.68	18.42	15.66	13.31	11.31	9.62	8.17	6.95
Interest on Long Term		15.12	15.12	15.12	13.23	11.34	9.45	7.56	5.67	3.78	1.89
Interest on Work Capital		9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90
PBT		134.98	134.98	134.98	136.87	138.76	140.65	142.54	144.43	146.32	148.21
Tax		67.49	67.49	67.49	68.44	69.38	70.33	71.27	72.22	73.16	74.11
PAT		67.49	67.49	67.49	68.44	69.38	70.33	71.27	72.22	73.16	74.11
Initial Flow	–321.00										
Operating Flow		110.00	105.50	101.68	98.42	95.66	93.31	91.31	89.62	88.17	86.95
Total Flow											160.37
NCF	–321.00	110.00	105.50	101.68	98.42	95.66	93.31	91.31	89.62	88.17	247.32

EVALUATION TECHNIQUES

Having defined the costs and benefits of a project in terms of cash flows the focus now shifts to the assessment of worthwhileness of the project. Certain assumptions are made while appraising the projects using the criteria discussed below.

- Firstly, risk or the quality of all project proposals under consideration does not differ from the risk of existing investment projects of the firm and that the acceptance of any proposal or group of investment proposals does not change the relative business risk of the firm.
- Secondly, the firm has certain benchmarks for evaluating the projects. Based on the benchmark the investment decision will be either to accept or to reject the proposal.

Appraisal methods can be classified into two broad categories:

i. Sophisticated or Time-Adjusted or Discounted Criteria.

ii. Unsophisticated or Traditional or Non-Discounted Criteria.

Discounted Criteria include:

a. Net Present Value;

b. Internal Rate of Return; and

c. Benefit-Cost-Ratio or Profitability Index.

Non-Discounted Criteria include:

a. Average Rate of Return or Accounting Rate of Return;

b. Pay Back Period; and

c. Urgency.

Discounted Cash Flow/Time-Adjusted Techniques

The distinguishing feature of this type of technique used for capital budgeting is that time value of money is taken into consideration. While evaluating costs and benefits of a project all the time adjusted evaluation methods require cash flows to be discounted at a certain rate popularly called the cost of capital. Here, this cost of capital (k) is the minimum discount rate that must be earned on a project that leaves the firms market value unchanged. Another characteristic feature of these techniques is that all benefits and costs occurring during the entire life of the project are considered. In the following pages, an attempt to explain the general procedure for calculating the DCF has been made. This is followed by the discussion of various techniques in detail.

The PV or DCF procedure recognizes that cash flow streams at different time periods differing in values can be compared only when they are expressed in terms of a common denominator i.e. present values. Hence, time value of money is taken into account. In this method, all cash inflows are expressed in terms of their present value. The PV so determined is compared with the PV of cash outflows.

Net Present Value

The net present value of a project is equal to the sum of the present value of all the cash flows (inflows and outflows) associated with it and is symbolically represented as follows:

$$NPV = \frac{CF_0}{(1+k)^0} + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \; — + \frac{CF_n}{(1+k)^n} \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}$$

Where NPV = Net present value

CF_t = Cash flows at the end of the year (t = 0 ....n)

(cash inflow has a positive sign and cash outflow has a negative sign) n = Life of the project

k = Discount rate

The discount rate (k) employed for evaluating the present value of the expected future cash flows should reflect the risk of the project.

Illustration 6

The following is the cash flow stream of a project 'X'. The net present value of the project at the cost of capital of 15% is calculated as:

Year	Cash Flow
0	–1,35,000
1	30,000
2	40,000
3	45,000
4	47,500
5	50,000

$$\text{NPV} = \frac{1,35,000}{(1+0.15)^0} + \frac{30,000}{(1+0.15)^1} + \frac{40,000}{(1+0.15)^2}$$

$$+\frac{45,000}{(1+0.15)^3} + \frac{47,500}{(1+0.15)^4} + \frac{50,000}{(1+0.15)^5}$$

$$-\frac{1,35,000}{1} + \frac{30,000}{1.15} + \frac{40,000}{1.3225} + \frac{45,000}{1.52}$$

$$+\frac{47,500}{1.75} + \frac{50,000}{2.01}$$

$$= -1,35,000 + 26,086.96 + 30,245.75 + 29,588.23 + 27,158.28 + 24,858.84 = 2,938.05$$

The net present value represents the net benefit over and above the compensation for time and risk. Therefore, the decision rule associated with the net present value criteria is:

i. The proposal may be accepted if the net present value of the project is positive.

ii. The proposal may be rejected if the net present value of the project is negative.

iii. If the net present value is zero, it is a point of indifference. However, in practice, it is rare if ever such a project is accepted, such a situation simply implies that only the original investment has been recovered.

iv. If there are two or more mutually exclusive projects, the project with highest NPV should be chosen.

Hence, based upon the above decision rules, Project X can be accepted.

Merits

NPV method has several merits.

- The first and the foremost significance of NPV method is that this method explicitly recognizes the time value of money.

It satisfies the required attribute of a sound method of appraisal, in that, it considers the total benefits arising out of the proposal over its life-time.

- Any change in the estimation of cost of capital can be built into the evaluation process by changing the discount rate.

- This method enables to calculate the NPV of two or more mutually exclusive projects. NPV of two projects is simply the sum of the NPV of individual projects.

Illustration 7

Consider another project Y in addition to Project X referred in illustration 6 which also has 5 years life. The cash flows relating to project Y are as follows:

Year	Cash Flows (Rs.)
0	–43,000
1	10,500
2	13,200
3	15,300
4	15,500
5	15,900

The NPV of project Y is Rs.2,938.82.

Cashflows of the two projects together are as under:

Year	Cash Flows (Rs.)
0	–1,78,000
1	40,500
2	53,200
3	60,300
4	63,000
5	65,900

The NPV of the above cash flows is Rs.5,876.87 which is the sum of the NPVs of projects X and Y.

- This method of asset selection helps in achieving the objective of financial management which is maximization of shareholder's wealth i.e. the decision rule according to this is in conformity with the principle of wealth maximization. In other words, NPV decision rule accepts only those projects which enhance the market value or has no change in the market value.

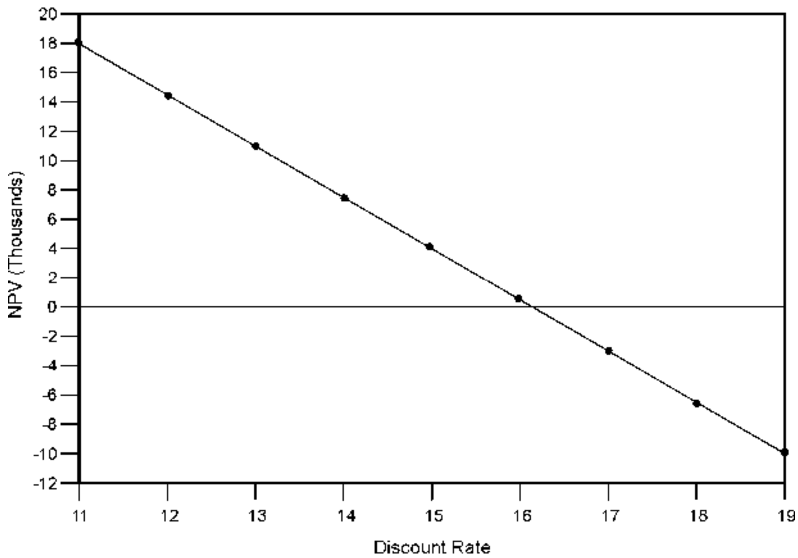
The market price of the shares will be affected by the relative force of what the investors expect and what return is actually earned on the funds. The discount rate that is used to convert future benefits into present value is the minimum rate or the rate of interest that is required by the investors. The implication of NPV is that when the present value of cash inflows is equal to the initial outlay or when the NPV = 0, the return on investment is just equal to the expected or required rate by investors. Hence no change in the market price of the shares. When the present value exceeds the outlay or the NPV > 0, the return would be higher than expected by the investors. It would, therefore, lead to an increase in share prices. Thus, the present value method is logically consistent with the firm's goal of maximizing shareholders wealth in terms of maximizing market price of shares. Hence, a correct technique for selection of projects for investment. However, there are few limitations.

Defects

The main drawback in this method of evaluation is the calculation of the required rate of return to discount the cash flows.

The discount rate is the most important element used in calculation of the present values because different discount rates will give different present values. The relative desirability of a proposal will change with a change in the discount rate. For instance, consider the project referred in illustration 6. As the NPV is positive, the project can be accepted. However, if the discount rate increases by 1% to 16%, the NPV would be –542.34 based on which, the project cannot be accepted. In general, the NPV of a conventional project decreases if the discount rate increases. This is so because when the discount rate increases, the discounting factors become smaller making the present value of cash flows smaller. The relationship between the NPV and the discount rate may be graphically represented as the net present value profile. The following figure shows the NPV profile of the above illustration.

Figure 1



Secondly, it is an absolute measure. Between two projects, this method favors projects which have higher NPV. But it is likely that this project may also involve a larger initial outlay. Therefore, in case of projects involving different outlays, the present value method may not give dependable results.

For instance, consider the same projects X and Y whose initial outlays are Rs.1,35,000 and Rs.43,000 respectively.

If the cost of capital is 15%, both the projects yield approximately a net present value of Rs.2,938. Based on the NPV criterion both the projects are accepted. When we assume that the projects under study are mutually exclusive projects and any one of the project has to be accepted the firm would be indifferent as to the acceptance of the projects. However, it should be noted that the NPV of Rs.2,938 lakh is on an investment of Rs.1,35,000 if it is project X, but to yield the same NPV in Project Y, we need to put in an investment of only Rs.43,000. Obviously, since the returns from both the projects are same in present value terms, Project Y with smaller initial outlay would be preferred to Project X with a larger outlay.

Lastly, the NPV method may not give satisfactory results in the case of two projects having different economic lives. In general, the project with a shorter economic life would be preferable. It may be likely that a project which has a higher present value may also have a longer economic life so that the funds will remain invested for longer period, while the alternative proposal may have shorter life but smaller present value. In such situations, the present value method may not reflect the worth of the alternative proposals.

Modified Net Present Value

Based on the PVIFA principle, the standard net present value assumes that the intermediate cash flows are re-invested at a rate of return equal to the cost of capital. However, if this assumption is invalid, the net present value has to be modified taking into account the reinvestment rate. This involves the following steps in a sequential manner:

a. The terminal value of the cash inflows of the project are to be calculated using the defined re-investment rates which are supposed to reflect the profitability of investment opportunities ahead of the firm.

$$TV = \sum_{t=1}^{n} CF_t (1 + r')^{n-t}$$

Where,

TV = Terminal value of the project's cash inflows.

CF_t = Cash inflow at the end of the year t.

r' = Re-investment rate applicable to the cash inflows of the project.

b. Then, modified net present value is to be calculated

$$NPV_n = \frac{TV}{(1+k)^n} - I$$

where

NPV_n = Modified net present value.

TV = Terminal value

k = Cost of capital

I = Investment outlay

Illustration 8

Consider the same projects X and Y. The net present values of both the projects given a cost of capital of 15% is approximately Rs.2,938. The underlying assumption of the present value of annuity is that the intermediate cash flows are reinvested at the same rate of discount i.e. 15%. Hence, when we say that the net present value of the project X is Rs.2,938, we assume that the cash flows occurring during the life of the project are reinvested at the same rate of 15% until the termination of the project and the present value or the net present value of the above cash flows is calculated as shown below:

Year	Project X			Project Y		
	Cash Flow	FVIF @ 15%	FV	C.Flow	FVIF @15%	FV
0	–1,35,000			–43,000		
1	30,000	1.749	52470.188	10,500	1.749	18364.566
2	40,000	1.521	60835.000	13,200	1.521	20075.550
3	45,000	1.323	59512.500	15,300	1.323	20234.250
4	47,500	1.150	54625.000	15,500	1.150	17825.000
5	50,000	1.000	50000.000	15,900	1.000	15900.000
Terminal Value			277442.688			92399.366

$$NPV_n = \frac{\text{Ter min al value}}{(1+k)^n} - \text{Initial Investment}$$

$$NPV_n\,(X) = \frac{277442.688}{(1.15)^5} - 1,35,000$$

$$= 137,938.05 - 1,35,000$$

$$= 2938.25$$

$$NPV_n\ (Y) \quad = \quad \frac{92,399.366}{(1.15)^5} - 43,000 = \text{Rs.}2,938.63$$

Thus, the present values of reinvested cash flows of project X and project Y are equal to the respective net present values of the projects.

However, if the reinvestment rate is different from the discount rate of 15% the net present value of the reinvested cash flows or the modified net present value would be different from the net present value of Rs.2,938. Consider reinvestment rates of 18% and 12%. The modified net present values are calculated as follows:

Reinvestment Rate of 18%

Year	Project X			Project Y		
	Cash Flow	FVIF@ 18%	Future value	Cash Flow	FVIF@ 18%	Future value
0	–1,35,000			–43,000		
1	30,000	1.939	58,163.333	10,500	1.939	20,357.166
2	40,000	1.643	65,721.280	13,200	1.643	21,688.022
3	45,000	1.392	62,658.000	15,300	1.392	21,303.720
4	47,500	1.180	56,050.000	15,500	1.180	18,290.000
5	50,000	1.000	50,000.000	15,900	1.000	15,900.000
			2,92,592.613			97,538.909

Modified NPV i.e.,

$$NPV_n\ (X) \quad = \quad \frac{2,92,592.613}{(1.15)^5} - 1,35,000 = 10,470.24$$

$$NPV_n\ (Y) \quad = \quad \frac{9,75,38.909}{(1.15)^5} - 43,000 = 5,494.07$$

Reinvestment Rate of 12%

Year	Project X			Project Y		
	Cash Flow	FVIF@ 12%	Future value	Cash Flow	FVIF@ 12%	Future value
0	1,35,000			43,000		
1	30,000	1.574	47,205.581	10,500	1.574	16,521.953
2	40,000	1.405	56,197.120	13,200	1.405	18,545.050
3	45,000	1.254	56,448.000	15,300	1.254	19,192.320
4	47,500	1.120	53,200.000	15,500	1.120	17,360.000
5	50,000	1.000	50,000.000	15,900	1.000	15,900.000
			2,63,050.701			87,519.323

Modified NPV i.e.,

$$NPV_n\ (X) = \frac{26,3050.701}{(1.15)^5} - 1,35,000 = -4,217.31$$

$$NPV_n\ (Y) = \frac{85,519.323}{(1.15)^5} - 43,000 = 512.57$$

From the above calculations, it is clear that the modified net present value is greater than the net present value if the reinvestment rate is greater than the discount rate and is less than the net present value when the reinvestment rate is less than the discount rate. Moreover, it can be seen in the above calculations that if the reinvestment rate is determined as 12%, then the Project X should not be accepted as the modified net present value is less than zero or negative.

Evaluation

The modified net present value method has a number of advantages.

Firstly, this method explicitly incorporates the assumption about how the cash inflows are re-invested once they are received and avoid any influence of the cost of capital on the cash inflow therein itself.

Secondly, it is simple to calculate making the process of evaluating the investment worth of alternative capital projects.

Thirdly, it best suits business executives as the compounding technique appeals more than the discounting.

The major drawback of this method is in projecting the future rates of interest at which the intermediate cash inflows received will be re-invested.

Benefit-Cost-Ratio (BCR)

Also known as profitability index, BCR is yet another time-adjusted capital budgeting technique and is some what similar to the NPV method. While NPV is based on the difference between the present value of future cash inflows and the present value of cash outlays, BCR measures the present value of returns per rupee invested.

BCR is defined as the present value of benefits to the initial investment which is represented as:

$$\text{BCR} = \frac{\text{PVB}}{\text{I}}$$

Where,

BCR = Benefit Cost-ratio

PVB = Present Value of Benefits

I = Initial Investment

Accept-Reject Rule

If the BCR or PI exceeds one, then that project is qualified for acceptance and if BCR equals 1, the firm is indifferent to the project.

In case of individual projects, when BCR is greater than, equal to or less than 1, the net present value is also greater than, equal to or less than 0 respectively. In other words, the NPV will be positive if BCR > 1; will be negative if BCR < 1. Hence it can be seen that, the NPV and BCR approaches give the same results regarding independent investment proposals.

Selection of projects with BCR method can also be done on the basis of ranking wherein the highest rank would be given to the project with the highest BCR and so on.

Illustration 9

Consider the same example of mutually exclusive Projects X and Y where it was said earlier that due to the difference in cash outlays, though net present value being the same, Project Y would be preferred to Project X because Project Y earns same return with smaller outlay than required for Project X.

The BCR of the two projects at the discount rate of 15% is calculated as follows:

Project X	Present value of cash inflows/Initial Investment = 1.02176333
Project Y	Present value of cash inflows/Initial Investment = 1.06834453

Thus, in the above case based on BCR of more than 1, both the projects can be accepted. However, if only one project has to be accepted, Project Y would be accepted as it has higher BCR than the BCR of Project X.

Though it is common to define BCR as the ratio of PV of cash inflow to ratio of PV of cash outflows, BCR can also be measured on the basis of the net benefits of a project against its PV of cash outlay rather than measure its gross benefits against its current cash outlay which is an important aspect in situations of capital rationing. Such a measure is referred to as Net Benefit Cost Ratio (NBCR) and is calculated as follows:

$$\text{NBCR} = \frac{\text{NPV}}{\text{I}} = \frac{\text{PVB} - \text{I}}{\text{I}} = \frac{\text{PVB}}{\text{I}} - 1 \text{ or BCR} - 1$$

The decision rule would be to accept the project if NBCR is positive and reject it if NBCR is negative.

The NBCR of projects X and Y is calculated as follows:

Net Benefit Cost Ratio	NPV/Initial Investment
Project X	293805/135000
	0.02176333
Project Y	2938.81/43000
	0.06834453

Based on the above, both the projects can be accepted and similar to BCR evaluation, NBCR also prefers Project Y to Project X.

Merits

Like the other discounted cash flows techniques, the BCR satisfies almost all requirements of a sound investment criterion. All elements of capital budgeting namely time value of money, totality of benefits etc. are considered. Already explained, it is a better evaluation technique than NPV in a situation of capital rationing. It is superior to the NPV method as the former evaluates the worth of projects in terms of their relative rather than absolute measures.

Defects

However there are some limitations like:

i. If there is no limit on the amount of funds that can be invested, use of both NPV and BCR will result in the same projects being accepted or rejected. But, if the funds available are limited, the ranks of projects using the two criteria will differ.

ii. Both BCR and NBCR are unsuitable if the cash outflows occur beyond the current period.

Internal Rate of Return (IRR)

The internal rate of return of a project is the discount rate which makes its net present value equal to zero. It is the discount rate in the equation:

$$0 = \frac{CF_0}{(1+k)^0} + \frac{CF_1}{(1+k)^1} + \ldots + \frac{CF_n}{(1+r)^n} = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}$$

Where, CF_t = Cash flows at the end of the year t

r = Discount rate

n = Life of the project.

In other words, the net present value is made equal to zero and the discount rate which satisfies this condition is the internal rate of return.

This is also known as yield on investment, marginal efficiency of capital, marginal productivity of capital, etc. This method is similar to the NPV method as it also considers time value of money by discounting the cash flow streams. The basis of discount factor, however, is different in both cases. In the case of the present value method, the discount rate is the required rate of return which is usually the cost of capital, which is determined by factors external to the proposal under consideration. The IRR, on the other hand, is based on the facts internal to the proposal. In other words, IRR considers the initial outlay and the cash inflows of the project under evaluation and hence appropriately known as internal rate of return.

Illustration 10

Consider the same project X which has the following cash flows.

Year	Cash flow
0	– 1,35,000
1	30,000
2	40,000
3	45,000
4	47,500
5	50,000

The internal rate of return is calculated as follows:

IRR is 'r' in the following equation

$$0 = \frac{-1,35,000}{(1+r)^0} + \frac{30,000}{(1+r)^1} + \frac{40,000}{(1+r)^2} + \frac{45,000}{(1+r)^3} + \frac{47,500}{(1+r)^4} + \frac{50,000}{(1+r)^5}$$

$$= -1,35,000 + \frac{30,000}{(1+r)^1} + \frac{40,000}{(1+r)^2} + \frac{45,000}{(1+r)^3} + \frac{47,500}{(1+r)^4} + \frac{50,000}{(1+r)^5}$$

The calculation of 'r' in the above equation is by the process of trial and error. Different values of 'r' are tried till the right-hand side of the above equation is equal to zero. The NPV with a discount rate(r) of 15% was equal to Rs.2,938.05.

Since it is more than zero, we have to try a higher value of r. (Generally, a higher r lowers the right-hand side value and a lower r increases the right-hand side value). Therefore, try r = 16%. Then the right-hand side becomes:

$$-1,35,000 + \frac{30,000}{(1+0.16)^1} + \frac{40,000}{(1+0.16)^2} + \frac{45,000}{(1+0.16)^3}$$

$$+ \frac{47,500}{(1+0.16)^4} + \frac{50,000}{(1+0.16)^5} = -\text{Rs.}542.34$$

This value is less than zero, therefore, the value of r lies between 15% and 16%. To find out the exact value, we have to use interpolation:

At 15%, the net present value is 2,938.05.

At 16%, the net present value is –542.34

At what %, the net present value is 0.

1% difference (between 15 & 16%) corresponds to a difference of 3,480.39. The difference between Rs.2,938.05 (net present value at 15%) and zero (Target net present value) is Rs.2,938.05 This difference will correspond to a percentage difference of:

$$= \frac{2,938.05}{3,480.39} \text{ x } 1 = 0.84$$

Adding this number to 15%, we get the actual value of r as 15.84%.

Similarly, IRR for project Y is calculated as 17.65%.

Interpretation of the Internal Rate of Return

IRR is the discount rate which equates the present value of future cash flows of the project to the initial outlay required. Based on the definition of IRR and the PVIFA principle which says that the present value of the cash flows is equal to the discounted value of the future flows reinvested at the rate equal to the discount rate one can interpret IRR in either of two ways as follows:

i. IRR is the rate earned on the unrecovered investment balances of the project; or
ii. It is the rate of return earned on the initial investment.

The first view of IRR as the return earned on the unrecovered investment balances can be explained with the following illustration.

Illustration11

Consider the same Project X whose cash flows are as follows:

Year	Cash flows
0	–1,35,000
1	30,000
2	40,000
3	45,000
4	47,500
5	50,000

IRR of the above project was calculated to be 15.84 percent. This implies that the rate of return earned on the unrecovered balances during the life of the project is 15.84%.

Unrecovered invesment balance at the end of a particular year is the balance of funds committed to the project. Funds committed to the project X is Rs.1,35,000. During the first year there is a cash inflow of Rs.30,000 from the project. Hence, the unrecovered investment balance at the end of first year is

–Rs.1,35,000 (1.1584) + Rs.30,000 = –1,26,384.

Similarly, at the end of second year the unrecovered investment balance is balance of funds committed plus interest during the second year minus the cash inflow during the second year. That is,

–Rs.1,26,384 (1.1584) + 40,000 = –1,06,403.23

The unrecovered investment balances for the rest of the life of the project is calculated as follows:

Year	Unrecovered investment (Beginning)	Cash flow	Unrecovered investment (End)
3	–106403.23	45,000	–106403.23 (1.1584) + 45,000 = – 78257.50
4	– 78257.50	47,500	–78257.50 (1.1584) + 47500 = – 43153.49
5	– 43153.49	50,000	43153.49 (1.1584) + 50,000 = 0 (approximately)

From the above calculations it is clear that by the end of the project the unrecovered investment balance is nil. (In the above, it is not exactly equal to zero because of the approximate IRR figure). This implies, if IRR is applied to the unrecovered investment balances, the balance in the project reduces to zero.

The above calculation of the unrecovered investment balance can be put in the form of an equation as follows:

$$F_t(r) = CF_0 (1 + r)^t + CF_1 (1 + r)^{t-1} + \ldots + CF_t$$

Where,

$F_t(r)$ = Unrecovered investment balance at the end of year t

CF_0 = Cash flow at the end of year 0

CF^t = Cash flow at the end of year t

r = Internal rate of return

The second interpretation of IRR says that it is the rate of return earned during the life of the project on the funds committed. This is based on the PVIFA principle which says that the present value of the future flows is equal to the discounted value of the intermediate cash flows reinvested at the rate equal to the discount rate. Thus, in case of IRR, it is the return earned on the initial investment assuming that the intermediate cash flows are reinvested at the IRR.

In quantitative terms, the above can be explained as follows:

Consider the same project X. The funds committed are Rs.1,35,000 and the IRR is calculated to be 15.84% which implies that return in rupee terms from the project is equal to 1,350,00$(1.1584)^5$ = Rs.2,81,596.02. This is equal to the cash inflows from the project reinvested for the rest of the life of the project at the rate of return of 15.84%. The same can be proved as follows:

Year	Cash flow	Future value of the cash flow reinvested at 15.84% for the remaining life
1	30,000	$30000(1.1584)^4$ = 54020.11
2	40,000	$40000(1.1584)^3$ = 62177.84
3	45,000	$45000(1.1584)^2$ = 60385.08
4	47,500	$47500(1.1584)^1$ = 55024.00
5	50,000	$50000(1.1584)^0$ = 50000.00
Total of the future value of the cash flows		Rs.281607.03

The above is approximately equal to the future value of the investment made. Thus the interpretation that the IRR is equal to the return earned on the initial investment will be valid only if the intermediate cash flow is reinvested at the IRR. However, if the reinvestment rate is different, which is mostly the case, then the above interpretation does not hold good. Thus, it can be concluded that if IRR can be more realistically interpreted as the return earned on the unrecovered investment balance.

Acceptance Criteria

The generally employed acceptance criterion with the IRR is to compare the IRR with a required rate of return, known also as the cut off or hurdle rate. If the internal rate of return exceeds the required rate, the project is accepted, otherwise rejected.

Ranking of projects is also simple. The project with highest IRR is ranked first and so on.

Accepting a project whose internal rate of return is more than the required rate of return, should generally result in an increase in the market price of the stock, as the firm accepts a project with a return greater than that required to maintain the present market price per share.

Merits

Internal rate of return which is the most popular discounted cash flow method has the following virtues:

– It considers the cash flow stream in its entirety.

– Time value of money is considered.

– Helps in assessing the margin of safety in a project i.e., it shows how much a project is earning more than required.

– Variations in the cost of capital does not change the ranking of projects based on the internal rate of return.

Defects

The following are, however, its limitations:

– It is not uniquely defined. There is a possibility of multiple rates of return if the cash flow stream has more than one change in sign.

Illustration 12

Consider project A whose cash outflows and inflows are as follows:

Year	Cash Flows
0	–250
1	600
2	–300

$$NPV = \frac{-250}{(1+r)^0} + \frac{600}{(1+r)^1} - \frac{300}{(1+r)^2}$$

$$= -250x^0 + 600x^1 - 300x^2$$

There are two rates of return that satisfy the condition NPV equal to 0. The values are 0.689 and – 0.289.

Thus, IRR is not uniquely defined and a project will have as many IRR's as there would be changes in the signs of the cash flows.

– The IRR figure does not distinguish between lending and borrowing and hence a high IRR need not be a desirable feature.

Illustration 13

For instance consider two projects P and Q the cash flows of which are as follows:

	0	1
P	– 500	+ 800
Q	+ 500	– 900

The internal rate of return of P is 60%, whereas the IRR of Q is 80%. Is Q more attractive than P. It is not the case. P is an attractive project whereas Q is an undesirable one. This is because P is investing Rs.500 at a rate of return of 50%, whereas Q is borrowing Rs.500 at a rate of return equal to 75%. But if we go by IRR figure, Q is more attractive.

– The IRR criteria, if used to choose between mutually exclusive projects with different outlays, the result can be misleading. For instance, consider the projects M and N.

	Cash Flows		IRR (%)	NPV (k = 12%)
	0	1		
M	– 12,000	+ 20,000	67	5,857
N	– 52,000	+ 70,000	35	10,500

Based on the acceptance criteria, both the projects are good according to IRR and NPV. However, Project N should be preferred as its NPV is better than the other and as NPV reflects the true value of the wealth of the shareholders.

Hence the IRR criterion seems unsuitable for rating projects of different scale.

– It is not suitable for non-simple mixed projects.

Non-simple mixed projects are those projects in which there would be more than one change in the sign of the cash flow and is both a user of funds as well as source of funds for the firm. If the cost imputed to the borrowed funds is equal to the rate of return earned on the investment, then IRR is the relevant measure as it would be the rate internal to the project. But, in general the rate imputed to the borrowed funds is different from the rate earned on the investment. In such cases, IRR is not the relevant measure and return on invested capital may be employed for proper evaluation.

Simple, non-simple, pure and mixed investments are explained in detail later in this chapter.

Modified Internal Rate of Return

The internal rate of return is generally interpreted as the constant rate of return earned on the initial investment over the life of the project. However, this is valid only when the intermediate cash inflows of the project are re-invested at a rate of return equal to the internal rate of return of the project. If this assumption is invalid, then modified IRR has to be calculated. For this, the terminal value of the project using the re-investment rates is to be calculated. Once the terminal value is calculated, the modified IRR is calculated as follows:

$$I\,(1 + r^*)^n = TV$$

$$r^* = \left[\frac{TV}{I}\right]^{1/n} - 1$$

Where,
- I = Initial Investment
- r^* = Modified IRR
- n = Project Life
- TV = Terminal Value

Non-Discounted Criteria

Pay Back Period

It is the simplest and the most widely employed quantitative method for appraisal of capital expenditure decision. This method gives an answer for the question: How many years will it take for the cash inflows to pay the original cost of an investment?

In other words, the pay back period of a project is the number of years required to recover the initial cash outlay.

For instance, if the initial outlay is Rs.2,50,000 and this generates a cash inflow of Rs.80,000, 90,000, 45,000 and Rs.35,000 in the 1st, 2nd, 3rd and 4th years respectively, then the pay back is in the 4th year as the total of all the cash inflows is equal to the initial investment.

When the annual cash inflow is constant, the pay back period is the initial investment divided by the annual cash inflow.

For example, a project requires an initial outlay of Rs.50,00,000 which generates a constant annual cash inflow of Rs.12,00,000 then the pay back period is Rs. $\frac{50,00,000}{12,00,000} = 4.17$ years.

If the annual cash flows are not equal the calculation becomes slightly complicated.

Illustration 14

Pay back period for the Projects X and Y is calculated as follows:

Year	Project X		Project Y	
	Cash Flow	Cumm. CF	Cash Flow	Cumm. CF
0	–1,35,000		–43,000	
1	30,000	30,000	10,500	10,500
2	40,000	70,000	13,200	23,700
3	45,000	1,15,000	15,300	39,000
4	47,500	1,62,500	15,500	54,500
5	50,000	2,12,500	15,900	70,400

From the cumulative cash flow column in the above table it is clear that the initial investment of both the projects is recovered between third and the fourth year. Hence, the pay back period is between 3 and 4 years for both the projects. Pay back period, precisely, can be calculated by using interpolation.

Project X $= 3 + [(135000 – 115000)/(162500 – 115000)]$

$= 3.4210526$

Project Y $= 3 + [(43000 – 39000)/(54500 –39000)]$

$= 3.2580645$

Acceptance Criteria

One application of this technique is to compare the actual pay back with a pre-determined pay back i.e. the pay back set-up by the management in terms of the maximum period during which the initial investment is to be recovered. If the actual pay back period is less than the predetermined pay back, the project would be accepted, if not rejected. Also, the pay back can be used as a ranking method. The shorter the pay back period, the more desirable the project is.

Merits

The following are the advantages of pay back period:

– It is simple in both concept – wise and application – wise.

– It is a rough and a ready method for dealing with risk. It favors projects which bring in cash flows in the earlier years against those which bring in cash inflows in the later years. As risk tends to increase in future, this may be helpful in avoiding risky projects.

– As it concentrates on earlier cash flows, it may be the appropriate criterion when the firm is pressed with problem of liquidity or during periods when financing costs are high.

Defects

The following are its limitations:

– Time value of money is ignored i.e., it considers all the cash inflows occuring at different time periods to have same value.

– It overlooks cash flows beyond pay back period. As the payback period is a measure of a project's capital recovery, it may divert attention from profitability.

Year	Cash Flows					
		Project M		Project N		
		15%			15%	
0	–20,000	1.0000000	–20,000.0000	–20,000	1	–20,000.00000
1	7,200	0.8695652	6260.86957	4,500	0.8695652	3913.04348
2	6,500	0.7561437	4914.93384	4,800	0.7561437	3629.4896
3	6,300	0.6575162	4142.35226	5,500	0.6575162	3616.33928
4	4,800	0.5717532	2744.41558	8,000	0.5717532	4574.02596
5	3,900	0.4971767	1938.98927	9,000	0.4971767	4474.59062
Net Present Value			1.56051348			207.488942

In the above projects based on pay back period criterion, project M would be preferred to N as its pay back period is 3 years while it is 3+ years for the latter. However, if we consider the entire flow of cash during the life time of the project, by calculating NPV, we find the Project N would be better than M as its NPV of Rs.207.49 lakh is higher than the NPV of M of Rs.1.56 lakh.

Discounted Pay back Period

To overcome the major shortcoming of the payback period of not considering time value of money, the discounted payback can be calculated. In this method, firstly, cash flows are converted into present values and is then added to ascertain the time period required to recover the initial investment on the project.

Calculation of Discounted Pay back Period for project X and Y is as follows:

Year	Project X Cash Flow	PV @ 15%	Cumm. Value	Project Y Cash Flow	PV @15%	Cumm. Value
0	–1,35,000	–1,35,000		–43,000	–43,000	
1	30,000	26,086.957	26,086.9565	10,500	9,130.4348	9,130.43478
2	40,000	30,245.747	56,332.7032	13,200	9,981.0964	19,111.5312
3	45,000	29,588.23	85,920.9337	15,300	10,059.998	29,171.5295
4	47,500	27,158.279	1,13,079.213	15,500	8,862.1753	38,033.7049
5	50,000	24,858.837	1,37,938.05	15,900	7,905.1101	45,938.8149

Discounted payback period is equal to

Project X = 4 + [(1,35,000 – 1,13,079.213)/(1,37,938.05 – 1,13,079.213)]

= 4.8818106

Project Y = 4 + [(43,000 – 38,033.7049)/(45,938.8149 – 38,033.7049)]

= 4.6282386

Accounting Rate of Return

Accounting rate of return also referred to as the average rate of return or the return on investment, is a measure of profitability by relating income to investment, both of which are measured in accounting terms. There can be a large number of measures to measure both income and investment for accounting rate of return.

The following are some of the commonly used ones:

a. $\dfrac{\text{Average income after tax}}{\text{Initial investment}}$

b. $\dfrac{\text{Average income after tax}}{\text{Average investment}}$

c. $\dfrac{\text{Average income after tax, but before interest}}{\text{Initial investment}}$

d. $\dfrac{\text{Average income after tax, but before interest}}{\text{Average investment}}$

e. $\dfrac{\text{Average income before interest and taxes}}{\text{Initial investment}}$

f. $\dfrac{\text{Average income before interest and taxes}}{\text{Average investment}}$

g. $\dfrac{\text{Total income after tax, but before depreciation} - \text{Initial investment}}{\dfrac{\text{Initial investment}}{2} \text{ x years}}$

Illustration 15

Year	Investment (Book-value)	Dep.	Income before interest and taxes	Interest	Income before tax	Tax	Income after tax
1.	1.25	0.25	0.40	0.15	0.25	0.125	0.125
2.	1.00	0.25	0.45	0.15	0.30	0.150	0.15
3.	0.75	0.25	0.50	0.15	0.35	0.175	0.175
4.	0.50	0.25	0.50	0.15	0.35	0.175	0.175
5.	0.25	0.25	0.45	0.15	0.25	0.125	0.125
Sum	3.75	1.25	2.30	0.75	1.50	0.750	0.75
Average	0.75	0.25	0.46	0.15	0.3	0.150	0.15

a. $$\frac{\text{Average income after tax}}{\text{Intial investment}} = \frac{0.15}{1.25} = 12\%$$

b. $$\frac{\text{Average income after tax}}{\text{Intial investment}} = \frac{0.15}{0.75} = 20\%$$

c. $$\frac{\text{Average income after tax, but before interest}}{\text{Initial investment}} = \frac{0.15 + 0.15}{1.25} = 24\%$$

d. $$\frac{\text{Average income after tax, but before interest}}{\text{Average investment}} = \frac{0.15 + 0.15}{0.75} = 40\%$$

e. $$\frac{\text{Average income before interest and taxes}}{\text{Initial investment}} = \frac{0.46}{1.25} = 36.8\%$$

f. $$\frac{\text{Average income before interest and taxes}}{\text{Average investment}} = \frac{0.46}{0.75} = 61.3\%$$

g. $$\frac{\text{Total income after tax, but before depreciation} - \text{Initial investment}}{\frac{\text{Initial investment}}{2} \text{ x years}}$$

$$= \frac{0.75 + 1.25 - 1.25}{\frac{1.25}{2} \text{ x } 5}$$

$$= \frac{2 - 1.25}{0.625 \text{ x } 5} = \frac{0.75}{3.125} = 24\%$$

The following points can be observed from a comparison of the ARR with IRR if ARR is calculated using the net income:

– The ARR will be higher than the IRR for the initial years and lower in the later years.

– ARR and IRR may be equal if the accounting depreciation is equal to the economic depreciation (Refer to Appendix II to this chapter for calculation of economic depreciation).

– Differences between the values of ARR and IRR also arise because of inflation and creative accounting.

Accept – Reject Rule

According to the ARR, the actual ARR would be compared with a predetermined or a minimum required rate of return or cutoff rate. A project would qualify for acceptance if the actual ARR is higher than the minimum desired ARR, otherwise rejected. Rating method can also be used to select or reject proposals. It can be arranged in a descending order starting with the project with the highest ARR and ending with the project having lowest ARR. Obviously, projects with higher ARR would be preferred to projects with lower ARR.

Merits

The following are some of the virtues of accounting rate of return:

– It is simple to calculate and accounting information is available readily.

– Benefits over the entire life of the projects is considered.

– Post-auditing of capital expenditure is facilitated because it is based on accounting information.

Defects

Shortcomings of the accounting rate of return:

– It is based on accounting profit, not cash flow.

– Time value of money is not considered.

– The ARR criterion does not differentiate projects with respect to the size of investment required for each project.

Urgency

According to this, projects that are more urgent get priority over projects that are less urgent. For instance, the failure of a machine will have to be looked into immediately if the failure affects the entire production as it may be futile to go into a detailed analysis and decision.

But, Urgency being a subjective criterion makes it difficult to determine the degree of urgency. Generally, when there are competing demands for funds, the demands of those who are more persuasive in presenting their need are considered to be more urgent. Therefore, this criterion is not really useful for investment decision making, particularly when the investment outlay is substantial.

Assessment of Basic Evaluation Techniques

	Net present value	Benefit cost ratio	Internal rate of return	Payback period	Accounting return of investment
Theoretical considerations					
1. Does the method consider all cash flows?	Yes	Yes	Yes	No	No
2. Does the method discount cash flows at the opportunity cost of funds?	Yes	Yes	No	No	No
3. Does the method satisfy the principle of value additvity?	Yes	No	No	No	No
4. From a set of mutually exclusive projects, does the method choose the project which maximizes shareholder wealth?	Yes	No	No	No	No

Assessment of Basic Evaluation Techniques					
	Net present value	Benefit cost ratio	Internal rate of return	Payback period	Accounting return of investment
Practical consideration					
1. Is the method simple?	Yes	Yes	No	Yes	Yes
2. Can the method be used with limited information?	No	No	No	Yes	Yes
3. Does the method give a relative measure?	No	Yes	Yes	Yes	Yes

Analysis of Simple, Non-simple, Pure and Mixed Investments

Simple investments are those investments in which the cash outflows are followed by cash inflows whereas non-simple investments are those in which cash outflow (or stream of outflows) occur more than once. In other words, in a non-simple project, there would be more than one change in sign of the cash flow.

A project can be either pure or mixed investment. A project can be said to be a pure investment if the unrecovered investment balance is either negative or zero throughout the life of the project and zero at the end of the project. This implies that a pure investment is a project which does not borrow at any time during the project and recovers the investment by the end of the project. An investment which is not a pure investment is referred to as mixed investment.

Illustration 16

Let us consider an example to test a project whether it is a simple or non-simple and pure or mixed investment.

Year	Project A	Project B	Project C	Project D
0	–1000	–2000	–1040	–2000
1	300	2500	6500	–2000
2	400	–250	–6500	3000
3	500			3000
IRR	0.089	0.14	0.25;4.00	0.225

From the above table and the one given below it is clear that projects A and D are simple and pure investments whereas projects B and C are non-simple and mixed investments.

Project A	Project B	Project C		Project D
		IRR = 0.25	IRR = 4	
F0 = –1000	–2000	–1040	–1040	–2000
F1 = –1000(1.089) + 300 = –789.000	– 2000(1.14) + 2500	– 1040(1.25) + 6500	– 1040(5) + 6500	– 2000(1.225) – 2000
	= 219.224	= 5200	= 1300	= –4449.49
F2 = –789.000(1.089) + 400 = –459.000	219.224(1.14) – 250	5200(1.25) – 6500	1300(5) – 6500	– 4449.49(1.225) + 3000
				= –2449.49
F3 = –459.000(1.089) + 500 = 0 (app)	= 0	= 0	= 0	– 2449.49(1.225) –3000 = 0

As already explained a pure investment is one which is only a source of funds to the firm throughout the life of the project and the unrecovered investment balance during the life of the project is either negative or zero and at the end of the life of the project is always zero. Thus, we have to find out the minimum rate of return which makes the unrecovered investment balance during the life of the project equal to or less than zero. This is referred to as $i_{(min)}$. Then one needs to find out the rate at which the unrecovered investment balance at the end of the life of the project is equal to zero. This is referred to as i*. If i* is more than the $i_{(min)}$ then it is referred to as pure investment and if i* is less than $i_{(min)}$ then it is referred to as mixed investment.

Illustration 17

Consider the projects B and D of the above example.

Project B

$F_0 = -2000$

$F_1 = -2000(1 + r) + 2500$ $i_{(min)}$ is r at which the above is equal to zero.

Therefore, $i_{(min)}$ is 0.25

$F_N(i^*) = 0$

i^* is nothing but IRR = 0.14

As $i^* < i_{min}$, the investment is mixed.

Project D

$F_0 = -2000$

$F_1 = -2000(1 + r) - 2000$

i_{min} is r at which the above is zero

Therefore, $i_{min} = 0$

IRR or $i^* = 0.225$

As $i^* > i_{min}$, the investment is pure.

Relationship between r* and k

Already it was proved that IRR is not the relevant measure for analyzing the mixed project. To analyze the project we need to distinguish between the funds committed to the project and funds borrowed from the project. If funds are committed to the project then the return on invested capital, r* should be employed and if funds are borrowed from the project, imputed cost of funds, k should be employed. This can be explained by considering Project B of the above example.

It was already shown that the project is a mixed investment. To find out whether the funds are committed to or borrowed from the project we need to find out the unrecovered investment balances during the life of the project. For the project B, $F_0 = -2000$ and unrecovered investment balance at the end of year 1 is $F_1 = -2000(1 + r^*) + 2500$. As r* cannot be negative and cannot exceed i_{min}, $F_1 \geq 0$. So it compounded at k and $F_2 = [-2000(1+ r^*) + 2500](1 + k) - 250$. As F_2 should be equal to zero we get the following equation:

$$(-2000 - 2000\,r^* + 2500)(1 + k) - 250 = 0$$

$$r^* = \left[\frac{250}{1+k} - 500\right]\frac{1}{2000} = \frac{1}{8(1+k)} - \frac{1}{4}$$

Using the above equation, if we know the cost of funds, we can calculate the return on invested capital.

APPRAISAL OF PROJECTS WITH SPECIAL FEATURES

Optimal Timing of Investment

According to the net present value method a project is accepted if its NPV is positive and rejected if the NPV is negative. However, in real life situations an investment decision is not just based on the NPV as calculated in the beginning. A positive NPV does not mean that the project can be accepted outright at that point of time. The project may give more returns if it is initiated may be at a later point of time. A negative NPV also does not mean that the project can be rejected. May be if investment is made in the same project at a later point of time the project may give positive NPV and may be considered for investment. The change in the net present value of the investment might be due to the change in the value of the beginning investment to be made and/or the change in the cash flows from the investment. Thus, the returns the net present value of the project has to be found out at various future dates and the investment decision has to be made at that point of time where the NPV is positive and maximum.

The above analysis can be done in the following steps:

i. Determine the various future dates for investment.

ii. Calculate the net present value of the investment as on those future dates (net future values).

iii. Discount the above net future values to the present.

iv. Find out the time at which the present value of the net future value is positive and maximum and this is the optimal time for investment.

Illustration 18

Consider a project whose required initial outlay is Rs.100 lakh and the expected cash flows from the project for the 5-year life of the project are as follows:

Year	Cash Flow (Rs. lakh)
0	–1200
1	350
2	275
3	250
4	300
5	400

The net present value of the project is Rs.13.44 lakh (negative) at a discount rate of 10%. As the NPV is negative the project should not be accepted. However, if we consider the changes that may occur in the initial flow and the cash inflows of the project if the investment is made at a different point of time, the project may be accepted. Steps involved are:

i. Determine the different points of time when investment can be considered.

For the project let us assume that the project, if not taken up now, can be considered for investment in year 1 or 3.

ii. Calculate the net future value or the net present values of the project assuming project is considered in year 1 or 3.

Let us assume for the project under consideration the initial outlay required would increase at the rate of 10% per annum and the cash inflows from the project would increase by 25% in years 1 and 2 and increase by 30% for the next two years and by 10% in the last year. The net present value of the project if investment is made during years 1 and 3 would be Rs.145.58 lakh and Rs.661.55 lakh respectively.

iii. Calculate the present value of the net future values: Employing the same discount rate the present values of the net future values are found out as follows:

Net present value if the investment is made at the end of one year from now:

$$\frac{145.88}{1.10} = \text{Rs.}132.62 \text{ lakh}$$

Net present value if the investment is made at the end of three years from now:

$$\frac{661.55}{1.10^3} = 497.04 \text{ lakh}$$

iv. Choose the optimal time for investment.

For the project under consideration the optimal time for investment is year 3 because the present value of the net future values is maximum in year 3. This implies that if investment is made in the 5 year project in year 3 from now the net present value is positive and maximum and can be considered for investment in year 3.

Inflation and Capital Budgeting

Until now the appraisal exercise which has been done was based on the cash flows estimated at the rupee value as on the beginning day, ignoring the effect of inflation on the cash flows. The basic reason for not considering inflation is, it was believed that the inflation would affect the costs and revenues to the same extent and hence can be ignored. However, inflation should be properly considered in investment decisions because:

1. The impact of inflation on the costs of inputs and selling prices is readily reflected in the books of account. But, there are items like plant and machinery whose values are shown in the financial statements ignoring the effect of inflation, at their historical values and depreciation is based on historical values. This will result in distortions in the picture presented by the financial statements.
2. If the discount rate or cost of capital used for discounting the cash flows already considers the inflation premium then, there would be inconsistency if the cash flows are not adjusted for inflation.

   Both the above statements can be explained with an example.

Illustration 19

Consider a project whose initial outlay required is Rs.2,00,000 and estimated useful life is 5 years. The annual cash inflows and outflows estimated on the beginning day of the project are as follows:

Annual Revenues	Rs.150,000
Annual Costs (excluding depreciation)	Rs.71,500
Tax Rate	30%
Depreciation	Straight line method
Salvage Value	Negligible

Without considering the effect of inflation of 6% p.a. the net cash flows of the above project are calculated as follows:

NCFs during year 1 – 5

Sales	150,000
Costs (Excl. dep.)	71,500
Depreciation	40,000
Profit Before Tax	38,500
Tax	11,550
Profit After Tax	26,950
Cash Flow (PAT + Dep.)	66,950

Considering the effect of inflation we get the following cash flows:

NCFs during years 1 – 5

	Year 1	Year 2	Year 3	Year 4	Year 5
Sales	1,59,000.0 0	1,68,540.00	1,78,652.40	1,89,371.54	2,00,733.84
Costs (excl. dep.)	75,790.00	80,337.40	85,157.64	90,267.10	95,683.13
Depreciation	40,000.00	40,000.00	40,000.00	40,000.00	40,000.00
PBT	43,210.00	48,202.60	53,494.76	59,104.44	65,050.71
Tax	12,963.00	14460.78	16,048.43	17,731.33	19,515.21
PAT	30,247.00	33,741.82	37,446.33	41,373.11	45,535.50
NCF	70,247.00	73,741.82	77,446.33	81,373.11	85,535.50
NCF adjusted for inflation	66,270.75	65,629.05	65,025.43	64,455.12	63,917.10

From the above table, it is clear that the cash flows are reduced if inflation is taken into account. When inflation is considered the tax shield on the historical costs based cash flows would not change and there would be a lower real net cash flow.

To consider the inconsistency in taking into account the effect of inflation on both the cash flows and the discount rate, extend the above example to calculate the net present value using the discount rate of 18% p.a. consisting of 6% p.a. inflation premium.

Considering the discount rate and discounting the cash flows (current rupees) the net present value is calculated as follows:

66950 $PVIFA_{18\%,5}$ – 200,000 = 9364.1

Discounting the cash flows adjusted for the inflation premium with discount rate of 18%, the net present value is Rs.4,057.

As it is clear from the above that the real net present value is lower if inflation is considered.

Interactions of Investments and Financing Decisions

Until now, all the capital budgeting decisions were discussed under the assumption that the projects are all financed with the same proportion of equity and debt as hitherto used by the firm. Given the information regarding a project, it was appraised by first estimating the after-tax cash flows of the project, discounting the cash flows using the opportunity cost of capital i.e. the expected rate of return offered to investors by the equivalent risk investments traded in the capital markets, to calculate the net present value. Thus, a project was not looked from the financial angle, that is, the desirability of a project depending on the financing pattern.

However, we cannot separate the financing and investment decisions and the capital budgeting exercise above can be extended to include the financing decisions. This can be done in two ways as follows:

Adjust the discount rate or adjust the net present value to consider the side effects of financing the project such as the tax shield that can be claimed on the debt raised, subsidies allowed, issue expenses, etc.

The side effects of financing decision can be accounted for in the discount rate that has to be employed to the cash flows to calculate the net present value.

The adjusted cost of capital or the minimum rate of return required for the project to be acceptable is calculated using the following two formulae, one given by Modigliani and Miller and the other by Miles and Ezzell.

According to Modigliani and Miller adjusted cost of capital is equal to

$$r^* = r(1-TL)$$

where,

r	=	Opportunity cost of capital if the project is 100 percent equity financed
T	=	Tax rate applicable to the firm
L	=	Marginal contribution of the project to the firm's debt capacity

Conditions specified by M&M to use the above formula are that the project should generate constant perpetual cash flow and the project should support permanent debt.

Illustration 20

Consider a project which requires an investment outlay of Rs.30 lakh and generates post-tax cash inflow equal to Rs.5 lakh per annum perpetually. The firm has the perpetual debt capacity of Rs.10 lakh carrying an interest of 14% p.a. The opportunity cost of capital or cost of equity is 16% and the marginal tax rate is 30 percent.

According to M&M adjusted cost of capital is equal to

$$r^* = r(1 - TL)$$

Substituting the values given in the problem in the above formula,

r*= 0.16(1 – 0.3 x 10/30)

= 0.16(1 – 0.1)

= 14.4 percent.

According to the second formula developed by Miles and Ezzell, adjusted cost of capital is calculated as

r* = r – Lr(D)T x (1 + r)/1 + r(D)

where, r(D) = cost of debt

The condition as given by Miles and Ezzell to use the formula is that the project should maintain a constant debt proportion.

Considering the same project as above, adjusted cost of capital according to Miles and Ezzell can be calculated as

r* = 0.16 – 10/30 x 0.14 x 0.3 x (1.16)/1.14

= 0.16 – 0.014

= 14.6 percent.

Now, we can use either of the two discount rates to determine the NPV of the project. The Modigliani and Miller formula is based on the assumption that the project in question generates a constant perpetual cash flow and supports permanent debt. The Miles and Ezzell formula, though based on the assumption that the proportion of debt remains constant, does not suppose any cash flow pattern. The choice of the formula to be used should be based on which of the two assumptions is closest to the circumstances of the project.

Adjusted Net Present Value

Adjusted net present value or the adjusted present value is the project's net present value adjusted for the side effects of the financing decision. Adjusted net present value is calculated in the following steps:

i. First, the base case NPV should be calculated. Base case NPV is the project's NPV assuming that the project is all equity financed.

ii. Then, the base case NPV should be adjusted to give effect to the financing decisions i.e., for issue expenses, tax shield on debt, etc.

Thus, adjusted net present value is equal to:

Base case net present value – Issue expenses + Present Value of tax shield on debt.

Illustration 21

Consider the same project as in illustration 20. Assume the firm incurs issue expenses of 5 percent of the gross proceeds of equity.

Base case NPV is equal to

–30 + 5PVIFA(16%, infinite) = –30 + 5/0.16 = 1.25

Issue Expenses = Equity required or net proceeds of equity x 0.05/0.95

= 20/0.95 x 0.05

= Rs.1.05 lakh.

Present value of tax shield on debt = 10 x 0.14 x 0.3 x 1/0.014 = 3 lakh

Adjusted net present value = 1.25 – 1.05 + 3.00 = 3.20 lakh

The adjusted net present value can be calculated even for finite life of the projects, different cash flows during the life of the project and finite debt.

Illustration 22

Consider the debt raised in the above example is to be repaid in 5 equal annual installments, repayments starting from the end of the first year and the life of the project is 5 years with negligible salvage value.

The present value of tax shield on the interest is calculated as follows:

Year	Debt o/s at the beginning	Interest @14%	Tax Shield @ 30%	PV of Tax shield @ 14%
1	10	1.40	0.420	0.368
2	8	1.12	0.336	0.258
3	6	0.84	0.252	0.170
4	4	0.56	0.168	0.099
5	2	0.28	0.084	0.044
		PV of tax shield on interest		0.939

Adjusted NPV = Base case NPV + Adjustments

Adjusted NPV $= -30 + 5\ PVIFA_{16\%,5} - 1.05 + 0.939$

$= -30 + 16.37 - 1.05 + 0.939 = -13.741$

Adjusted cost of capital, the minimum acceptable rate of return to be earned for the project to be accepted, can also be calculated from the above. Give the net impact of side effects of financing decision to be –1.05 + 0.939 = –0.111, the base case NPV of the project for the adjusted NPV to be zero should be +0.029. Hence the annual income from the project would be C in the following equation:

$$+0.111 = -30 + C\ PVIFA_{16\%,15}$$

$$C = \frac{30.111}{3.274} = 9.197$$

The adjusted cost of capital would be $9.172\ PVIFA_{\%,5} = 30$

The adjusted cost of capital is approximately 16%.

Determination of Economic Life

The number of years an asset can be used to produce a certain profit is referred to as economic life of an asset.

The economic life of an asset depends on the operating, maintenance and capital costs of the asset. The first two refer to the expenses made to operate, maintain and repair the asset and the last refers to the decline in the value of the asset as time passes. Given the definition of economic life as above, it can be referred to as the period after which the asset should be replaced so that the total costs i.e., the sum of operating, maintenance and capital costs is minimized. Thus, it is that period at which the uniform annual equivalent total costs is minimized. Uniform annual equivalent of total costs UAE(TC) is the sum of the uniform annual equivalent operating costs, UAE(OC) and uniform annual equivalent capital costs, UAE(CC). UAE(OC) increases as the replacement cycle is extended due to the increase in the costs to operate and maintain the asset. In contrast, UAE(CC) decreases with the increase in the replacement cycle due to the fall in the annual capital cost. Thus, with the increase in the replacement cycle, UAE(CC) will be reduced and UAE(OC) increases and at some point the costs would be minimized and that point of time should be the end of the economic life of the asset.

Illustration 23

Consider a plant which requires an initial outlay of Rs.30 lakh and has a physical life of 6 years. The plant is depreciated at 30% on WDV basis and the marginal tax rate is 30%. The operating and maintenance costs and the salvage value for the next 6 years are as follows:

Operating and Maintenance Costs and Salvage Value are as follows:

						Rs.
	1	2	3	4	5	6
Operating and Maintenance	4,00,000	5,00,000	6,50,000	8,00,000	12,00,000	14,00,000
Salvage value at the end of time 't'	20,00,000	16,00,000	12,00,000	6,00,000	3,00,000	1,50,000

Assume the discount factor as 12%. The economic life can be determined by finding out the UAE(OC) and UAE(CC). The economic life would be that where the UAE(TC) is minimum.

UAE(OC) can be calculated by the following steps:

i. Converting the operating and maintenance costs into post-tax terms

ii. Discounting the above to obtain the costs in present value terms

iii. Cumulating the present values for various replacement periods

iv. Applying suitable annuity factors and finding out the UAE(OC) for various replacement periods.

The UAE(OC) for various replacement periods is calculated as follows:

						(Rs. lakh)
Replacement Period	1	2	3	4	5	6
Operating and Maintenance Costs (A)	4.00	5.00	6.50	8.00	12.00	14.00
Post-tax Operating and Maintenance Costs (B) = A x 0.7	2.80	3.50	4.55	5.60	8.40	9.80
Present Value of Post-tax Operating and Maintenance Costs (C) = (B) $PVIF_{12\%,t}$	2.50	2.79	3.24	3.56	4.76	4.97
Cumulative PV of (C) = D	2.50	5.29	8.53	12.09	16.85	21.82
UAE (OC) = E = D/$PVIFA_{12,t}$	2.80	3.13	3.55	3.98	4.67	5.31

UAE(CC) is the annual capital costs after considering the salvage value (SV) and the depreciation tax shields (DTS). UAE(CC) is calculated as UAE (Initial cost) – [UAE (DTS) – UAE (SV)].

For the above example UAE(CC) is calculated as:

Replacement Period	1	2	3	4	5	6
Initial Outlay = F	30	30	30	30	30	30
UAE(IO) = G = F/$PVIFA_{12,t}$	33.59	17.75	12.49	9.88	8.32	7.30

UAE (DTS) for various replacement periods

Replacement Period	1	2	3	4	5	6
Depreciation = H	9.00	6.30	4.41	3.09	2.16	1.51
DTS = I = H x 0.3	2.70	1.89	1.32	0.93	0.65	0.45
PV of DTS = J	2.41	1.51	0.94	0.59	0.37	0.23
Cumm. PV = K	2.41	3.92	4.86	5.45	5.82	6.05
UAE (DTS) = L = k/$PVIFA_{12\%,t}$	2.70	2.32	2.02	1.79	1.61	1.47

UAE (SV) for various replacement periods

Replacement Period	1	2	3	4	5	6
Salvage value = M	20	16	12	6	3	1.5
PV of SV = N = M.PVIF$_{12, t}$	17.86	12.75	8.54	3.82	1.701	0.76
UAE (SV) = O = N/PVIFA$_{12, t}$	20	7.54	3.56	1.26	0.47	0.18

UAE (TC) for various replacement periods

Replacement Period	1	2	3	4	5	6
UAE (I. Cost) = G	33.59	17.75	12.49	9.88	8.32	7.30
UAE (DTS) = L	2.70	2.32	2.02	1.79	1.61	1.47
UAE (SV) = U	20	7.54	3.56	1.26	0.47	0.18
UAE (CC) = P = G – L – O	10.89	7.89	6.91	6.83	6.24	5.65
UAE (TC) = Q = E + P	13.69	11.02	10.46	10.81	10.91	10.96

As UAE (TC) is minimum for 3 year replacement cycle, economic life is 3 years.

Investment Appraisal: Indian Practice

Some of the important points to be looked into while appraising are: the economic analyses of capital expenditure, the methods used for analysis of capital expenditure, the rationale underlying other methods and the means to improve the economic analysis of capital expenditures.

Besides these, several non-standard measures are used for evaluating investments.

For investments of small size, the pay back method is commonly used for evaluating whereas for large size investment, average rate of return is employed.

Also discounted cash flow techniques are now gaining importance to evaluate large size investments.

SUMMARY

- After the financial projections regarding the future sales cost of a project and the means of funds have been determined, it is necessary to appraise the project in terms of its net benefits. While appraising the project, cash flows are considered instead of accounting profits. For calculating the cash flows, all non-cash charges are added back to the accounting profits. Further, only incremental cash flows are considered for the project appraisal and sunk costs are ignored. The cash flows to be used for appraising the project can be estimated from three viewpoints – long-term funds, equity funds and total funds. There are two types of appraisal criteria:
    i. Discounted Criteria: Net Preset Value, Internal Rate of Return, and Benefit-to-Cost Ratio.
    ii. Non-Discounted Criteria: Accounting Rate of Return, Payback Period and Urgency.
- Each of these criteria has their own advantages and disadvantages. So, appropriate judgment can be taken after considering the specific factors relating to the project.

Appendix I

Rationale of NPV

Net present value maximizes the shareholders wealth. This is proved in this appendix.

Figure 1

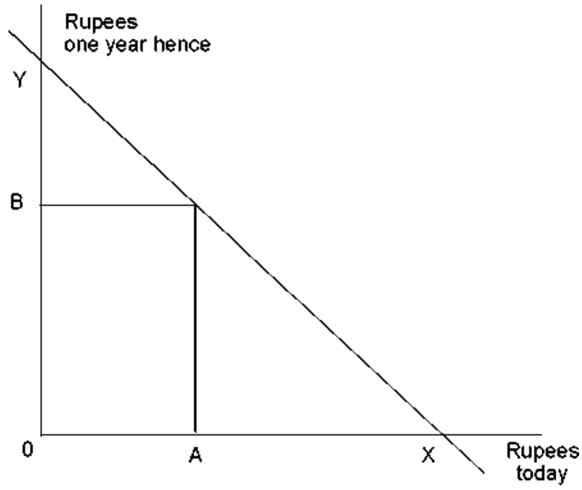
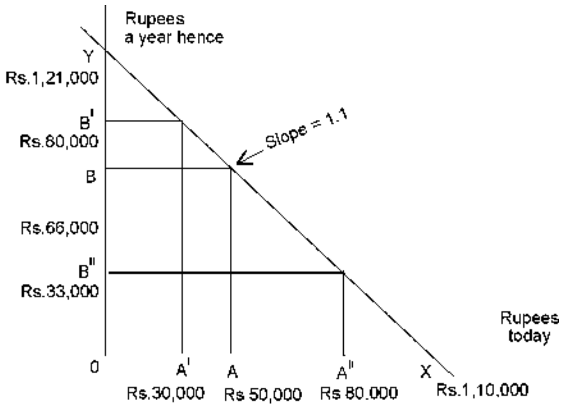


Figure 1 illustrates the problem of choosing between spending today and spending in the future. x-axis represents the amount of rupees one has and can be spent today and y-axis represents the amount of rupees one will have and can be consumed one year hence. The downward sloping line represents the rate of exchange in the capital market. Its slope is 1 + r where r is the one year rate of interest. Assume an individual holds OA rupees today and has a receivable of OB rupees a year hence. OA rupees can be spent today or saved and spent a year after. Transfer of wealth across time can be done through capital market. Thus, capital market is a place where rupees today are traded for rupees in the future. Assume the entire OA are invested in the capital, the present consumption would be nil and the future consumption would increase by OA (1 + r) = BY and would be equal to OY. If rupees are borrowed today against rupee in the future, the present consumption would increase by OB (1 + r) = AX to OX and future consumption will be zero. The line joining the X and Y is the line whose slope is the one-year interest rate. Let us consider that the individual has Rs.50,000 today and expects to get Rs.66,000 in future. If Rs.50,000 are invested totally in the capital market at 10% interest the future consumption increases by 50,000 (1.1) = Rs.55,000 to Rs.1,21,000. If rupees are borrowed in the capital market against future rupees the present consumption can be increased by 66000/1.1 = 60,000 to Rs.1,10,000. The line joining the 1,10,000 on Y-axis and Rs.1,21,000 on X-axis is the capital market line whose slope is 1.1.

If the individual wishes not to invest total Rs.50,000 nor consume Rs.50,000, but wishes to invest a part say Rs.20,000 and consume Rs.30,000 today, the future consumption would increase by 20,000 (1.1) = Rs.22,000. This is graphically shown in figure 2. If present consumption is restricted to OA', future consumption would increase to OB'.

However, if rupees are borrowed today against say Rs.33,000 in the future, present consumption would be increased by 33,000/1.1 = Rs.30,000 to Rs.80,000. The same can be seen in figure 2. If future consumption is reduced to OB'', present consumption would increase to OA''.

Figure 2

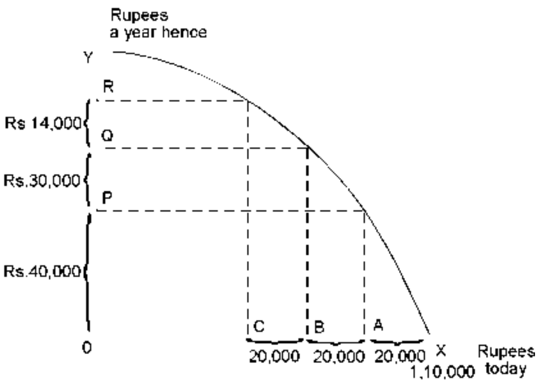


Thus, an individual can reach any point on the line XY depending on how much he would like to consume and invest.

Real Investment Line

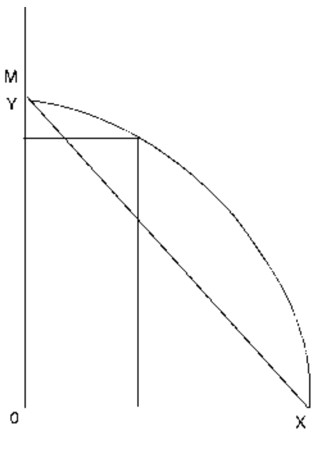
An individual is not restricted, in real life, just to capital market line. There might be real investment line that represents return from investments in real assets. The return from first investment in real assets would be higher, but starts reducing with the subsequent investments. The real investment line would generally be in the form XY as shown below:

Figure 3



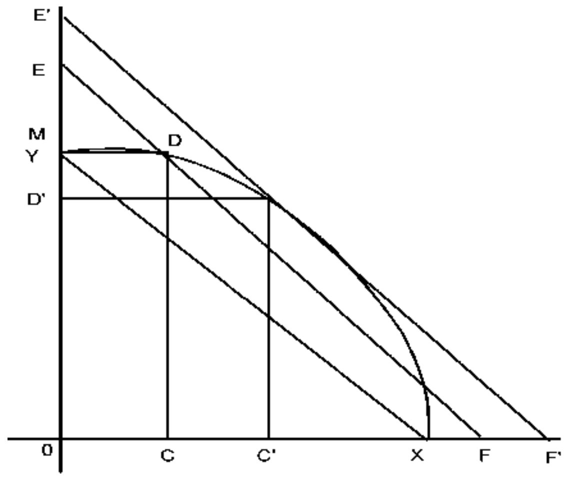
The return from investment in real assets of AX = Rs.20,000 today would be equal to OP = Rs.40,000 next year. The next investment of BA = Rs.20,000 would yield only Rs.30,000 i.e. PQ and next investment CB = Rs.20,000 would yield only Rs.14,000 i.e. QR. Thus, each subsequent investment would yield lower returns.

Figure 4



The example of capital market investment can be extended to include investment in real assets. Let the money today be OX including the money that is borrowed against future money. Let the investment in real assets be CX, as shown in the following figure.

Figure 5



The return from such investment would be OD. If the amount OC is not consumed today but invested in the capital market the return from the investments in year 1 would increase from OD to OE. Based on the future consumption of OE the present consumption can be increased to OF. Thus, the cost is CX and the net present value i.e. the difference between the present value and its cost is FX. Similarly, if investment in real assets is $C'X$ then the return from real assets would be OD' and the investment in capital market of OC' would increase the future money to OE'. Based on this future money present consumption can be increased to OF' and net present value would be XF'. Thus, based on the amount of investment in real assets, an individual can move on to higher capital market line and increase his returns. His net present value would be maximized when the increased (or new) capital market line would be tangent to the real asset investment line. This constitutes the rationale for the net present value criterion.

Appendix II

There are other methods also, for evaluating the desirability of a project apart from those discussed earlier. In these methods also, the return being expected from the project is compared with the return required from it. Let us now study two such methods which are in wide use.

Economic Rate of Return

In this method, the return actually earned on the unrecovered investment balances is compared with the required rate of return (or the opportunity cost of capital). The technique involved in this method may be divided into the following steps:

- The unrecovered investment balance at the beginning of the period under evaluation (generally a year) is compounded at the opportunity cost of capital. This is what the value of the investment should be, assuming there is no withdrawal of money from the project.
- From the above, the cash flow from the project during the year is reduced. The balance remaining will become the opening balance of unrecovered investment for the succeeding year.
- The difference between the value of the investment at the beginning of the year and the end is called the economic depreciation.
- The economic income is calculated by reducing the economic depreciation from the cash inflow during the year.
- The economic income expressed as a percentage of the investment balance at the beginning of the year gives the economic rate of return.

The following illustration makes the concept more clear.

Illustration 24

Selwell Supermarkets Ltd. is planning to set-up a new supermarket in fast growing residential locality in one of the suburbs of Hyderabad. The cash flows projected from the supermarket are as follows:

Year	1	2	3	4	5	6	After 6
Cash flow in Rs. lakh	10	20	25	29.8	29.8	29.8	0

The initial investment required for the venture is Rs.100 lakh, and the opportunity cost of capital of the firm is 10 percent.

The economic rate of return for the investment can be calculated as follows:

Years	1	2	3	4	5	6
Cash Flow	10.0	20.0	25.0	29.8	29.8	29.8
Present value, @10%, start of the year	100.0	100.0	90.0	74.0	51.6	27.0
Present value, end of the year	100.0	90.0	74.0	51.6	27.0	0.0
Change in value during the year	0.0	–10.0	–16.0	–22.4	– 24.6	–27.0
Economic Income	10.0	10.0	9.0	7.4	5.2	2.8
Rate of Return	0.1	0.1	0.1	0.1	0.1	0.1
Economic Depreciation	0.0	10.0	16.0	22.4	24.6	27.0

As can be seen from the above table, the return expected by the investors from this project is 10 percent, uniformly for all the years.

Book Return on Investment

This method involves calculation of the return on investment on the book value of the investment as at the beginning of the year. This method can be explained in the following steps:

- The depreciation is reduced from the book value of the investment to get the value of the investment at the end of a year.
- The depreciation is also reduced from the cash flows.
- Book return on investment is calculated as the ratio of the cash flows netted for depreciation to the book value of the investment, expressed as a percentage.
- The book value at the end of a year is taken as the book value at the beginning of the subsequent year.

Let us now calculate the book return on investment for the same project as in illustration 24.

Illustration 25

Years	1	2	3	4	5	6
Cash Flow	10.0	20.0	25.0	29.8	29.8	29.8
Book value, start of the year	100.0	83.3	66.7	50.0	33.3	16.7
Book value, end of the year	83.3	66.7	50.0	33.3	16.7	0.0
Change in value during the year	16.7	16.7	16.7	16.7	16.7	16.7
Economic Income	–6.7	3.3	8.3	13.1	13.1	13.1
Rate of Return	–.067	0.04	0.124	0.262	0.393	0.784

The book return on investment offered by the project can be compared with the return required by the investors to judge the desirability of the project.

Chapter IX

Risk Analysis in Capital Investment Decisions

After reading this chapter, you will be conversant with:

- Definition of Risk?
- Project Risk Management
- Types of Risk
- Measurement of Risk
- Methods of Risk Adjusted Investment Appraisal
- Advanced Techniques of Risk Analysis
- Decision Tree Analysis

In the earlier chapters on appraisal criteria, we have assumed that the risk of the new projects undertaken by a firm will be the same as that of the existing projects. In other words, the risk from new projects is the same as the firm's risk without the proposed projects, i.e., the risk factor is constant. This assumption was the basis, it may be recalled, for using the cost of capital to discount the cash flows from new projects and was intended to make the exposition of the appraisal concepts simpler to understand. Predictably, this situation obtains rarely in real life. Having made ourselves familiar with the conceptual framework of appraisal, we can now take the risk factor head on.

Risk in projects manifests itself as the variability of the cash flows. But, how does risk arise at all? We will discuss this very shortly and will follow it up with the various methods of measuring risk (or measures of risk). Then we will proceed to the methods of incorporating the risk factor into the appraisal. Before all that, let us first have a closer look at risk itself.

DEFINITION OF RISK

If, in a given situation, all the future events are known beforehand, it is described as certainty. Uncertainty, the opposite condition, is the situation in which the future events are not known. Risk lies between the two.

Risk is a situation where the possible events are known, but which of those will actually happen is not known. However, the probability of their occurrence can be determined. For fitting into the definition of risk, a situation should satisfy both the conditions. In the present context, we use the term risk to mean that though it is known how much the cash flows are likely to be, we can express their realizability only through a probability distribution.

In this chapter, we are going to study risk in capital investment decisions, while certainty has already been discussed in the chapter on Appraisal Criteria.

PROJECT RISK MANAGEMENT

The element of risk is inherent in every activity of a project. The project manager should carefully handle the risks that the project is likely to be exposed to. For projects whose duration is less than one year, we can assume that the operating environment is known and stable. But in the case of big projects of longer duration, it is necessary to conduct a 'risk analysis'. Projects are exposed to various types of risks like technical risks, economic risks, social risks, production risks, financial risks and human risks.

Since all risks cannot be eliminated or avoided, it is the job of the project manager to ensure that risks do not have adverse consequences. Every project manager follows a specialized risk management methodology that normally consists of four processes: risk identification, risk quantification, risk response and risk control.

To relieve themselves of risk, individuals and firms insure the projects they undertake. While insurance cannot prevent risk, it can mitigate the risk by providing financial compensation. This chapter examines the risks in projects and alternative ways of dealing with these risks.

Risk is defined as the possibility of an outcome being different from the expected outcome. It refers to the possibility of adverse results flowing from the uncertainty involved in carrying out the activities. When a project or a project activity is expected to be possible, the chance of its occurrence varies from zero and one. Every activity of the project is always exposed to a certain degree of risk. Damage to machinery, dramatic changes in technology, loss of human life and stagnation of financial flows are some of the areas of risk that a project manager should pay attention to.

Risk Management

Risk management is defined as "the formal process by which risk factors are systematically identified, assessed, and provided for." Risk management is not a separate project activity; rather, it is an aspect of project implementation. A project manager must use several tools to manage risks in technical areas, to understand the causes of risks, and to identify the corrective actions.

A project manager should take a proactive rather than reactive approach to project management. Take the case of a project for developing new technology for a particular activity. According to the schedule, the project must be completed in six months. But the technical team feels that the development of new technology requires eight months. If the project manager is proactive, he might develop a contingency plan for completing the activity within six months, either by increasing the size of the team or by outsourcing some aspects of the development of technology. If the project manager is reactive, he will not take any action until the problem actually occurs. Proper risk management clearly reduces the likelihood of a risk occurring.

To execute a project successfully, a project manager must be capable of taking good decisions. Project managers take decisions under three conditions: certainty, risk and uncertainty. Decision-making is easy under conditions of certainty, but it is extremely difficult under conditions of uncertainty. As the situation progresses from certainty to risk to uncertainty, the expected potential damage to the project increases.

Decision-Making Under Certainty

Decision-making under certainty implies that the project manager is fully aware of all the states of nature available and the expected pay-offs for each state of nature. The term 'state of nature' refers to a future event that is not under the control of the decision maker. By constructing a pay-off matrix for all the states of nature, the project manager can select the best possible strategy.

To construct a pay-off matrix, the project manager identifies all the states of nature and formulates the strategies to be taken for each state of nature. All the possible outcomes for each action, under each state of nature, are recorded to complete the pay-off matrix. Under conditions of certainty, the project manager exactly knows which state of nature is going to occur. The project manager selects the best course of action on the basis of the state of nature that will exist.

The following illustration explains the decision-making process under conditions of certainty. For example, Midwest Laboratories wants to develop a new drug with an investment of Rs.5 lakh. The existing states of nature of market demand are:

Table 1: Pay-off Matrix (Profit in Lakhs of Rupees)

Strategy	States of Nature		
	N1	N2	N3
S1	2	1.5	0.5
S2	3	1.6	0.8
S3	2.5	1.4	0.8

Where,

N1: strong market demand

N2: average market demand, and

N3: weak market demand

The company has three strategies for developing the drug, S1, S2, and S3. Table 1 shows the pay-off matrix for the given states of nature and the three strategies formulated.

If the project manager knows that a particular state of nature is going to exist, he/she can choose the appropriate strategy. For example, if the project manager knows N2 is the expected state of nature, he/she can adopt strategy S2 as it provides higher returns than other strategies.

Decision-Making Under Risk

Risk is defined as "the totality effect of outcomes (i.e., states of nature) that can be described within established confidence limits (i.e., probability distributions). Under conditions of risk, the project manager is able to assign some probability of occurrence to each state of nature. Based on this information, the project manager calculates the 'expected value' for each strategy and selects the strategy that earns higher returns.

The expected value of a strategy is calculated as the sum of the product of the probability of a state of nature and the respective pay-off value of a strategy. Assume the probabilities of a particular state of nature are 0.25, 0.25 and 0.5. Table 2 represents the pay-off matrix under conditions of risk.

Table 2: Pay-off Matrix (Profit in Lakh of Rupees)

Strategy	States of Nature			Exp. Value
	N1	N2	N3	
S1	2	1.5	0.5	1.125
S2	3	1.6	0.8	1.35
S3	4	3	0.1	1.8

P (N1) = 0.25, P(N2) = 0.25 and P(N3) = 0.5

Considering the above pay-off matrix, the project manager chooses strategy S3 as it has high expected value.

Decision-Making Under Uncertainty

Under conditions of uncertainty, the project manager does not know the probability of occurrence of each state of nature. So the project manager uses four types of criteria to select a strategy.

They are:

- Maximax criterion (Hurwicz criterion)
- Maximin criterion (Wald criterion)
- Minimax regret criterion
- Criterion of realism.

Maximax criterion: This criterion is also called 'Hurwicz' criterion. Under this criterion, the project manager chooses the strategy that is likely to earn him the highest returns. From Table 2, the project manager would choose strategy S3, as it gives higher returns than other strategies.

Maximin criterion: This criterion is also called 'Wald' criterion. Under this criterion, the project manager identifies the minimum pay-off values for each strategy and adopts the strategy that has the highest pay-off value. In Table 2, the minimum pay-off are 0.5, 0.8 and 0.1. Using the maximin criterion, the project manager selects strategy S2.

Minimax regret criterion: In this criterion, the project manager attempts to minimize the maximum regret value (maximum opportunity loss). The regret value is obtained by subtracting all the pay-off values in each state of nature from the largest pay-off value of that state of nature. Table 3 is the regret table for the values given in Table 2. The maximum regrets for each strategy are 2, 1.4 and 0.7. So, the project manager chooses strategy S3 as it minimizes the maximum opportunity loss.

Table 3: Regret Table

Strategy	Status of Nature			Max. Regret
	N1	N2	N3	
S1	2	1.5	0.3	2
S2	1	1.4	0	1.4
S3	0	0	0.7	0.7

Criterion of realism: This criterion is also called the 'Laplace criterion.' According to this criterion, each state of nature has the same probability of occurrence. So, the project manager considers the average value of all the pay-off for each strategy and selects the strategy that has the highest average pay-off value. For Table 2, the average pay-off are 1.33, 1.8 and 2.36. So, the project manager chooses strategy S3.

Decision tree analysis: The project manager can use 'decision tree analysis' when a decision involves a series of several interrelated decisions. The project manager computes the 'Expected Monetary Value' (EMV) of all strategies and chooses the strategy with highest EMV.

Insurance for Projects

The concept of insurance is a kind of risk transfer response. Diversification of risk is an important aspect of insurance that spreads the risks over a large group of projects. The project manager enters into an insurance or risk pool to transfer the risk over a wide area and over a period of time.

Basically, risks are of two types: speculative risks and pure risks. The mechanism of insurance is applicable only for pure risks. The term 'pure risk' refers to those situations that involve the likelihood of incurring losses. Speculative risk describes a situation where there is the possibility of making profits. Risks caused by changes in technology, political upheaval, etc. are speculative risks; and damage caused by fire, earthquake or human risks such as burglary, theft negligence, etc. are pure risks.

The purpose of insurance is to safeguard the business against a set of pure risks that affect the solvency of the project. The project manager should acquaint himself with all the aspects of insurance coverage and he should identify all the risks that can be covered and the risks that cannot be covered by insurance coverage. At the same time, the project manager is responsible for reducing the severity of the risks. Some of the techniques followed by project managers to secure the project against certain types of risks are self-insurance, captive company, Fire and Natural Calamities Insurance.

TYPES OF RISK

Risk is primarily of two types – business risk and financial risk. All kinds of risks can be included under one of the two heads. Though risks are all interrelated, studying them separately makes their nature more clear.

Business Risk

Business risk can be defined as the variability of the earnings due to changes in the firm's normal operating conditions. It has its origin in the impact of the changing economic environment on the firm's activities and the management's decisions on the capital intensity of the operations. Higher capital investments generally result in higher fixed costs, which in turn increase the sensitivity of the EBIT to changes in output. Business risk is the variability of the EBIT and is therefore unconnected to the financial risk. In other words, business risk can be expressed as the possibility that the firm may not be able to compete in the market place as effectively as planned to with the assets available with it. Some authors perceive business risk to be composed of two sub-types of risk: investment risk and portfolio risk.

INVESTMENT RISK

Investment risk is the variability in the earnings due to variations in inflows and outflows of cash resulting from the capital investments made by the firm. These variations arise due to errors in the judgment of or unexpected changes in the market acceptance of the product or service of the firm, unforeseen technological changes and changes in the cost structure. Sometimes, changes beyond the control and foresight of the management, such as unexpected energy shortages and natural disasters are also considered a part of investment risk.

PORTFOLIO RISK

Portfolio risk is also the variation of the earnings but from a completely different perspective. It is a measure of the variability of the earnings caused by the diversification achieved by the firm in its operations and in its asset portfolio. Such type of risk can be reduced by investing in projects or acquiring other firms that have a negative correlation with the earnings of the firm. The complete impact of the portfolio of assets of the firm on its earnings will be dealt with in a later chapter.

Financial Risk

Financial risk is the variability of the after tax earnings or the EPS of the firm caused by the financial structure, or more precisely, the debt content in the capital structure. In other words, it is the impact of the efficient (or otherwise) use made by the firm of its long-term capital on the earnings of the firm.

Let us now proceed to learn the methods of measuring the expected return and its variability (or dispersion) resulting from the various risks faced by the firm.

MEASURES OF RISK

As already mentioned, risk manifests itself as the variability of cash flows. Therefore, the statistical measures of dispersion are very useful to gauge the extent of variation in the cash flows. There are two types of statistical measures of dispersion – namely, absolute measures and relative measures. Range, Mean, Absolute Deviation, Variance and Standard Deviation are the commonly used absolute measures. Among relative measures, Coefficient of Variation is the most popular.

Range

Range (Rg) $= R_h - R_l$

where R_h = Highest value of the distribution

R_l = Lowest value of the distribution

Mean Absolute Deviation (MAD)

$$\text{MAD} = \sum_{i=1}^{n} P_i \left|(R_i - \overline{R})\right|$$

Where P_i = the probability associated with the i th possible value

R_i = the i th possible value of the variable

$\bar{R}$ = the mean of the distribution

n = no. of values that can be taken by the variable

The Mean Absolute Deviation shows the variability of the values without regard to the sign of variation.

Variance

$$\text{Variance} = \sum_{i=1}^{n} P_i (R_i - \bar{R})^2$$

The notations are the same as above. The square root of variance is called standard deviation. Variance and standard deviation are measures of how well the expected value (or mean return) represents the distribution. Higher the SD, lower is the utility of the mean as high SD indicates that the values scatter in a greater area around the mean. Putting it in a different way, higher the standard deviation, higher the risk.

Semi-variance

$$\text{Semi Variance} = \sum_{j=1}^{k} P_j (R_j - \bar{R})^2$$

Where j = set of values of random variables that are less than the expected value

k = number of outcomes which are less than the expected value

Semi-variance considers only the downside deviations and hence is a measure of the downside risk of the expected return.

Coefficient of Variation

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}}$$

Coefficient of Variation measures the risk borne per unit of return. That is, the amount of risk as represented by the standard deviation for each unit of expected return.

The interpretation of these measures can be demonstrated with the following illustration.

Illustration 1

A finance manager faces uncertainty regarding how the economy may perform during the next year. According to the estimates available with him, three different states of economy may occur: strong economic performance with a probability of 0.30, moderately strong economic performance with a probability of 0.50, and weak economic performance with a probability of 0.20. The finance manager is considering three alternative investments which offer the following returns:

Table 4

State of the Economy	Probability	Expected	Investment	Outcomes
		A	B	C
Strong	0.30	180	160	200
Moderate	0.50	150	120	160
Weak	0.20	80	100	90

Using the above information, and the measures of risk explained above, we can estimate the risk associated with the cash flows as follows:

Expected return on investment for A = $\sum P_i R_j$ = 145

B = 128

C = 158

Range (R_g) for	A = $R_h - R_i$	= 180 – 80 = 100
	B	= 160 – 100 = 60
	C	= 200 – 90 = 110

MAD for A = 0.30 (|180 – 145|) + 0.50 (|150 – 145|) + 0.20 (|80 – 145|) = 26

The calculation of the MAD for B and C has been left as an exercise for the reader. The values are 19.20 and 35.20 for B and C respectively. That is, C is the riskiest project followed by A and B in that order.

$$\text{Variance for A} = 0.2\,(80 - 145)^2 + 0.50\,(150 - 145)^2 + 0.30\,(180 - 145)^2$$
$$= 1{,}225$$

Standard Deviation for A = Square root of variance = 35

The reader may find for himself that the values of variance for B and C are 496 and 1,456 respectively while those of standard deviation are 22.17 and 38.16. Variance, being the square of the standard deviation, gives the same results as the standard deviation. The order of riskiness of the projects according to variance and standard deviation is the same as that indicated by Mean Absolute Deviation.

Semi-variance for A = $0.20\,(80 - 145)^2 = 845$

The semi-variance for B and C is 188.8 and 942.8 respectively. Again, the downside risk of C is the highest, followed by A and B.

$$\text{Coefficient of Variation for A} = \frac{\text{Standard deviation}}{\text{Mean expected return}} = 35/145 = 0.24$$

Coefficient of variation of B and C is 0.17 and 0.24 respectively, which means that the risk per unit of return is the lowest for B followed by A and C.

Of all these measures, the standard deviation and variance are the most popular measures of risk due to the following reasons:

i. SD has the same units as the original variable and can be interpreted easily.

ii. SD is the measure of dispersion that characterizes the normal distribution.

METHODS OF RISK ADJUSTED INVESTMENT APPRAISAL

We are now fully equipped with the methods of measuring risk. We can now study the means of incorporating the risk factor into the investment appraisal.

Certainty Equivalent Method

This method is based on the utility of the decision maker for the return obtained by taking each additional unit of risk. If, for example, a finance manager feels that he would rather have a certain inflow of Rs.10,000 in the second year of a project rather than an uncertain inflow of: (i) Rs.20,000 with a probability of 0.75, and (ii) Rs.30,000 with a probability of 0.25, the certainty equivalent of the uncertain cash flow, which has an expected value of Rs.22,500 is Rs.10,000 and the certainty equivalent coefficient of the cash flows based on the risk-return preferences of the finance manager is 10,000/22,500 = 0.44. This approach is useful when the risk-return perceptions of the decision maker differ from one year to another. The certainty equivalents of various years are decided first and then the certainty equivalents of the cash flows are computed. The cash flows are then discounted with the risk-free rate of discount, as the risk adjustment has already been made.

The Certainty Equivalent Coefficient (CEC) ranges between 0 and 1. The higher the equivalent, the higher is the confidence of the management on the forecasted cash flows. A CEC of unity indicates that the management is absolutely sure that the cash flows will be realized as estimated. A CEC of zero, on the other extreme, indicates that the management is highly doubtful of the realizability of the cash flows. Generally, the certainty equivalent coefficient (CEC) is high for earlier years than the later years in the life of a project as the risk will be higher for later years. It is one only for investments that are completely risk-free, such as T-bills and government securities. The change in the CEC depends on the degree of correlation among the cash flows of different years. If the cash flows are highly correlated, the CEC remains the same for all the years. But, if the correlation is low, the CECs for cash flows of different years will have to be determined independently.

The following illustration will make the concept more clear.

Illustration 2

A financial analyst is looking at a project proposed by a company whose cost of capital is 10%. The project calls for an initial investment of Rs.10 lakh and provides inflows of Rs.20 Lakh and Rs.25 Lakh at the end of the first and second years respectively. The life of the project is two years and the salvage value is negligible. The promoters of the project feel that the certainty equivalent coefficients suitable for the cash inflows in the first and second years are 0.85 and 0.75 respectively. The risk-free rate of discount according to the analyst is 8%.

Table 5

Year	Cash Inflows (Rs. Lakh)	CEC	Certainty Equivalents of Cash Inflows (Rs. Lakh)
1	20.000	0.85	17.00
2	25.000	0.75	18.75

$$\text{NPV} = \frac{17.00}{1.08} + \frac{18.75}{1.08^2} - 10 = 31.79$$

It may be noted that while the basic NPV explained in Appraisal Criteria approach clubs both the risk factor and the time value of money in the discount rate used, this approach considers the risk adjustment separately and discounting is done only to reflect the time value of money. We have to understand one more point before we proceed. What we have calculated is the expected NPV of cash flows that have uncertainty associated with them. That is, what we have is an expected or mean value of NPV. Hence, our knowledge of the attractiveness of the project can be complete only when we know the dispersion of the criterion we have chosen, namely NPV. Simply put, we can comment on the attractiveness of this project only when we study the NPV we now calculated with its standard deviation.

The method of calculation of the Standard Deviation of the NPV is quite simple and depends on the degree of correlation between cash flows of different years. We, however, have to defer our discussion on the calculation of the standard deviation of NPV till we learn the next method of risk adjusted appraisal, namely the Risk Adjusted Discount Method, as the concept is useful there as well.

Risk Adjusted Discount Rate Method

The rationale underlying this method is that all the projects undertaken by a firm should not be discounted at the same rate. The rate should be so chosen for each project that it reflects the risk characteristics of the project. It may be recalled that under the Net Present Value method of appraising the projects, it is assumed that the risk characteristics of the new projects is the same as the investments already made by the firm and that the proposed project does not alter the risk associated with the firm as a whole. This approach, on the contrary, considers that new projects do alter the total risk of the firm and hence need to be discounted at a higher or lower rate as necessary if the firm is to make sound investment decisions.

The Risk Adjusted Discount rate (RAD), therefore, consists of three components. The risk-free rate of discount, the premium for the normal risk of the firm and the premium (whether positive or negative) for the extra or below normal risk of the project.

Symbolically,

$$i' = r + u + a$$

where, i' = the risk adjusted discount rate

r = the risk-free rate

u = the premium for normal risk of the firm

a = the premium for the abnormal or subnormal risk of the project compared to the normal risk of the firm

The additional risk premium may be decided upon by the firm on a case to case basis, or a blanket rate may be decided for each class of investments. For example, a firm may decide the discount rates for various categories of investments as follows:

Category of Investment	**Discount Rate**
Replacement Investments	Cost of Capital + 2%
New Projects	Cost of Capital + 4%
Research and Development Investments	Cost of Capital + 5%

The concept has been demonstrated in the following illustration:

Illustration 3

A firm is considering a replacement investment. The firm feels that the suitable discount rate for the investment is cost of capital + 2% and the cost of capital is 13%. The cash flows as projected by the company's analyst are as follows:

Table 6

Initial Outflow	Cash flows in years 1 to 5		Cash flows in years 6 to 10	
	Probability	Amount	Probability	Amount
14.00	0.20	2.00	0.20	2.60
	0.40	2.40	0.60	3.20
	0.30	2.80	0.10	3.40
	0.10	3.40	0.10	3.60

Expected cash flows in the years 1 to 5 = 2.54

Expected cash flows in the years 6 to 10 = 3.14

$$NPV' = -14.00 + 2.54 \text{ x PVIFA } (15,5) + 3.14 \text{ x PVIFA } (15,5) \text{ x PVIF } (15,5)$$

$$= -14.00 + 2.54 \text{ x } 3.352 + 3.14 \text{ x } 3.352 \text{ x } 0.497 = 0.255$$

This method has sometimes been criticized for using the same discount rate over the life of the project. However, there is no reason why different discount rates cannot be used for different years if the need is felt, keeping the risk factor in view. Again, the change in the discount rate over the years can be based on the correlation between the cash flows of different years.

Calculation of Standard Deviation of NPV

PERFECTLY CORRELATED CASH FLOWS

Perfectly correlated cash flows are obtained when there are no factors that cause uncertainty such as competition, non-availability of raw materials fluctuation in demand, etc. The behavior of the cash flows in all periods is the same and they are linearly related to each other. In such cases, the expected NPV and the standard deviation of the NPV can be estimated as follows:

$$\text{Expected NPV } \left(\overline{NPV}\right) = \sum_{t=1}^{n} = \frac{\overline{A}_t}{(1+i)^t} - I$$

Standard Deviation of the NPV = $\sum_{t=1}^{n} \frac{\sigma_t}{(1+i)^t}$

Where, $\overline{A}_t$ = the expected cash flows

i = the risk-free discount rate

t = the life of the project

$\overline{(NPV)}$ = the expected net present value

σ_t = standard deviation of the cash flows

Illustration 4

The cash flows of a project are perfectly correlated. The project involves an initial cash outflow of Rs.20,000. The mean or expected value and standard deviation of the cash flows are as follows:

Table 7

Year	Mean Cash Flow	Standard Deviation
1	10000	3000
2	6000	2000
3	8000	4000
4	6000	1200

Assuming a risk-free interest rate of 6 percent, the expected net present value can be calculated as follows:

$$\overline{(NPV)} = \frac{10,000}{(1.06)} + \frac{6,000}{(1.06)^2} + \frac{8,000}{(1.06)^3} + \frac{6,000}{(1.06)^4} - 20,000 = 6,243.46$$

$$\sigma(NPV) = \frac{3,000}{(1.06)} + \frac{2,000}{(1.06)^2} + \frac{4,000}{(1.06)^3} + \frac{1,200}{(1.06)^4} = 8,919.17$$

UNCORRELATED CASH FLOWS

Cash flows cannot be correlated with each other when the firm operates in conditions of uncertainty such as severe competition, heavy advertising expenditure, etc. which make the cash flows of each year independent of the others. In such cases, the net present value of the cash flows and the standard deviation of the NPV can be estimated as follows:

$$\overline{NPV} = \sum_{t=1}^{n} \frac{\overline{A}_t}{(1+i)^t} - I$$

$$\sigma(NPV) = \left[\sum_{t=1}^{n} \frac{\sigma_t^2}{(1+i)^t}\right]^{1/2}$$

The notations remain the same as above.

Assuming that in the above illustration the cash flows are perfectly correlated, the expected NPV and its standard deviation can be calculated as follows:

i. $\overline{NPV}$ = 6,243.46.

The NPV remains the same as in perfectly correlated cash flows as the formulae are identical in both cases.

ii. Standard Deviation of NPV

$$\sigma(NPV) = \frac{(3000)^2}{(1.06)^2} + \frac{(2000)^2}{(1.06)^4} + \frac{(4000)^2}{(1.06)^2} + \frac{(1200)^2}{(1.06)^8} = 4,833.34$$

MODERATELY CORRELATED CASH FLOWS

In the real world, the cash flows generally fit into neither of the above two patterns, namely perfect correlation and the complete absence of correlation. The reality may generally be somewhere in the middle, that is, moderate correlation may exist between cash flows of different years. In such cases, the NPV and its standard deviation cannot be estimated by the above methods and have to be based on the conditional probabilities. Conditional probability is the probability of the event occurring given that the event preceding it has occurred. P(B/A) indicates the probability of the occurrence of B given the probability of occurrence of A.

Before proceeding, recall that the joint probability of three events, that is, the probability of all the three events occurring, say P (A, B, C) is the product of the conditional probabilities of the three events, that is, P(A) x P(B/A) x P(C/B,A). The following illustration makes things clear:

Table 8

Year 1		Year 2		Year 3		
Net Cash Flow	Initial Probability	Net Cash Flow	Conditional Probability	Net Cash Flow	Conditional Probability	Joint Probability
20000	0.35	20000	0.40	25000	0.20	0.028
				30000	0.80	0.112
		30000	0.60	35000	0.30	0.168
				40000	0.70	0.147
30000	0.65	55000	0.20	45000	0.50	0.065
				55000	0.50	0.065
		65000	0.80	60000	0.60	0.312
				70000	0.40	0.208

Assuming an initial investment of Rs.1,00,000, the net present value of the above cash flows and the respective joint probabilities can be tabulated as follows:

Table 9

Cash Flow Stream	Net Present Value	Joint Probability
1.	$\frac{20000}{(1.06)}+\frac{20000}{(1.06)^2}+\frac{25000}{(1.06)^3}-100000=-1185.58$	0.028
2	$\frac{20000}{(1.06)}+\frac{20000}{(1.06)^2}+\frac{30000}{(1.06)^3}-100000=-4272.13$	0.112
3.	$\frac{20000}{(1.06)}+\frac{30000}{(1.06)^2}+\frac{35000}{(1.06)^3}-100000=-1577.90$	0.063
4.	$\frac{20000}{(1.06)}+\frac{30000}{(1.06)^2}+\frac{40000}{(1.06)^3}-100000=-3064.51$	0.147
5.	$\frac{35000}{(1.06)}+\frac{55000}{(1.06)^2}+\frac{45000}{(1.06)^3}-100000=1283.88$	0.065
6.	$\frac{35000}{(1.06)}+\frac{55000}{(1.06)^2}+\frac{55000}{(1.06)^3}-100000=1829.62$	0.065
7.	$\frac{35000}{(1.06)}+\frac{65000}{(1.06)^2}+\frac{60000}{(1.06)^3}-100000=12868.75$	0.312
8.	$\frac{35000}{(1.06)}+\frac{65000}{(1.06)^2}+\frac{70000}{(1.06)^3}-100000=10325.54$	0.208

The reader may satisfy himself that the expected NPV from the above probability distribution is 4,303.57 and the standard deviation is 4,166.06.

Once the expected or mean NPV and the standard deviation of the NPV are known, the probability of achieving a desired NPV can be estimated using the z distribution or the normal distribution. In the above illustration, the probability of obtaining an NPV of, say, 50,000 can be found out as follows:

i. Standardize the desired value to a z value by dividing the difference between the desired value and the mean or expected value with the standard deviation. For a required NPV value of 50,000 we get a 'z' value of:

$$= \frac{50{,}000 - 13{,}578}{36{,}574} = 0.9958$$

ii. Rounding off the z value to 1.00 and looking up in the table of normal distribution given in the Appendix II to this book, we get a value of 0.1587.

iii. The z value of 0.1587 indicates that the probability of obtaining the required NPV of 50,000 is 0.1587 + 0.5000 = 0.6587 or 65.87%.

ADVANCED TECHNIQUES OF RISK ANALYSIS

Until now, we have focused on the calculation of the mean or expected NPV and its standard deviation. But, there are certain aspects regarding the risk of a project that cannot be answered using the mean and a measure of dispersion, but are nevertheless highly relevant for the decision maker. For example, one might want to know how the NPV of project will change with change in the selling price or the quantity sold. Such situations can be handled through 'what if' analysis or sensitivity analysis.

Some other decisions involve highly complex interrelationships between the variables and are therefore, not amenable to the CEC and RAD methods. They call for the technique called 'simulation'.

In this section, we discuss these two techniques and also the decision tree analysis which is useful when the situation at hand is complex and presents many chance events and alternative decisions possible for each event.

Sensitivity Analysis

Sensitivity analysis is based on the view that only those projects that can stand the possible changes in future in the critical elements which have a vital bearing on the costs/benefits of the project need be undertaken. For instance, the cost of raw material may go up or say, its supply may be delayed which may prolong the production process or if the same thing happens with the supply of machinery, the gestation period may be prolonged, affecting the expected future benefits as a consequence.

In sensitivity analysis, the factors that are likely to change during the life of the project are first identified. Then, the extent of change in the NPV or other criterion chosen for evaluation with change in the factor. The changes are measured in percentages. This provides information on the extent to which the project remains viable under different situations, or, the extent of change in the variables that will be tolerated by the project.

The following problem illustrates the mechanics of this technique.

Illustration 5

Camco Cements is evaluating the risk of the project proposed to be undertaken shortly. The finance committee feels that the following factors can reasonably be assumed to remain constant through the life of the project:

Table 10

Initial Investment	(I)	:	Rs.900 crore
Cost of capital	(k)	:	10%
Fixed costs	(F)	:	Rs.450 crore
Depreciation (SLM)	(D)	:	Rs.90 crore
Tax Rate	(T)	:	40%
Life of the Project	(n)	:	10 years
Net Salvage Value	(S)	:	0

The quantity sold (Q), selling price (P), and variable cost per unit (V), are expected to vary as follows:

Table 11

Q	Units	P	(Rs. Lakh)	V	
Value	Probability	Value	Probability	Value	Probability
360	0.100	1.50	0.30	1.50	0.50
480	0.200	2.25	0.20	2.25	0.30
540	0.300	3.00	0.10	3.00	0.20
600	0.200	3.75	0.40		
660	0.100				
750	0.025				
900	0.025				
1000	0.025				
1150	0.025				

Given these variables, the sensitivity model for Camco Cements can be defined as follows:

$$\text{NPV} = \sum_{t=1}^{n} \frac{\left[Q(P-V)-F-D\right](1-T)+D}{(1+k)^t} + \frac{S}{(1+k)^n} - I$$

Where,

Q = Quantity sold

P = Selling Price

V = Variable Cost per Unit

F = Fixed Cost

D = Depreciation

T = Tax Rate

S = Salvage Value

k = Cost of Capital

n = Economic Life

I = Initial Investment

NPV = Net Present Value of the cash flows from the project

Using the above model, let us now consider how the NPV of the project varies with variation in two parameters – the selling price and the quantity sold. Though we are considering only two factors for our illustration, the impact of any of the above mentioned factors on the NPV, that is, change in the NPV with change in the factor, can be studied using the above model.

Impact of Change in Selling Price on NPV

Initial Investment = 900

Expected value of Q = 575

Expected value of V = 2.025

Substituting the given values in the model excepting the selling price, the NPV will be

$$\sum_{t=1}^{n} \frac{\left[575(P-2.025)-450-90\right](1-0.40)+90}{(1.10)^t}$$

On simplification, we get

$$\sum_{t=1}^{n} \frac{345 \text{ x } P-886.46}{(1.10)^t} - 900$$

For the given range of values of P, we get the following values of NPV:

Table 12

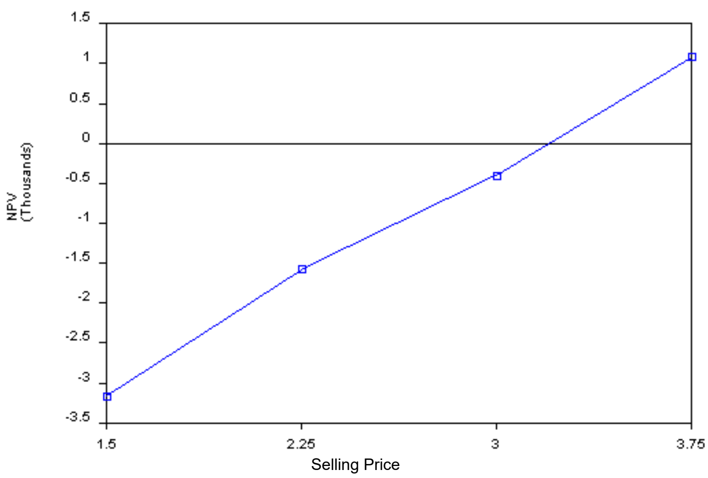
P	1.50	2.25	3.00	3.75
NPV	–3167.09	–1577.19	12.71	1608.98

The reader may verify for himself/herself that the expected NPV will be –Rs.620.70 crore

Impact of the Change in Quantity Sold on NPV

Modifying the model for studying the change in NPV with change in quantity sold, we get

Figure 1: Change in NPV with Change in P



$$\text{NPV} = \sum_{t=1}^{n} \frac{\left[Q(2.70 - 2.025) - 450 - 90\right](0.60) + 90}{(1.10)^t} - 900$$

Expected value of P = 2.70

On further simplification, we get

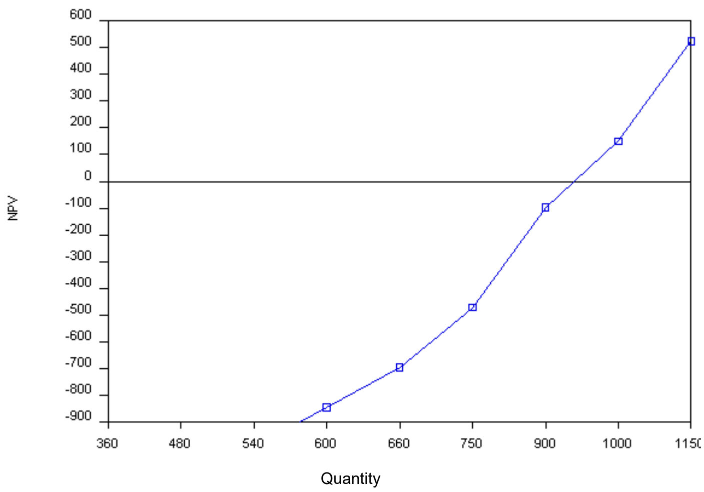
$$\text{NPV} = \sum_{t=1}^{n} \frac{0.405\,Q - 234}{(1.10)^t} - 900$$

Substituting the given range of values of Q, starting from 600, we get the following values of NPV:

Table 13

Q	600.0	660.00	750.00	900.00	1000	1150
NPV (Rs. crore)	–844.7	–695.36	–47.42	–98.13	150.72	524.00

Figure 2: Change in NPV with Change in Q



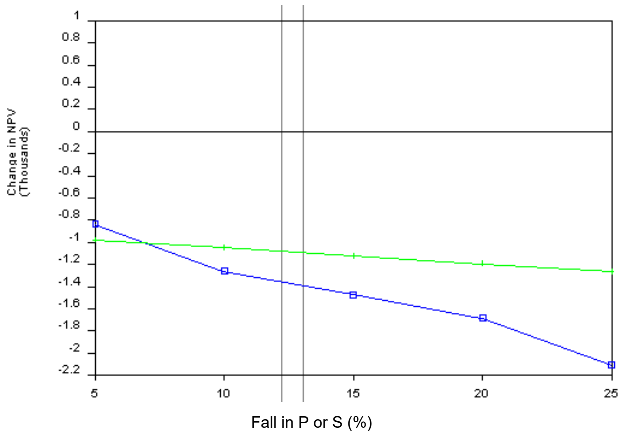
The expected NPV is –Rs.906.12 crore

Another useful way of applying the technique of sensitivity analysis is to examine the changes in the NPV with adverse deviations in the causal factors from the most likely values. For example, the change in NPV with a 5% change in the selling price or the quantity sold can be very revealing.

The impact on the NPV of unfavorable changes in the two parameters, namely P and Q will be as follows:

Fall (%)	Q Value	NPV	P Value	NPV
5	546	–979.08	2.60	–835.24
10	518	–1048.75	2.40	–1259.21
15	489	–1120.92	2.30	–1471.19
20	460	–1193.09	2.20	–1683.18
25	431	–1265.26	2.00	–2107.16

Figure 3: Change in NPV with Change in P and Q



Fall in P or Q (%)

Legend:

Change in NPV with change in P: ________________

Change in NPV with change in Q: ____|______|_____

The significance of a variable can be gauged from an examination of the steepness of the slope of the line that traces the fall of the NPV.

Scenario Analysis

In sensitivity analysis, we have seen how to study the changes in the criterion of merit (NPV) with changes in one of the variables. But, most of the time such situations may be encountered in real life that two or more variables change at the same time and the changes may be interrelated.

For example, the economist of a company that proposes to set-up a transport service is worried that the running costs may increase due to the proposed deregulation of oil prices. He also feels that if the oil prices rise, the number of passengers on each service will also increase as quite a few among the working classes may be unable to travel on private vehicles after the rise. For studying the desirability of such projects, analysts use what is called Scenario Analysis. In scenario analysis, different scenarios are generated and the desirability of the project is studied in each scenario. In the given example, two scenarios are possible:

i. The prices of petroleum products are not deregulated and therefore, both the running costs and revenues remain low. Such a scenario, which assumes that the conditions continue to be what they are now is called the Base Case.

ii. The prices of the petroleum products are deregulated, resulting in hike of both the costs and revenues.

For the transport service project, the net present value in the two different scenarios and the relevant background information is as follows:

(Rs. lakh)

	Base Case	High Costs and Revenues
Initial Investment	150	150
Revenue	350	425
Variable Costs	275	325
Fixed Costs	35	40
Depreciation	15	15
Pre-tax Profit	25	45
Tax (40%)	10	18

(Rs. lakh)

	Base Case	High Costs and Revenues
Profit after Tax	15	27
Net Cash Flow	30	42
Cost of Capital	10%	10%
Salvage Value	nil	nil
Life of the Project	10 years	10 years
Net Present Value	34.34	108.07

Simulation Approach

In sensitivity analysis, the impact on NPV of change in one of the variables has been examined. The reader might have observed that for studying the impact of each variable, all other factors have either been assumed to be constant, or their expected values have been used. But, if the decision maker wants to know the expected value of the NPV taking into account each possible value of all the factors that affect it, sensitivity is not the method to be used as the number of alternatives for which the NPV may have to be calculated will be very high. For example, in the illustration given in the section on sensitivity, for each value of Q, there are four values of P for each of which in turn there are three values of V.

To overcome these difficulties in sensitivity analysis, the simulation approach has been developed. Simulation, or Monte Carlo simulation, as it is generally referred to, has been found to be a useful technique in evaluation of capital investments under conditions of risk. It is a flexible operations research tool that can handle any problem if the structure and logic of the problem can be specified.

In simple words, simulation is an imitation of a real world system using a mathematical model that captures the characteristic features of the system as it encounters random events in time. It can also be defined as the method of solving decision-making problems by designing, constructing, and operating a model of the real system.

The basic principle in simulation is that since risk arises out of events which cannot be fixed into a pattern, that is random events, a model can be developed in which all factors excepting the random factors are fixed, and the impact of the random factors on the output can be studied by generating the random events artificially. It should be noted that though the occurrence of the events is not known, it should be possible to fix the occurrence of the event in some probability distribution. For example, in the illustration on sensitivity, we knew the range of values in which the three variables can be and also the probabilities associated with each of the values within each range.

Using simulation, the manager or decision maker should:

1. Define the problem
2. Identify the fixed and variable factors
3. Identify the various courses of action available to him
4. Construct a mathematical model incorporating all the variables
5. Run the model and get the results
6. Decide on the best possible course of action.

To illustrate the above procedure, let us consider the following problem.

Illustration 6

The McGraw Mount Manufacturing Company is evaluating an investment proposal which has uncertainty associated with all the three major aspects: the initial investment or original cost, the useful life, and the annual cash flows. The probability distributions of the three variables are as follows:

Table 14

Original Cost			Useful Life			Annual Net Cash Flows		
Value (Rs. Lakh)	Probability	Cumulative Probability	Value (Years)	Probability	Cumulative Probability	Value (Rs. Lakh)	Probability	Cumulative Probability
9.00	0.10	0.10	7.00	0.20	0.20	2.00	0.20	0.20
7.00	0.60	0.70	6.00	0.40	0.60	2.50	0.40	0.60
6.00	0.30	1.00	5.00	0.40	1.00	1.50	0.10	0.70
						1.00	0.30	1.00

The firm's cost of capital is 15% and the risk-free rate is 12%. The finance committee feels that these two values are likely to remain unchanged during the life of the project.

Table 15

Original Cost			Useful Life			Annual Net Cash Flows		
Value (Rs. Lakh)	Probability	Cumulative Probality	Value (years)	Probability	Cumulative Probability	Value (Rs. Lakh)	Probability	Cumulative Probability
9.00	0.10	0.10	7.00	0.20	0.20	2.00	0.20	0.20
7.00	0.60	0.70	6.00	0.40	0.60	2.50	0.40	0.60
6.00	0.30	1.00	5.00	0.40	1.00	1.50	0.10	0.70

Now let us try to find the expected NPV of the investment using the step by step procedure outlined above. As the definition of the problem and identification of the fixed and variable factors has already been done in the problem we will start with the third step.

Step 3

The courses of action available are:

i. Go ahead if the expected NPV is positive

ii. Drop the investment plan if the NPV is less than or equal to zero.

Step 4

The mathematical model that suits this problem is the usual NPV formula. That is,

$$\sum_{t=1}^{n} \frac{CF(t)}{(1)} + (t)^{t} - I$$

Where CF(t) = Expected cash flow in year t

n = Useful life

I = Initial investment

Step 5

This step in turn contains five phases.

Phase I

In Phase I, the cumulative probabilities of each value that can be taken by the variables should be calculated. This makes the allocation of the random numbers easy. The calculation of the cumulative probabilities has been shown in Table 12.

Phase II

In the second phase, a range of random numbers is chosen depending on how the simulation is proposed to be run. If it is proposed to be run using two digit random numbers, the range chosen should be 0 to 99 and if three digit numbers are being used, the range should be 0 to 999 and so on. The random numbers may be chosen from tables, generated using a computer or simply by lottery. For our illustration, we will use two digit random numbers and the range of numbers will be 0 to 99.

Phase III

In the third phase, the random numbers are distributed to each value of the variables. The allocation will be in proportion to the probability associated with each of the variables. In our illustration, the range chosen, 0 to 99 should be allocated to each of the values of the variables. The number range allocated to each of the values of a variable depends on the value's cumulative probability. The number range for the first value starts at zero. If the probability is, say, 0.10, as is the case with the first value of Original Cost in the illustration, the numbers will be 0 to 9. For the second value of Original Cost, the cumulative probability is 0.70, which indicates that the number range ends at 69 and begins at the next number after it ended for the first value, i.e. at 10. The number range for the second value will therefore be 10 to 69. Similarly, the range for the third value will be 70 to 99. The random number ranges for the remaining two variables can also be decided on the same lines, starting with zero. The random number ranges for the three variables are given in table 13.

Table 16

Original Cost				Useful Life				Annual Net Cash Flows			
Value (Rs. Lakh)	Original Probability	Cumulative Probability	Random No. Range	Value (Years)	Proba-bility	Cumulative Probability	Random No. Range	Value (Rs. Lakh)	Proba-bility	Cumulative Probability	Random No. Range
9.00	0.10	0.10	0 to 9	7.00	0.20	0.20	0 to 19	2.00	0.20	0.20	0 to 19
7.00	0.60	0.70	10 to 69	6.00	0.40	0.60	20 to 59	2.50	0.40	0.60	20 to 59
6.00	0.30	1.00	70 to 99	5.00	0.40	1.00	60 to 99	1.50	0.10	0.70	60 to 69
								1.00	0.30	1.00	70 to 99

Phase IV

Running the model is the fourth phase. To run the model, random numbers are generated. We use the following random number table for our simulation:

Table 17: Table of Random Numbers*

52	06	50	88	53	30	10	47	99	37	66	91	35	32	00	84	57	07
37	63	28	02	74	35	24	03	29	60	74	85	90	73	59	55	17	60
82	57	68	28	05	94	03	11	27	79	90	87	92	41	09	25	36	77
69	02	36	49	71	99	32	10	75	21	95	90	94	38	97	71	72	49
98	94	90	36	06	78	23	67	89	85	29	21	25	73	69	34	85	76
96	52	62	87	49	56	59	23	78	71	72	90	57	01	98	57	31	95
33	69	27	21	11	60	95	89	68	48	17	89	34	09	93	50	44	51
50	33	50	95	13	44	34	62	64	39	55	29	30	64	49	44	30	16
88	32	18	50	62	57	34	56	62	31	15	40	90	34	51	95	26	14
90	30	36	24	69	82	51	74	30	35	36	85	01	55	92	64	09	85
50	48	61	18	85	23	08	54	17	12	80	69	24	84	92	16	49	59
27	88	21	62	69	64	48	31	12	73	02	68	00	16	16	46	13	85
45	14	46	32	13	49	66	62	74	41	86	98	92	98	84	54	33	40
81	02	01	78	82	74	97	37	45	31	94	99	42	49	27	64	89	42
66	83	14	74	27	76	03	33	11	97	59	81	72	00	64	61	13	52

74	05	81	82	93	09	96	33	52	78	13	06	28	30	94	23	37	39
30	34	87	01	74	11	46	82	59	94	25	34	32	23	17	01	58	73
59	55	72	33	62	13	74	68	22	44	42	09	32	46	71	79	45	89
67	09	80	98	99	25	77	50	03	32	36	63	65	75	94	19	95	88
60	77	46	63	71	69	44	22	03	85	14	48	69	13	30	50	33	24
60	08	19	29	36	72	30	27	50	64	85	72	75	29	87	05	75	01
80	45	86	99	02	34	87	08	86	84	49	76	24	08	01	86	29	11
53	84	49	63	26	65	72	84	85	63	26	02	75	26	92	62	40	67
69	84	12	94	51	36	17	02	15	29	16	52	56	43	26	22	08	62
37	77	13	10	02	18	31	19	32	85	31	94	81	43	31	58	33	51

** Excerpted from A Million Random Digits with 100,000 Normal Deviates, The Free Press, 1955, p.7.*

A random number table can be read any way that is convenient. We select the first three columns and read the values horizontally. The numbers in the first, second and third columns from the left end will be used for Original Cost, Useful Life, and Annual Net Cash Flows respectively.

The first value of the first column is 52. It falls in the range of 10 to 69 allocated for the value of Rs.7 lakh. So, in the first run, the value of the original cost will be Rs.7 lakh. We now proceed to the right, i.e. to the first reading in the second column. The reading is 06, and falls in the range of 0 to 19, which indicates that the useful life for the first run is seven years. Moving further right, we read the first number in the third column, which, being in the range 20 to 59, indicates that the Annual Net Cash Flow value for the first run to be Rs.2.50 lakh. This completes the first run. Once all the variables are known, the NPV for the first run can be calculated using the mathematical model. It should be remembered that the discounting should be done using the risk-free rate.

For the second run, we have to start again from the first column, this time with the second value in the column (i.e., 37) and proceed to the right, on the same lines as in the first run. The model in the illustration has been run ten times to get the following output. The output has been given in table 18:

Table 18

Run	Original Cost		Useful Life			
	Random Number	Corresponding Value	Random Number	Corresponding Value	Annual Net Cash Flows	Net Present Value
1	52	7	6	7	2.5	4.41
2	37	7	63	5	2.5	2.01
3	82	6	57	6	1.5	0.17
4	69	7	2	7	2.5	4.41
5	98	6	94	5	1.0	–2.4
6	96	6	52	6	1.5	0.17
7	33	7	69	5	2.5	2.01
8	50	7	33	6	2.5	3.28
9	88	6	32	6	2.0	2.22
10	90	6	30	6	2.5	4.28
Expected Net Present Value						2.06

Phase V

The final phase is to interpret the output from the model. Our output, as shown in the previous phase, has been an expected NPV of Rs.2.06 lakh. As the NPV is positive, the firm may proceed with the investment.

Advantages of Simulation

Simulation is one of the techniques of risk analysis that is in widespread use. It is used not only in finance, but also in analyzing such complex situations as the movement of traffic in a city, the arrival of passengers at a railway terminus and the progress of a chemical reaction which takes place in a fraction of a second. The factors that give it a prominent place among risk analysis techniques are as under:

i. As already explained, simulation models can handle any problem which fits into the following description:

   a. The behavior of the variables affecting the problem can be described using a probability distribution.

   b. The interrelationship between the variables can be mathematically expressed.

   c. The operation of the system can be described using a mathematical model.

   Such problems generally do not lend themselves to be handled with analytical techniques. For example, a model described using a complex integral equation. Analytical model that handles such problems may be impossible to build or highly expensive.

ii. The model formulated, for simulation, can be used to perform sensitivity analysis or 'What If' analysis to study the impact of one of the variables. This can be done by fixing all other variables excepting the one intended to be studied.

iii. Simulation models are highly flexible and once developed, can be modified for use in different conditions.

iv. Simulation can be used to study problems which are too risky or difficult to study in the real life situation, such as the possibility that the proposed project will fail or whether the proposed computerized system of service is good enough to satisfy the customer.

v. One of the unique features of simulation is its ability to 'compress time'. The effects of advertising, changes in credit policies and others can be studied instantly using simulation.

Alongside the advantages, the technique has significant limitations too.

Limitations of Simulation

i. It may often be difficult to fit the variables into a probability distribution with reasonable accuracy, which seriously impedes the effectiveness of this technique. For example, while the probability of the selling price taking different values can be predicted depending on projections of demand, it is almost impossible to predict the changes in regulation that may have impact on the sales.

ii. Model building can get very complex as it requires a thorough understanding of the variables of the system and their logical and mathematical interrelationships.

iii. Building a model good enough for simulation requires collection and study of data of several years which makes it very expensive.

iv. The output of a simulation is a probability distribution. In the illustration, we could do with an average value of NPV because we assumed that an approximate answer is good enough. But there are many situations where such approximate solutions lead to wrong decisions. For example, if simulation is used to study the possibility of a fire accident in a factory, reasonable accuracy is not enough. Or, suppose a firm is in a highly competitive market, investing in a loss making venture can make it defenceless against the onslaught of the competitors. In such cases, the values in the tail of the distribution assume importance and if the distribution itself is approximate, the entire exercise becomes meaningless.

v. The accuracy of the output of the model depends directly on the precision with which the model was framed. This makes it particularly pliable in the face of the model builder's biases.

vi. Simulation does not produce an optimal solution to the problem under study. It only imitates the real world situations under the given conditions. Therefore, the user of the technique will have to generate all possible combinations of conditions and constraints to choose the optimal solution. The model itself does not produce the optimal solution and is a trial and error approach.

DECISION TREE ANALYSIS

Consider the following situation

In Hyderabad, the demand for power is growing at a rate of 6% per annum. The Hyderabad Electric Supply Company, which supplies power in most parts of Hyderabad, is planning to set-up a thermal power plant to meet the demand. According to the estimates made by the company, there is 70 percent probability that the demand will continue to grow at 6 percent and a probability of 30 percent that it may slow down to 5 percent. It is considering two plants a smaller plant that costs Rs.30 crore and a larger plant that costs Rs.50 crore. If the smaller plant is set-up, and demand picks up later, the capacity of the plant can be expanded.

If the larger plant is set-up and demand continues to grow at 6 percent, the present value of the net operating cash inflow from the plant is Rs.70 crore. But, if the demand growth falls to 45 percent, the present value will be only Rs.45 crore.

The present value of the net operating cash flows if a small plant is built and demand grows at only 5 percent is Rs.41 crore. But if the demand continues to grow at 6 percent, the company may have to expand the capacity. The present value of the investment on expansion is Rs.25 crore. With this, the PV of the cash flows will increase to Rs.60 crore. If the company chooses not to expand capacity even if the demand grows at 6 percent, there is a 30 percent probability that the revenues will fall to Rs.35 crore as the inability to cater to demand and consequent bad market reputation may wean away some customers to other sources such as internal generation.

The unique feature of the above case is that it involves sequential decisions as time passes. The decisions can be taken only after the happening of an uncertain future event. Such complex situations can be tackled using decision tree analysis. A decision tree (also called a decision tree diagram) is drawn indicating the chance events and decision points at the nodes. By convention, chance points are indicated with circles and decision points with squares. The branches emanating from chance points indicate the chance happenings possible at that juncture. It can automatically be guessed that all the decision alternatives possible are indicated by branches from the decision points. The decision points and chance points follow each other excepting at the beginning and end of the diagram. At each point (decision or chance), the alternatives which give scope for further alternatives, either for decisions or chances are further branched while those that do not, are terminated. At the right of the branches at the end of the tree, the probabilities of the alternatives represented by the branches and their outcomes are written. The final output from the tree is either a choice of different courses of action and their pay-offs or a mean value of the expected benefit from the project and its standard deviation, depending on whether the tree is ending with chances or decision alternatives. One caveat that should be borne in mind while drawing a decision tree is that the tree should not be allowed to become unwieldy and confusing. Care should be taken to see that the alternatives are not generated for the sake of generating alternatives and should, prima facie, be practicable.

The above narration can be summarized into four steps:

i. Enumerate all the chance events, their probabilities, alternative courses of action and the monetary outcome form each action.

ii. Represent the chances and decisions on a decision tree in a logical sequence. These two steps can be treated as one, as generating alternatives and drawing the diagram can take place simultaneously.

iii. Calculate the conditional probabilities of each possible outcome at each chance point.

iv. Calculate the benefit, or expected value from each alternative and choose the best alternative.

To illustrate the procedure, let us solve the case given at the beginning:

Step 1

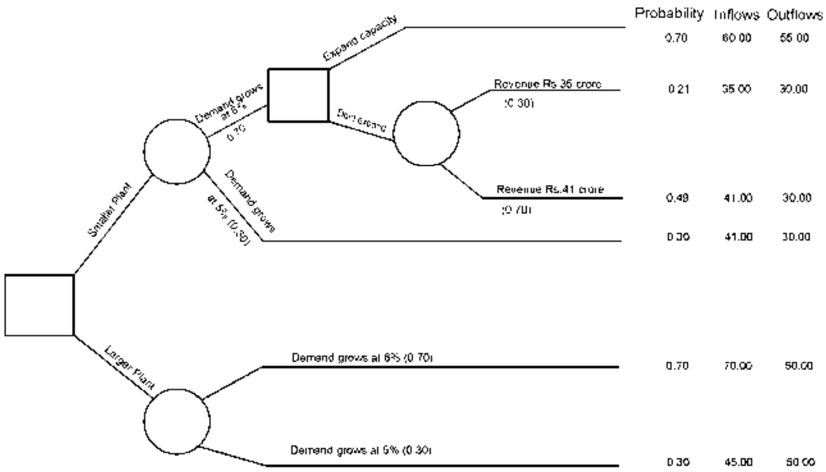
The chance events and alternatives are:

Table 19

Alternatives	Chance Events
Install smaller plant and expand	Demand grows at 6%
Install smaller plant and don't expand	Demand grows at 5%
Install larger plant	

Step 2

Figure 4



Step 3

The possible revenues and the relevant probabilities are:

Table 20

Plant Size	Demand Growth	Expansion	Present Value of Cash Flow	Probability
Small	6%	Yes	60.00	0.70
Small	6%	No	35.00	0.21
Small	5%	-	41.00	0.49
Small	5%	-	41.00	0.30
Large	6%	-	70.00	0.70
Large	5%	-	45.00	0.30

Step 4

The alternative courses of action and the expected cash flows are:

i. Build a small plant and expand if necessary:

The expected cash flows are: 60.00 x 0.70 – 55 = –13.00

ii. Build a small plant and don't expand under any circumstances:

(35.00 x 0.21 + 41.00 x 0.49 + 41.00 x 0.30) – 30 = 9.74

iii. Build a large plant:

(50.00 x 0.70 + 40.00 x 0.30) – 50 = –3.00.

Of the above three alternatives, alternative (iii) is the best, as it provides the highest expected cash flows.

The decision tree approach, of course, has its own drawbacks. Though the solution appears sophisticated, it would be imprudent to choose the alternative that gives the highest NPV depending solely on the decision tree. This is because while the solution is optimal, it is not necessarily the best, as the tree does not provide any indication of the risk characteristics of the alternatives such as those arising from the financing pattern of the project. It is also necessary to analyze the magnitude of change permissible in the chance events before the solution chosen becomes non-optimal (i.e. sensitivity analysis) to get a good grasp of the risk of the project. Some authors, therefore, suggest that decision trees should only be used as a first step which calls for further analysis and not as a decision-making tool.

SUMMARY

- While appraising a project, it is assumed that the new project undertaken by a firm will have same risk. But this does not happen in real life because there are many additional factors that affect the risk of the new project. Risk in a project is variability of the cash flows. There are different types of risks affecting the cash flows like business risk, investment risk, portfolio risk, and financial risk. Therefore, a risk adjusted investment appraisal helps in making better judgment about the financial viability of the project. The Certainty Equivalent Method and Risk, Adjusted Discount Rate Method and Standard Deviation of NPV can be used for a risk-adjusted appraisal. Some advanced techniques developed in this regard are sensitivity analysis, scenario analysis, simulation approach and decision tree analysis.

Chapter X

Application of Portfolio Theories in Investment Risk Appraisal

After reading this chapter, you will be conversant with:

- Portfolio Theory of Markowitz
- Single Index Model of Portfolio Analysis
- Capital Asset Pricing Model of Portfolio Analysis
- Application of Portfolio Theories to Capital Budgeting

In the chapter on 'Risk Analysis in Capital Investment Decisions', during the discussion on the types of risk, we postponed the discussion on portfolio risk to a later chapter. The time is now ripe to fulfill that obligation.

A firm can be viewed as a collection of assets or projects. When a firm holds many projects in its portfolio, often, the cash flows of one of the projects may vary substantially in tandem with the cash flows of one or more other projects of the firm. For example, suppose a firm that produces polyester yarn sets up a plant to produce polyester cloth. The revenues from both the projects will increase or decrease depending on the demand for polyester cloth. The cash flows from the two projects, therefore, have a high degree of correlation to each other. Similarly, there are also projects that influence the cash flows of each other negatively. The correlation between cash flows of different projects also comes into play when new projects are proposed. If a firm takes on projects that have a high degree of correlation with the existing projects, its total risk will increase, as the cash flows from all the projects will increase or decrease at the same time. By the same logic a new project with a negative correlation will reduce the total risk of the firm as the fluctuations of the cash flows from one project will be offset by those from another. The covariation (varying together) of the cash flows sometimes leads to a project that is unviable in isolation becoming viable. A project that gives a negative NPV may become attractive as part of the portfolio of assets.

You might recall that we find the expected return given the possible returns and their probabilities with the formula:

$$E(R_p) = \sum_{j=1}^{n} X_j E(R_j) \quad \text{….. Eqn. (1)}$$

Where,

$E(R_p)$: Expected return on the portfolio

X_j : Proportion of the asset j

$E(R_j)$: Expected return from asset 'j'.

While the calculation of the expected return on the portfolio is fairly simple, calculation of the standard deviation, which is the most commonly used measure of risk, is not. We cannot find the standard deviation of the change in returns on a portfolio by weighting the standard deviations of the individual assets of the portfolio with their proportions in the portfolio. The interactive effects mentioned earlier vitiate the result. This problem has been addressed by the Modern Portfolio theory propounded by Harry Markowitz.

PORTFOLIO THEORY

According to the portfolio theory, the standard deviation of a portfolio can be found using the formula.

$$\sigma_p = \sqrt{\sum_{i=1}^{N}\sum_{j=1}^{N} X_i X_j r_{ij} \sigma_i \sigma_j} \quad \text{...... Eqn. (2)}$$

Where,

σ_p = Expected portfolio standard deviation

X_i = Proportion of asset i in the portfolio

X_j = Proportion of asset j in the portfolio

r_{ij} = Correlation coefficient between i and j

σ_i = Standard deviation of security i

σ_j = Standard deviation of security j

N = Total no. of securities in the portfolio

The above formula indicates that all (i) the assets of the portfolio should be paired, (ii) the proportions, and covariances of each pair should be multiplied and (iii) the products thus arrived at should be added.

The double summation symbol indicates that N^2 terms have to be added.

Expanding the formula for two assets 1 and 2, we get:

$$\sigma_p = \sqrt{X_1 X_1 r_{11} \sigma_1 \sigma_1 + X_1 X_2 r_{12} \sigma_1 \sigma_2 + X_2 X_2 r_{22} \sigma_1 \sigma_2 + X_2 X_2 r_{12} \sigma_1 \sigma_2}$$

$$= \sqrt{X_1^2 \sigma_1^2 + X_2^2 \sigma_2^2 + 2 X_1 X_2 r_{12} \sigma_1 \sigma_2} \quad \text{..... Eqn. (3)}$$

In the above expansion, we paired the asset 1 with itself, and with 2. Then we paired the asset 2 with itself and with 1. When each asset is paired with itself, the correlation coefficient is one. So, for asset 1, the term X_1 X_1 r_{11} $X_1 X_1 r_{11} \sigma_1 \sigma_1$ becomes $X_1 X_1 \sigma_1 \sigma_1$ or $X_1^2 \sigma_1^2$.

For three assets, the expansion of the formula will be:

$$\sigma_p = \sqrt{\begin{array}{l} X_1^2 \sigma_1^2 + X_2^2 \sigma_2^2 + X_3^2 \sigma_3^2 + 2X_1 X_2 r_{12} \sigma_1 \sigma_2 \\ + 2X_1 X_3 r_{13} \sigma_1 \sigma_3 + 2X_2 X_3 r_{23} \sigma_2 \sigma_3 \end{array}} \quad \text{..... Eqn. (4)}$$

Using the above formula the variance of a portfolio of any number of assets can be calculated.

A Simplified Version of the Formula

In the case of expansion for three securities, you will find that the last three terms contain the correlation coefficients and standard deviations of the corresponding assets.

The product of the correlation coefficient and standard deviations of a pair is equal to the covariance between the pair of assets. Therefore, the last three terms can be rewritten as $2X_1$ X_2 Cov_{12}, $2X_1$ X_3 Cov_{13}, $2X_2$ X_3 Cov_{23}. Substituting with covariance, the general formula we gave earlier itself can be changed to:

$$\sigma_p = \sqrt{\sum_{i=1}^{N} \sum_{j=1}^{N} X_i X_j \, Cov_{ij}} \quad \text{..... Eqn. (5)}$$

The significance of covariance in the formula is as follows:

For given values of standard deviation, covariance is directly proportional to correlation coefficient. Covariance takes the sign of the correlation coefficient as standard deviation is always positive. It can be positive, negative or zero.

If the covariance between two projects is positive, the total risk of the firm increases. If the covariance is negative, the total risk decreases. If it is zero, then too the total risk falls. The logic for this is the same as explained earlier with correlation.

It is now necessary to study the application of what we have learnt.

Illustration 1

A firm is evaluating the return and risk on a combination of two projects. The characteristics of the two projects are as follows:

	P_1	P_2
E (R_i)	30%	35%
σ_j	7%	1%
X_j	0.50	0.50

The correlation between the two projects is –0.30.

The return from the combination is:

$$E(R_p) = \sum_{j=1}^{2} X_j [E(R_i)]$$

$$= \quad 0.50 \times 0.30 + 0.50 \times 0.35 = 0.325 \text{ or } 32.5\%$$

$$\sigma_p = \sqrt{\sum_{j=1}^{N} X_j^2\,\sigma_j^2 + 2\sum_{j=1}^{N-1}\sum_{j=1}^{N} X_i\,X_j\,\rho_{ij}\,\sigma_i\,\sigma_j}$$

$$= \sqrt{0.50^2 \text{ x } 0.07^2 + 0.50^2 \text{ x } 0.01^2 + 2 \text{ x } 0.50 \text{ x } 0.50 \text{ x } -0.30 \text{ x } 0.07 \text{ x } 0.01}$$

$= 0.00114$

σ_p = 0.034 or 3.4%

Illustration 2

A firm is considering four projects, 1, 2, 3 and 4. The proportions in which it wants to invest its total funds is 0.20, 0.30, 0.35 and 0.15. The risk-return characteristics of the projects are:

	1	2	3	4
E (R_i)%	10	15	20	22
σ_i %	2	4	5	4

The returns expected on the projects are 10%, 15%, 20% and 22% respectively. The correlation coefficients of the projects with each other are:

	1	2	3	4
1.	1.00	0.12	0.65	0.75
2.	0.12	1.00	0.70	0.35
3.	0.65	0.70	1.00	0.80
4.	0.75	0.35	0.80	1.00

Now,

$E_{(Rp)} = X_1 R_1 + X_2 R_2 + X_3 R_3 + X_4 R_4$

0.20 x 0.10 + 0.30 x 0.15 + 0.35 x 0.20 + 0.15 x 0.22

= 0.168 or 16.80%

$$\sigma_p^2 = \sum_{j=1}^{N} X_j^2\,\sigma_j^2 + 2\sum_{j=1}^{N-1} X_i\,X_j\,r_{ij}\,\sigma_i\,\sigma_j$$

$$= \begin{array}{l} X_1^2\sigma_1^2 + X_2^2\sigma_2^2 + X_3^2\sigma_3^2 + X_4^2\sigma_4^2 + 2X_1X_2r_{12}\sigma_1\sigma_2 + 2X_1X_3r_{13}\sigma_1\sigma_3 \\ + 2X_1X_4r_{14}\sigma_1\sigma_4 + 2X_2X_3r_{23}\sigma_2\sigma_3 + 2X_2X_4r_{24}\sigma_2\sigma_4 + 2X_3X_4r_{34}\sigma_3\sigma_4 \end{array}$$

σ_p^2 = 0.20^2 x 0.02^2 + 0.30^2 x 0.04^2 + 0.35^2 x 0.05^2 + 0.15^2 x 0.04^2 + 2 x 0.20 x 0.30 x 0.12 x 0.02 x 0.04 + 2 x 0.20 x 0.35 x 0.65 x 0.02 x 0.05 + 2 x 0.20 x 0.15 x 0.75 x 0.02 x 0.04 + 2 x 0.30 x 0.35 x 0.70 x 0.04 x 0.05 + 2 x 0.30 x 0.15 x 0.35 x 0.04 x 0.04 + 2 x 0.35 x 0.15 x 0.80 x 0.05 x 0.04

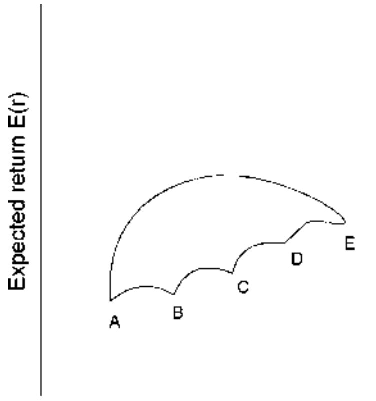
or σ_p^2 = 0.00115

σ_p = 0.034 or 3.4%

BUILDING PORTFOLIOS

We now know how the risk of the portfolio can be found and how it changes with addition of assets of different characteristics. But how is a portfolio constructed? A brief explanation of this will be in order. Consider the graph in Figure 1.

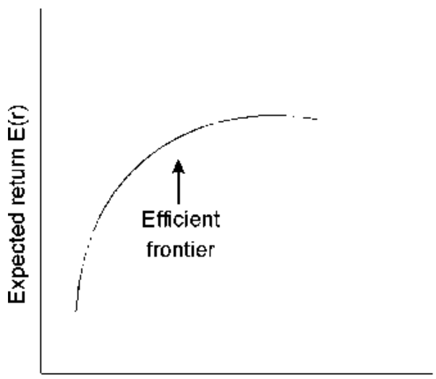
Figure 1



Standard deviation of return (σ)

The area enclosed by the graph is the area which contains all the risk-return combinations of the portfolios that can be set-up with the funds at the disposal of the firm. But, assuming that the firm is risk-averse, i.e. it wants the maximum possible return for the risk it undertakes, it invests only in assets corresponding to the curve AE. At any other point on the graph there is either another point where higher return is possible for the same risk or the risk is lower for the same return. The portfolios which lie on AE offer the highest return per every unit of risk and lowest risk for a given return. These are called the efficient portfolios and AE is called the efficiency frontier. Eliminating all the portfolios that are not efficient from the graph it can be redrawn as in Figure 2.

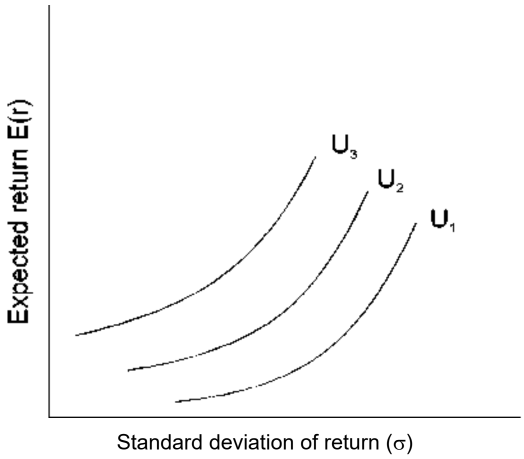
Figure 2



Standard deviation of return (σ_p)

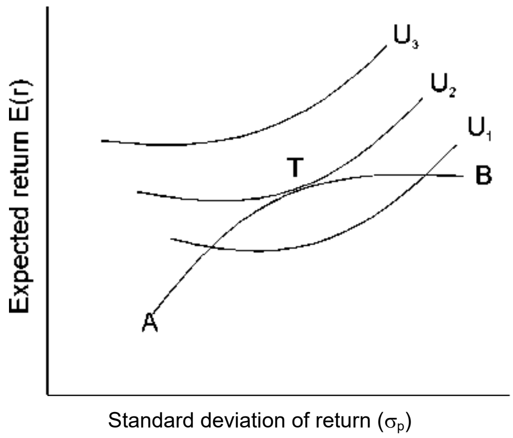
Once the set of efficient portfolios offering different combinations of risk and return is known, the firm can choose those ideally suited for its risk disposition. But how does a firm decide on the ideal mix of risk and return? To answer this, let us take the help of utility theory.

Figure 3



The curves in Figure 3, named U_1, U_2 and U_3 are isoquants of utility for the firm. That is, the firm is indifferent to choosing any particular combination of risk and return on any of these graphs. But, moving downwards from U_1 to U_2 to U_3, the return required per each unit of risk increases. If the efficient frontier and utility curves are plotted on a single graph, the point of tangency of the efficient frontier with one of the utility curves is the point which gives the required combination of risk and return for the firm. The same has been depicted in Figure 4. The point T is the point of tangency of the efficient frontier with U_2.

Figure 4



Mathematical Approach

What we have seen till now is a purely conceptual explanation of portfolio building. The composition of a portfolio, i.e. the proportion of various assets in a portfolio can also be determined mathematically.

Recall the equation for calculation of the standard deviation of a portfolio of two assets (Equation 3):

$$\sigma_p = \sqrt{X_1^2\,\sigma_1^2 + X_2^2\,\sigma_2^2 + 2\,\mathrm{Cov}_{12}\,X_1\,X_2} \qquad \text{....Eqn. (3)}$$

We now have to choose the proportion of X_1 (or X_2, which automatically fixes the proportion of the other) in such a way that σ_p is minimized. We can achieve it by using a technique of calculus, called minimization. By differentiating the portfolio variable σ_p^2 with respect to X_1 and equating the first differential to zero, we get

$$X_1 = \frac{\sigma_2^2 - Cov_{12}}{\sigma_1^2 + \sigma_2^2 - 2Cov_{12}} \qquad \text{.....Eqn. (6)}$$

The procedure is similar even for a portfolio with more than two assets.

Limitations of the Portfolio Theory

1. The number of inputs required is very high: For a portfolio of securities, the number of inputs required is $\frac{N\,(N + 3)}{2}$ i.e., N standard deviations of returns, N proportions and $\frac{N\,(N - 1)}{2}$ correlations.
2. The model assumes that:
   i. Investors are risk averse and utility maximizers.
   ii. Their investment decisions depend on the expected return and its standard deviation.
   iii. The expectations of all the investors in the market are homogenous.

The impact of these assumptions limits the usefulness of the model. However, empirical studies have revealed that the model works fairly well in real life.

CAPITAL ASSET PRICING MODEL (CAPM)

Markowitz, the propounder of the portfolio theory, was fully aware of the cumbersomeness of the risk-return calculation suggested by him. He, therefore, indicated that the procedure may be simplified by regressing the returns from the portfolio with the returns from a market index. The underlying logic is that the movements of the market as a whole have substantial effect on the values of the assets. The extent of correlation with the movements in the market as a whole can therefore, be used to predict changes in asset values.

Taking cue from the idea given by Markowitz, William Sharpe has developed the Single Index Model, which in turn formed the basis of the CAPM.

Single Index Model

The basic idea in the model is:

$$\bar{R}_{jt} = \alpha_j + \beta_j(\bar{R}_{mt}) + \bar{e}_{jt} \qquad \text{.....Eqn. (7)}$$

where, $\bar{R}_{jt}$: Expected return on asset 'j' during time 't'

$\bar{R}_{mt}$: Expected return on the market index during time 't'

α_j, β_j : Parameters developed by linear regression that describe the relationship between $\bar{R}_{jt}$ and $\bar{R}_{mt}$

$\bar{e}_{jt}$: Random error factor in the model

The above equation gives the return on the asset $(\bar{R}_{jt})$ if the return on the market $(\bar{R}_{mt})$, the relationship of the return on the asset to the market return (β_j) and the return on the asset irrespective of the movement of the market index (α_j) are known. β_j is the slope of the equation and α_j is the intercept.

The calculation of risk, i.e. variance of the return on the asset 'j' is as follows:

$$\begin{aligned} Var(\bar{R}_{jt}) &= Var[\alpha_j + \beta_j(\bar{R}_{mt}) + \bar{e}_{jt}] \\ &= Var(\alpha_j) + Var[\beta_j(\bar{R}_{mt})] + Var(\bar{e}_{jt}) \end{aligned}$$

or $\sigma^2 R_j = \beta_j^2 \ \sigma_m^2 + \theta_j^2$ Eqn. (8)

where,

σ_m^2 : Variance of return on market index

θ_j^2 : Variance of the random error

As the above equation shows, the total risk of a project consists of two components. Of the two, θ_j^2, the risk due to the random error, can be got rid of by diversifying the portfolio and is therefore called diversifiable or unsystematic risk. The other component, $\beta_j^2 \ \sigma_m^2$ is the risk due to the changes in market returns. It cannot be reduced by diversification and is called non-diversifiable or systematic risk. An alternative way of looking at it is to classify the components into that explained and not explained by the regression equation. Obviously, the random error is the part that is not explained. Now, recall the statistical measure of the extent to which regression equation correctly estimates the reality, namely the coefficient of determination. The total risk (σ_{Rj}^2) multiplied by the coefficient of determination, gives $\beta_j^2 \ \sigma_m^2$. Then, ($\sigma_{Rj}^2 - \beta_j^2 \ \sigma_m^2$) gives the value of θ_j^2, the unexplained portion of risk.

The variance in the above equation has been calculated using portfolio theory. Since α_j is the intercept, its variance will be zero. The correlation of $\bar{e}_{jt}$ with $\bar{R}_{mt}$ will be zero as this is one of the assumptions of the model.

This model assumes that:

i. The random error is not correlated with $\bar{R}_{mt}$,

ii. There is no correlation between random errors of different periods, and

iii. There is no correlation between random errors of different assets. Therefore, all other terms get cancelled.

The slope of the regression line, (β_j) can be found with the usual regression formula, i.e.

$$\beta_j = \frac{n \sum_{t=1}^{n} \bar{R}_{mt} \ \bar{R}_{jt} - \left(\sum_{t=1}^{n} R_{mt} \right) \left(\sum_{t=1}^{n} \bar{R}_{jt} \right)}{n \sum_{t=1}^{n} \bar{R}_{mt}^2 - \left(\sum_{t=1}^{n} \bar{R}_{mt} \right)^2} \quad \text{.... Eqn. (9)}$$

Once β_j is known, α_j can be found by substituting and interpolating equation (6):

$$\alpha_j = (\bar{R}_j) - \beta_j \ (\bar{R}_{mt}) \quad \text{..... Eqn. (10)}$$

An illustration is now in order.

Illustration 3

A firm is considering a new project. The firm's analyst feels that the returns from the project can be linked to a broad based market index. The returns from the index have been given in the following table. The table also contains returns from another project which, in the analyst's view is comparable to the proposed project.

Period (t)	Similar Project R_{jt}%	Market Index R_{mt}%
1	11	12
2	10	11
3	11	10
4	11	10
5	10	9
6	9	8
7	7	7
8	9	7
9	10	9
10	7	7

Let us now compute the values of α_j and β_j for the proposed project and frame the regression equation.

t	R_{jt}	R_{mt}	$R_{jt}\ R_{mt}$	R^2_{mt}
1	11	12	132	144
2	10	11	110	121
3	11	10	110	100
4	11	10	110	100
5	10	9	90	81
6	9	8	72	64
7	7	7	49	49
8	9	7	63	49
9	10	9	90	81
10	7	7	49	49
Total	95	90	875	838
Average	9.50	9.00		

$$\beta_j = \frac{n \sum R_{mt}\ R_{jt} - (\sum R_{mt})(\sum R_{jt})}{n \sum R^2_{mt} - (\sum R_{mt})^2}$$

$$= \frac{10 \text{ x } 875 - (90 \text{ x } 95)}{(10 \text{ x } 838) - (90 \text{ x } 90)} = 0.71$$

$$\alpha_j = E(\bar{R}_j) - \beta_j\ [E(\bar{R}_m)]$$

$$= 9.50 - 0.71 \text{ x } 9.00$$

$$= 3.11.$$

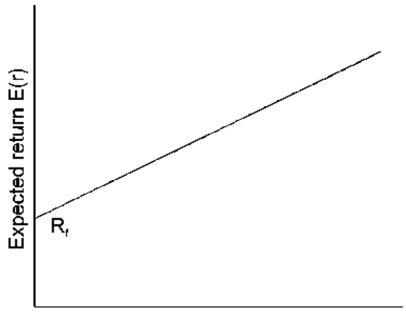
The regression equation is 3.11 + 0.71 [E (R_m)]. The equation indicates that the project earns 3.11% on its own and also 71% of the expected return on the market index.

The CAPM is very similar to the single index model. The only major difference is that historical market data on a broad based index is used to calculate β_j instead of a random variable as in the single index model. And, it is assumed that the relationship between the returns on the individual projects and the market index is perfectly linear, which results in sacrificing accuracy to a certain extent. The CAPM can be described well using two underlying concepts: the capital market line and the security market line.

Capital Market Line

As we have already seen, investors seek to maximize utility and therefore hold portfolios located at the tangency of the indifference curve and the efficient frontier. The portfolio at the point of tangency contains all the risk assets of the market in the same proportion as the value of the portfolio to the value of the total market portfolio. And, investors being different in their risk-return preferences, hold portfolios at various points on the efficient frontier. The aggregate of the individual preferences is represented by the capital market line (Figure 5)

Figure 5



The CML can be written as

$$E(R_P) = R_f + \frac{R_m - R_f}{\sigma_m}\sigma_p \qquad \text{.....Eqn. (10)}$$

Where, $E(R_p)$: Expected return on the portfolio

σ_p : Standard deviation of return on the portfolio

R_f : Risk-free rate

R_m : Return on the market portfolio

σ_m : Standard deviation of the market portfolio

R_f is the intercept of the regression line. The slope of the line is $(R_m - R_f)/\sigma_m$. The slope is also generally referred to as the 'market price of risk', as it indicates the excess return on the market portfolio over the risk-free rate per unit of risk in the market portfolio. Thus, the return on the portfolio has two components: the risk-free rate or the time value of money and excess return to compensate for risk.

Security Market Line

The capital market line shows the relation between return and risk for efficient portfolios. The SML represents the return expected on individual assets or securities. It is also called the 'market price of risk' line. All the risky assets in a market are priced in such a way that the return expected from them can be found using Equation 11.

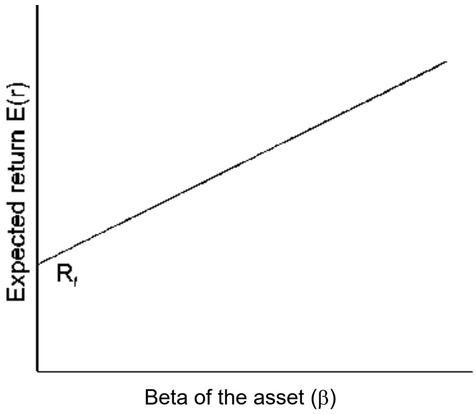
$$E(R_j) = R_f + \beta_j\,[E(R_m) - R_f] \qquad \text{....Eqn. (11)}$$

Where, $E(R_j)$: Required or expected return on security 'j'.

β_j : Measure of risk and is equal to $\left\{\frac{\text{Cov.} R_j, R_m}{\sigma_m^2}\right\}$

The return expected by the investors depends on the time value of money (R_f), covariance of the return on the security with the market return, and the variance of the market return itself. Statistically, the SML is the regression line between the expected return and the beta of the asset. The slope of the line (see Figure 6) is $[E(R_m) - (R_f)]$ and R_f is the intercept.

Figure 6



Securities that plot above the SML would be desirable for the investors, since they have a higher expected rate of return for the same beta (as against the lower E(r) indicated by the SML). The securities that lie on the SML would be giving the normal returns for the given risk (beta). The securities that lie below the SML would be unacceptable to the investors as they would get reduced returns for the same beta, than what is indicated by the SML.

The SML differs from the CML in two important aspects:

i. The measure of risk of the individual security is its covariance of its return with the market return and not the standard deviation of return on the security.

ii. The measure of market risk is the variance of return on the market and not standard deviation.

Illustration 4

A company is considering two projects – Alpha and Beta. The beta value for the two projects is estimated to be 0.43 and 1.12. The risk-free rate of interest is 8 percent and the return on the market portfolio of such assets is 12%. Calculate the expected return on the two projects.

$$E(R_j) = R_f + \beta_j\,[E(R_m) - R_f]$$

Substituting in this equation,

Alpha : 0.08 + 0.43 (0.12 – 0.08) : 0.0972 or 9.72%

Beta : 0.08 + 1.12 (0.12 – 0.08) : 0.1248 or 12.48%

Application of the CAPM to Capital Budgeting

Why should the CAPM be applied to capital budgeting at all? Sometimes, it is difficult to estimate the return expected by the equity providers, which makes the estimation of the rate of discount suitable to the project impossible. For example, a new company has no way of knowing the returns that equity providers expect and what its cost of capital is going to be. In such cases, CAPM comes in handy. The application of the CAPM in finding the rate of discount suitable for a project is as follows:

1. *Obtain a sample of betas of firms engaged in the same line of business as the proposed project:*

   Betas of firms engaged in the same line of activity and are comparable in size and scale should be obtained.

2. *Obtain asset betas from the equity betas:*

   Just as the equity has a beta, assets can also be assigned a beta value and it can be found given the equity beta, debt-equity ratio and the tax rate applicable to the company.

   Suppose you hold all the securities (equity and debt) issued by a company. Then the beta of the portfolio (β_p) is equal to the beta of the assets (β_A) of the company.

   $$\beta_p = \beta_A \qquad \text{.....Eqn. (12)}$$

   The beta of the portfolio can be expressed as the weighted average of the betas of the debt and equity issued by the firm. That is,

   $$\beta_P = \beta_E \frac{E}{E+D} + \beta_D \frac{D}{E+D} \qquad \text{.....Eqn. (13)}$$

   Since $\beta_A = \beta_P$

   $$\beta_A = \beta_E \frac{E}{E+D} + \beta_D \frac{D}{E+D}$$

   Solving the above equation for β_E , we get

   $$\beta_E = \beta_A + (\beta_A - \beta_D)\frac{D}{E}$$

   If the beta of the debt is assumed to be zero, we get

   $$\beta_E = \beta_A + \beta_A \frac{D}{E} = \beta_A \left[1 + \frac{D}{E}\right] \qquad \text{...Eqn. (14)}$$

   Now, $$\beta_A = \frac{\beta_E}{\left[1 + \frac{D}{E}\right]} \qquad \text{...Eqn. (15)}$$

   Adjusting the interest on debt for the tax shield, we get

   $$\beta_E = \beta_A \left[1 + \frac{D}{E}(1 - T)\right] \qquad \text{...Eqn. (16)}$$

   $$\beta_A = \frac{\beta_E}{\left[1 + \frac{D}{E}(1 - T)\right]} \qquad \text{...Eqn. (17)}$$

Once the asset betas of all the firms are calculated, the average β_A should be calculated.

3. *Calculate the average equity beta for the proposed project from the asset beta*.*

   Once the asset beta is known, the equity beta can be calculated using equation 16.

   $$\beta_E = \beta_A \left[1 + \frac{D}{E}(1 - T)\right]$$

4. *Apply the CAPM to find the return required on the equity:*

   $R_e = R_f + (R_m - R_f)\ \beta_E$

   where

   R_e : Return required on equity = cost of equity

   R_f : Risk-free rate

   R_m : Return on market portfolio

   β_E : Equity beta.

5. Find the weighted average cost of capital for the project.

WACC	:	$W_eK_e + W_d K_d (1 - T)$
Where,		
W_e	:	Weight of equity in the capital
W_d	:	Weight of debt in the capital
K_e	:	Cost of equity
K_d	:	Cost of debt
T	:	Tax rate

The WACC thus calculated is the appropriate discount rate for the cash flows of the project.

The following illustration makes the concept.

Illustration 5

Orange Computers Ltd. is planning to set-up a software project. The company's pre-tax cost of debt is 14 percent and the tax rate is 40%. It plans to twice as much debt as equity to find the project. The risk-free rate of interest and return on market portfolio, estimated by the company's analyst are 8% and 25%. The company has obtained the financial information relating to similar companies:

Company	Beta	Debt Equity Ratio	Tax Rate %
Satyam Computers Ltd.	1.20	2.00	30
WIPRO	1.50	1.50	35
TCS	0.75	1.75	40

The company wants to find out how much return should be earned on the project.

The company has already done the first step of collecting betas of comparable companies.

Step 2: Calculation of asset betas

From the given information and equation 16, asset betas are:

Satyam Computers Ltd.	0.50
WIPRO	0.76
TCS	0.52
The average is	0.60

Step 3: Calculation of equity beta

Using equation 15, and substituting the information given on Orange Computers Ltd, the equity beta is

$$\frac{0.59}{1 + 2.0\ (1 - 0.40)} = 1.30$$

Step 4: Calculation of expected return on equity by shareholders

$$\begin{aligned} K_e &= R_f + \beta\ (R_m - R_f) \\ &= 0.08 + 1.30\ (0.12 - 0.08) \\ &= 0.132 \text{ or } 13.2\%. \end{aligned}$$

Step 5: Calculation of WACC:

$$\frac{2}{3} \text{ x } 14\ (1 - 0.40) + \frac{1}{3} \text{ x } 13.20 = 10\%.$$

Assumptions of the CAPM

i. Investors are risk averse and utility maximizers.

ii. They all have the same time horizon for investment.

iii. Their estimates of $E(R_p)$, σ_p, and Cov (R_j, R_m) are homogenous.

iv. Investors can lend or borrow at R_f in unlimited amounts.

v. The markets are perfects, i.e. there are no taxes or transaction costs and information is available fairly to all the investors.

vi. The quantity of assets in the market is fixed.

SUMMARY

- A firm may be having different types of projects. Generally, cash flows of all the projects held by a firm may be correlated i.e., cash flows of a project may affect the cash flows of all or some of the projects of the firm. Therefore, it is essential to treat all the projects of the firm as a portfolio. A new project though having a positive NPV may have perfect correlation with the firms' existing projects, thereby increasing the risk of the firm. On the other hand, a project having a negative PV may have a negative correlation with cash flow of existing projects, thus reducing the overall risk of the firm. Thus, if a new project is evaluated as an addition to the existing portfolio of the projects, it may lead to a better decision. Therefore, the portfolio theory is an important tool in project management.

Chapter XI

Environmental Appraisal of Projects

After reading this chapter, you will be conversant with:

- Meaning of Environment and Pollution
- Pollution Created by Different Industries
- Methods of Preventing Pollution
- Environmental Regulations in India
- Environmental Impact Assessment for Projects

Environmental appraisal, until the last two-three decades, was almost unheard of. So long as companies could identify a forbidden place or a drain to dump their wastages, they never bothered about the consequences of indiscriminate dumping of toxic wastes. But as time passed, the awareness about the impact of toxic wastes increased.

In the last few years, in many states, courts have ordered the closure of some industrial units in and around populated areas, on complaints from people affected by pollution created by the units. Industrial pollution has reached such proportions that now there is a public outcry against pollution. Pollution avoidance is, therefore, an important aspect in evaluation of projects.

According to some experts on pollution, controlling pollution and providing a clean environment is a profitable proposition to corporates. There are many avenues to generate profits through pollution control. And, being a 'clean' company boosts the image of the company and results in higher sales. But this argument does not sound very logical. Opportunities to make profits through pollution control do not exist in all industrial sectors. Even if they do exist, they may not be the most profitable avenues into which corporates would like to pump in their money. Another factor is that a 'clean' image is not always important – particularly in high technology industries. Therefore, we cannot depend on the profitability and the desire of the corporates for a clean image to obtain a clean environment, much less in India.

Under these circumstances, what are the factors that can effectively induce the corporates to behave in a more environmental friendly manner? Four such factors can be identified:

- Pollution control regulation,
- Consumer pressure,
- Pressures from the local people, and
- Pressure from the investors.

Pollution Control Regulation

There are various laws and regulations governing pollution by industries. Almost all of them contain pollution standards. Standards are limits on the amounts of polluting substances that can be released into the environment, per unit of the medium containing the polluting substance, such as water, air, etc. The laws also prescribe ranges within populated areas in which certain highly polluting industries cannot be located. Certain industries cannot be located at all unless clearance is obtained from the regulatory authorities set up under these laws. Penalties and punishments are also prescribed under these laws to companies that flout the pollution standards. This factor, therefore, is the most important and potent factor among the four.

Consumer Pressure

The second factor, namely consumer pressure, is not at all powerful. It calls for well co-ordinated consumer movements to boycott the products and services of the polluting companies. These are difficult to initiate and manage. Consumers, particularly in the developing countries such as India, are concerned more about the cost and performance of the product than the environmental affects of producing the product. Even in the West, movements by consumers against polluting industries are just taking root.

Pressures from the Local People

Pressures from the local people can also be quite effective, particularly in labor intensive industries. If the local people boycott the industry, it becomes very difficult to get labor. But this is most unlikely to happen in countries with high rates of unemployment and poverty, such as India. Another form of pressure from the local people can be through filing of public interest petitions in the local courts. The courts may order the closure of the polluting units if the pollution standards are not met by them.

Pressure from the Investors

The last in the order is pressure from the investors of the company, who want to ensure that their company does not pollute the environment. Though this is one of the factors that prevails in the West, it is almost non-existent in India. Shareholders are more concerned about the profits and dividends than pollution. But a day may soon come when at least large institutional investors will force the companies in which they invest to wear a green look. This is, in fact, in the interest of the stockholders, as flouting pollution norms may land their company, sooner or later, in trouble.

Most of the large multinational companies, the world over, have separate departments for managing the environmental pollution. Apart from just avoiding pollution or clearing up when pollution takes place accidentally, these departments also undertake a strategically more important task: projecting a clean image through the media, and, liaising with various government departments to scout for changes in laws that are too cumbersome for the industry. They also lobby for preventing enactment of laws that are, though environment-friendly, not so friendly towards the industry. It is the medium and small scale enterprises that face a continuous struggle in the market place that do not care much for the environment. For them, being alive today is, naturally, more important than a possible danger that may arise tomorrow. They generally care for the environment only to the extent of meeting the regulatory requirements and, often, do not even meet them. More or less the same situation prevails in India too. Large corporations are trying to put up a somewhat greenish look, while medium and small companies are almost not concerned about the environment.

WHAT IS ENVIRONMENTAL POLLUTION?

Until now, we discussed about the need for pollution control, compliance or otherwise of pollution standards by corporates and the factors that influence the decision of the corporates on whether or not to comply with the environmental standards. But what exactly is meant by environment and what is pollution?

The environment of man consists of everything that is outside him. It is the earth, all things on it, surrounding it and within it. It consists of living and non-living components. The life component includes the plants, animals and micro-organisms. The non-life component consists of the land, water, air, clouds, sunshine, etc. In relation to a project, environment can be defined as the surrounding areas within which the life and non-life components are subject to the influence of the project. This, of course, includes human beings. According to The Environmental (Protection) Act, 1986, 'environment' includes water, air, and land and the interrelationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organisms and property. The definition includes the interactions between the non-life components and their interactions with the living creatures also.

The study of the interrelationships between various organisms and their environment is called ecology. It involves the study of the interrelationships between the two in terms of living habits, food habits, growth of populations, reproductive patterns and death. Ecology is divided further by some authors into two branches: human ecology or ecology proper and social ecology. Human ecology is the study of interrelationships between human biological factors and the natural environment. Social ecology is the study of the interrelationships among societies, environment and technology.

We should now move on to the second question – what is pollution? Pollution is the presence of any extraneous substances in any of the components of the environment in such amounts that it causes harm to life, directly or indirectly. According to the Environment (Protection) Act, 1986, environmental pollution means the presence in the environment of any solid, liquid, or gaseous substance in such concentration, that may be or tend to be, injurious to the environment. Such substances are defined as 'environmental pollutants' under the Act. The definition given to the term 'air pollution' by the Air (Prevention and Control of Pollution)

Act, 1981, is more specific and considers excessive noise also a pollutant. The Water (Prevention and Control of Pollution) Act, 1974, has a more stringent definition: pollution means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water, harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of plants or animals or acquatic organisms. The definition of water pollution is justifiably strict, as water pollution is the most difficult to detect – to detect both that there is pollution and the unit causing pollution.

SOURCES OF POLLUTION

In this section, let us discuss how the two basic requirements of all living creatures on earth – air and water – get polluted. Industries, as can be expected, are the major perpetrators of pollution. Smoke released from the chimneys of factories pollutes the air on a large scale. Industries using any type of fuel oil, natural gas, coal, electricity or nuclear energy can pollute the air. Thermal power plants, most of which are located close to populated areas, also pollute the air substantially. In India, most of the thermal power plants run on coal, and the ash content of Indian coal is very high– up to 40%. The ash that remains after burning the coal, called fly ash is released into the air. It not only results in a dirty grey coating on everything surrounding the plant, but also causes respiratory diseases to those living in the surrounding areas. But, as the sulphur content of Indian coal is low, it does not cause acid rain. Second to the industries in pollution are the vehicles. Road vehicles, aircrafts, ships and rail engines – all contribute to the pollution of air. With the number of vehicles increasing exponentially, pollution in cities is also rising steeply. It is said that though the number of vehicles in India is much less than in the West, the pollution levels are comparable with those in the West. Two factors are responsible for this: the air pollution standards being lax in India than in the West and a weak enforcement mechanism. The final factor, which is insignificant compared to the other two, is the pollution generated by domestic use of fuel. Burning of coal, wood and gas for cooling also generates a lot of smoke, but comparatively is less in quantity and impact than the other two. And, it cannot be avoided also.

Water pollution is more complex. There are many ways in which water gets polluted:

i. Dumping of industrial affluents on the ground can cause pollution of the ground water. Over a period of time, they seep into the water table.

   The same way, human wastes such as sewage and organic matter such as vegetables, which can decompose, slowly seep in and reach the ground water.

ii. Pesticides used for agriculture can cause pollution. They reach streams and rivers when water from fields is drained into streams and sewage canals.

iii. Even fertilizers contribute to pollution. They too reach rivers and lakes the same way as the pesticides. Apart from the fact that they are undesirable chemicals outside the fields and can cause serious diseases to human beings they promote pollution by stimulating the growth of acquatic plants, which is undesirable beyond a limit.

iv. Waste materials dumped on the ground reach rivers when they get washed away due to rains.

v. In many industrial areas, industrial wastes are discharged directly into sewage canals. And all sewage canals are ultimately drained into rivers. Thus the wastes reach rivers and increase pollution.

vi. According to some experts[1] discharge of sewage from communities into rivers and lakes is the biggest cause of water pollution, bigger than even the effect of industrial effluents. Most of the sewage water is released into water sources without any treatment, increasing the pollution.

1 'Environmental Pollution and Management' by I. Mohan, Ashish Publishing House, New Delhi, 1989.

Pollutants Released by Various Industries

Most of the industries produce some sort of wastes or the other. Some produce dust or ash, some produce chemicals in liquid or gaseous form while some produce unbearable noises. Many industries produce more than one type of pollution. In this section, let us take a brief look at the pollutants released by some of the major industries.

i. **Tanneries:** Effluent chemicals are released by this industry in each stage of production: soaking, liming, deliming, bating, pickling, tanning and finishing. This industry uses large amounts of water and the wastes chemicals are released mixed with water. The commonly found chemicals in the wastes released by this industry are carbonates and chlorides. The water released also contains high quantities of colors, suspended solids, hair and flashings.

ii. **Textile Industry:** Textile mills based on cotton produce 225 to 270 cubic meters of water containing effluents for every 1000 meters of cloth they produce. The water released also contains heavy amounts of colors (dyes) and suspended solids, apart from dissolved chemicals.

iii. **Distilleries:** Waste water released by this industry contains large doses of organic matter. The decomposition of the organic matter reduces the oxygen content of water drastically and affects water plants and animals. It also creates a horrible stink in the surrounding areas. In addition, these waters are acidic and contain potash and sulphates.

iv. **Fertilizers:** The harmful chemicals contained in the water released by this industry are ammonium salts, acids, amines, arsenic, fluorides, phosphates and carbon particles. Not all units release all these chemicals. The chemicals released and the quantities released depend on the type of fertilizer produced and the process of manufacture.

v. **Steel Mills:** The wastes of steel mills are generated from coke ovens, blast furnace, scrubbers, cooling water towers, steel pickling wastes and sanitation. The harmful chemicals released are ammonia, phenols, organic acids, cyanides, sulphates, alumina, lime, magnesia acids and compounds of iron.

vi. **Oil Refineries:** The effluents released by oil refineries include free oil, emulsified oil, acids, hydrogen sulphide, mercaptans, ammonia, cresols, phenols, alkalies, etc. These chemicals are released into water and pollute the coastal areas. Sometimes, they may be also released into air. The polluting effects are hazards of explosion, breathing problems, destruction of acquatic flora and fauna.

vii. **Drugs and Pharmaceuticals:** The wastes released by the units in this industry depend on the type of drugs produced and the processes used. The chemicals released vary very widely and may be released into air or water, depending on the nature of the effluent and the location of the plant.

viii. **Sugar:** The major waste materials released by this industry are organic material resulting from crushing of the cane, and traces of sugar and other carbohydrates, apart from acids and other chemicals used in processing. Organic matter and carbohydrates decompose after release into water, and result in a stink in the surrounding areas. The biological oxygen content in the water also gets reduced drastically due to release of hydrogen sulphide gas.

In this chapter, we are concerned specifically about the pollution caused by industries and its control. There are many methods by which industries separate or render harmless the polluting substances. We will discuss them in the following section.

METHODS OF EFFLUENT TREATMENT

Treatment of Air Pollutants

Let us begin with methods of separating air pollutants:

i. **Mechanical Separation:** Air containing particles of the pollutants is passed slowly through chambers, called collectors. Particulate matter, being heavier than air, settles down the bottom of the chambers.

ii. **Electrostatic Precipitation:** In this method, an electrostatic precipitator imparts electric charge to the particulate matter. Then, the air containing particulate matter is passed over an electric plate with an electric charge opposite to that given to the particles. The particles get attracted towards the plate and are collected.

iii. **Filtering:** Air containing pollutants is passed through porous media such as felt or fibrous materials. The particulate pollutants are caught in the filtering materials. This method is considered to be very effective and is very popular too.

iv. **Scrubbing:** In this method, generally, minute drops of water are used to trap the particulate matter. In this method, as some gases react with water, even gaseous pollutants can be eliminated.

In addition to these, there are many other methods such as absorption, adsorption, etc.

Treatment of Water Pollutants

Let us now move on to the treatment methods of pollutants contained in water. Processing the industrial effluents before releasing into sewers or rivers is called effluent treatment.

Effluent treatment is generally carried out in three phases:

- Primary treatment
- Secondary treatment
- Tertiary treatment.

i. Primary Treatment: Primary treatment is aimed at removing the undesirable chemicals, particles or suspended matter or organic matter through mechanical means. Mechanical devices such as screens, and filters are used to remove particles. Comminutor devices are used to breakdown larger particles to smaller particles so that they can be released into drains and sewages. Inorganic particulate matter such as sand, iron, cinder are separated by passing through grit chambers where the particles settle down. Alternatively, sedimentation tanks are used. Water containing particulate matter is allowed to stand for sufficient time in these tanks, so that the particles settle down to the bottom of the tank or sediment.

ii. Secondary Treatment: Secondary treatment is carried out to eliminate pollutants such as proteins, carbohydrates and fats that cannot be separated by or are carried over from the primary treatment. Secondary treatment is generally made by using suitable micro-organisms. The mechanisms commonly used are trickling filters, activated sludge, oxidation ponds and biological disc. In most of the methods, the pollutants are brought into a condition where they can be degraded by micro-organisms. This may be achieved by adding enzymes which break down proteins and carbohydrates. Then, the effluents are passed through media containing the organisms. Once the pollutants are further decomposed by the micro-organisms, rendering them harmless, they are released into drainages or rivers. This process of using organisms is called aerobic process. There is an alternative process, called the anaerobic process. In the anaerobic process, bacteria which do not require oxygen (anaerobic bacteria) are used for decomposition. Organic matter is first degraded into fatty acids and alcohols, which are further degraded by bacteria into methane and other gases.

iii. Tertiary Treatment: There are many chemicals that cannot be degraded using this procedure. They are dealt with in tertiary treatment. Chemicals such as detergents, pesticides and petrochemicals call for modern treatment methods. In chemical precipitation, certain chemicals are added to the effluents to precipitate the polluting substances. In the method called 'oxidation', pollutants are converted to other harmless substances through oxidation. Oxygen, potassium permanganate, chlorine and hydrogen peroxide are the commonly used oxidation agents.

This brings us to the end of our discussion on methods of treatment of polluting substances. At the beginning of this chapter, we have said that pressure from the regulators is the major factor that induces firms into adopting pollution control measures. We shall now discuss the salient features of environmental laws in India.

ENVIRONMENTAL LAW IN INDIA

The Government of India has a responsibility to protect and improve the environment and to safeguard the forests and wildlife of the country as stated in the Indian Constitution. The Constitution imposes a duty on every citizen to improve and protect the natural environment including forests, lakes, rivers, and wildlife. So, the Government through the Ministry of Environment and Forests formed and implemented many rules, regulations and Acts to protect the environment. The main Acts are:

i. The Environment (Protection) Act, 1986.

ii. The Water (Prevention and Control of Pollution) Act, 1974

iii. The Air (Prevention and Control of Pollution) Act, 1981

iv. The Indian Forests Act, 1927.

v. The Wild Life (Protection) Amendment Act, 2002.

vi. The Air (Prevention and Control of Pollution) Rules, 1982

vii. The Water (Prevention and Control of Pollution) Rules, 1975.

viii. The Environment (Protection) Third Amendment Rules, 2002

ix. The Environment (Sitting for Industrial Projects) Rules, 1999.

The Environment (Setting for Industrial Projects) Rules, 1999

These rules impose prohibitions and regulations to setting up new industries in some areas. The main provisions are:

A. Prohibition for setting up of certain industries: No new unit of the industries listed in Table 1 shall be allowed to be set-up in the following areas:

i. The entire area within the municipal limits of all Municipal Corporations, Municipal Councils and Nagar Panchayats (by whatever name these are known in each state) and a 25 km belt around the cities having population of more than 1 million;

ii. 7 km belt around the periphery of the wetlands listed in Table 2;

iii. 25 km belt around the periphery of National Parks, Sanctuaries and core zones of biosphere reserves, and

iv. 0.5 km wide strip on either side of national highways and rail lines;

B. Establishment of new units with certain conditions: Establishment of new units of the industries listed in Table 1 shall be allowed in 7 km to 25 km belt around the periphery of the wetlands listed in Table 2 only after careful assessment of their adverse ecological and environmental impacts.

Table 1

1.	Petroleum Refineries
2.	Chemical Fertilizers
3.	Petro-chemical complex (Both Olefinic and Aromatic) and Petrochemical intermediates such as DMT, Caprolactam LAB etc. and production of basic plastics such as LLDPE, HDPE, PP, PVC.
4.	Hydrocyanic acid and its derivatives.
5.	Primary metallurgical industries (such as production of Iron and Steel, Aluminium, Copper Zinc, Lead and Ferro Alloys).
6.	Viscose Staple fibre and filament yarn.
7.	Storage batteries integrated with manufacture of oxides of lead and antimony alloys distilleries.
8.	Raw skins and hides, and tanneries.
9.	Dyes and Dye intermediates.
10.	Pesticides.
11.	Bulk drugs and pharmaceuticals.
12.	Caustic soda/Chlorine.
13.	Pulp and Paper.
14.	Cement.

Table 2

1.	Chilka, Orissa
2.	Keoladeo Ghana National Park, Rajasthan
3.	Sambhar, Rajasthan
4.	Wullar, Jammu & Kashmir
5.	Loktak, Manipur
6.	Harike, Punjab.

- The Water (Prevention and Control of Pollution) Act was passed:

i. As the name suggests, to prevent and control the pollution of water, and to restore or maintain wherever necessary water sources that have already been polluted,

ii. To set up Central and State Pollution Control Boards to carry out the aim mentioned in (i) above, and

iii. To give the necessary powers to the central and state boards to achieve the aim.

- The major provisions of the Act are:

i. Draining effluents into streams without the permission of the Board is prohibited.

ii. It laid down that no person should cause or permit entry into any stream or well of any poisonous, noxious or polluting matter determined in accordance with the standards laid down by any pollution control board.

iii. Fines and punishments have been prescribed for those violating the provisions relating to the prohibition in (i) and (ii) above.

iv. The Central Pollution Control Board is empowered to, inter alia:

- Subject to the provisions of the Act, take necessary actions to promote cleanliness of streams and wells in different areas of the states
- Advise the Central Government on any matter concerning the prevention and control of water pollution
- Co-ordinate the activities of the state boards
- Lay down, modify or annul pollution standards for streams and wells
- Organize through mass media a comprehensive program regarding the prevention and control of water pollution.

v. The major functions and powers of the states' boards are similar to those of the central board, but are limited to the respective states.

- The Air (Prevention and Control of Pollution) Act, 1981, has also envisaged creation of Central and State Pollution Control Boards with similar objectives as those of the boards set up for control of water pollution. But, the responsibilities were later delegated to the boards set up under the Water (Prevention and Control of Pollution) Act, 1974, and no separate boards were set up for air pollution. According to the Air (Prevention and Control of Pollution) Act, no person shall, without the previous consent of the State Pollution Control Board, operate any industrial plant specified in the schedule to the Act, in an air pollution control area. An air pollution control area is an area declared as such by the state government. The state government can make such a declaration only after consultation with the state pollution control board.

  The Section 20 of the Act prescribes standards of omission from motor vehicles.

  Both these Acts have been criticized by experts in law for being defective. The definition of offenses is not clear, punishments prescribed are not applicable for all possible offenses, it is difficult to prove the offenses and punishments have not been provided for negligent acts. Realizing the inadequacies of these two pieces of legislation and to fulfill the commitments given by India at the United Nations Conference on Human Environment in 1972, the Environment (Protection) Act, 1986, was passed in 1986.

- The Environment (Protection) Act, 1986, contains strict prohibition against handling of hazardous substances excepting according to the procedures laid down and with the safeguards prescribed under the Act. The Act empowers the central government to lay down the procedures and safeguards for preventing accidents that may cause environmental pollution. Standard limits on concentration of polluting substances that can be released into the environment have been prescribed in the rules framed under the Act. For example, A Notification (SO 60(E) dated 27.1.94) issued under The Environment (Protection) Act, 1986 has listed 30 projects in respect of which environmental clearance needs to be obtained from the Ministry of Environment & Forest, Government of India. This list includes industries like petrochemical complexes, petroleum refineries, cement, thermal power plants, bulk drugs, fertilizers, dyes, paper, etc. However, if investment is less than Rs.1,000 million, such clearance is not necessary, unless it is for pesticides, bulk drugs and pharmaceuticals, asbestos and asbestos products, integrated paint complexes, mining projects, tourism projects of certain parameters, tarred roads in Himalayan areas, distilleries, dyes, foundries and electroplating industries. Further, any item reserved for the small- scale sector with investment of less than Rs.10 million is also exempt from obtaining environmental clearance from the Central Government. Powers have been delegated to the State Governments for grant of environmental clearance for certain categories of thermal power plants. Setting up industries in certain locations considered ecologically fragile (for example, Aravalli Range, coastal areas, Doon valley, Dahanu, etc.) are guided by separate guidelines issued by the Ministry of Environment and Forests, Government of India. Any person responsible for releasing pollutants in excess of the limits is required to inform the concerned authorities immediately and render all forms of assistance required by the authorities to contain the pollution.

Permission has been given to citizens, under the Act, to initiate proceedings against any establishment polluting the environment. Under the Air (Prevention and Control of Pollution) Act, such proceedings can be initiated only with the permission of the state pollution control board. The punishments for various offenses have also been made more stringent under this Act. A summary of the standards of pollution laid down under this Act has been given in the Appendix I.

ENVIRONMENTAL IMPACT ASSESSMENT OF PROJECTS

Whether to comply with the laws and regulations, or to satisfy the customers, if a company should take care to see that it does not pollute the environment, it should first know what the impact of the project on the environment is likely to be. A study of the environmental impacts of a project is called Environmental Impact Assessment (EIA), and a statement of the impact is referred to as Environmental Impact Statement (EIS).

Environmental Impact Assessment (EIA) is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoided treatment/clean-up costs and impacts of laws and regulations.

An EIS, developed through an EIA, generally contains the following:

i. A description of the project proposed, its purpose, and technical details such as the materials proposed to be used, manpower requirements, etc.

ii. The effect on the land use plans, policies and controls in the surrounding areas. This aspect is generally to be studied only for government's projects, as private projects affecting land use plans in the surrounding areas are generally not permitted by the government.

iii. The impact of the project on each component of the environment, describing the nature of impact and its severity.

iv. Possible alternative projects that do not cause adverse effects as foreseen in the present project, and their evaluation.

v. Proposed measures to contain the adverse effects of the projects on the environment.

vi. The amount of unavoidable pollution in spite of taking all possible measures to avoid the undesirable impact on the environment.

vii. An evaluation of the commercial and social desirability of the project in comparison with the pollution caused by it.

viii. Amounts of resources that have to be committed irretrievably to the project.

The next question that arises, once we know what are all the aspects to be studied, is, the procedure for carrying out such a study. It is broadly stated as follows:

i. Find out the nature and amounts of the environmental resources to be used by the project, such as water, air, and land.

ii. Identify the nature and extent of the impact of the project on various components of the environment.

iii. Identify the areas surrounding the location of the project that are affected by each type of pollution that the project can cause, such as deposition of fly ash, spread of noxious odours, etc.

iv. Identify the components of the environment that are destroyed by the project, such as extinct species of birds and plants, scenic beauty, etc. and the possibility of preserving them.

v. Evaluate the project's desirability keeping all the above factors in view.

This, of course, is an oversimplified version of the methodology for environmental impact assessment. There are many sophisticated methods of carrying out this study that use checklists, matrices, networks and computers. A detailed study of all these is beyond the scope of this book. We thus conclude our discussion on the environmental appraisal of projects.

SUMMARY

- In the modern world, because of the rapid development of industry, pollution has reached alarming proportions. There are various factors like government regulation, pressure from consumers, local people and investors, which forces the firm to act in a more environment – friendly manner. Therefore, location of the project, technology and system of effluent of disposal are decided only after taking these factors into consideration.

Appendix I

The Environment (Protection) Rules, 1986

Emission Standards for Diesel Engines (Engine Rating more than 0.8 MW (800 KW)) for Power Plant, Generator Set Applications and Other Requirements

Parameter		Area Category	Total engine rating of the plant (includes existing as well as new generator sets)	Generator sets commissioning date		
				Before 1/7/2003	Between 1/7/2003 and 1/7/2005	On or after 1/7/2005
Nox (as NO_2) (AT 15% O_2), dry basis, in ppmv		A	Upto 75MW	1100	970	710
		B	Upto 150MW			
		A	More than 75MW	1100	710	360
		B	More than 150MW			
NMHC (as C) (at 15% O_2), mg/Nm^3		Both A and B		150	100	
PM (at 15% O_2), mg/Nm^3	Diesel Fuels – HSD & LDO	Both A and B		75	75	
	Furnace Oils – LSHS & FO	Both A and B		150	100	
CO (at 15% O_2), mg/Nm3		Both A and B		150	150	
Sulphur content in fuel		A		<2%		
		B		<4%		
Fuel specification		For A only	Up to 5MW	Only Diesel Fuels (HSD, LDO) shall be used.		
Stack height (for generator sets commissioned after 1/7/2003)		Stack height shall be maximum of the following, in meter: i. 14 $Q^{0.3}$, Q = Total SO_2 emission from the plant in kg/hr ii. Minimum 6 m above the building where generator set is installed. iii. 30 m.				

Note:

1. Acronyms used: MW: Mega (10^6) Watt; FO : Furnace Oil; NO_x : Oxides of Nitrogen; HSD : High Speed Diesel; NO_2 : Nitrogen Dioxide; LDO : Light Diesel Oil; O_2: Oxygen; LSHS: Low Sulphur Heavy Stock; NMHC: Non Methane Hydrocarbon; kPa: Kilo Pascal; C : Carbon; mm : Milli (10^{-3}) metre; PM : Particulate Matter; kg/hr : Kilo (10^3) gram per hour; CO : Carbon Monoxide; mg/Nm^3 : Milli (10^{-3}) gramper; SO_2: Sulphur Dioxide Normal metre cubic; ppmv : part per million (10^6) by volume.
2. Area categories A and B are defined as follows: Category A: Areas within the municipal limits of towns/cities having population more than 10 lakh and also up to 5 km beyond the municipal limits of such towns/cities. Category B: Areas not covered by category A.
3. The standards shall be regulated by the State Pollution Control Boards or Pollution Control Committees, as the case may be.
4. Individual units with engine ratings less than or equal to 800 KW are not covered by this notification.
5. Only following liquid fuels viz. High Speed Diesel, Light Diesel Oil, Low Sulphur Heavy Stock and Furnace Oil or liquid fuels with equivalent specifications shall be used in these power plants and generator sets.
6. For expansion project, stack height of new generator sets shall be as per total Sulphur Dioxide emission (including existing as well as additional load).
7. For multi engine plants, fuels shall be grouped in cluster to get better plume rise and dispersion. Provision for any future expansion should be made in planning stage itself.

8. Particulate Matter, Non-Methane Hydrocarbon and percent moisture (dry basis). Carbon Monoxide results are to be normalized to 25^{0}C, 1.01 Kilo Pascal (760 mm of mercury) pressure and zero.
9. Measurement shall be performed at steady load conditions of more than 85% of the rated load.
10. Continuous monitoring of Oxides of Nitrogen shall be done by the plants whose total engine capacity is more than 50 Mega Waft. However, minimum once in six month monitoring for other parameters shall be adopted by the plants.
11. Following methods may be adopted for the measurement of emission parameters.

Sl.No.	Emission Parameters	Measurement Methods
1.	Particulates	Gravimetric
2.	SO_2	Barium Perchlorate – Thorin indicator method
3.	NO_X	Chemiluminescence, Non-Dispersive Infra Red, Non-Dispersive Ultra-violet (for continuous measurement), Phenol disulphonic method
4.	CO	Non Dispersive Infra Red
5.	O_2	Paramagnetic, Electrochemical sensor
6.	NMHC	Gas Chromatograph – Flame lonization Detector

Schedule[2] [I]
(See Rule 3)

Sl. No.	Industry	Parameter	Standards	
1	2	3	4	
1.	Caustic Soda Industry		Concentration not to exceed, milligramme per liter (except for pH and flow) 0.01	
		Total concentration of mercury in the final effluent* Mercury bearing waste-water generation (flow)	10 kiloliters/tonne of caustic soda produced	
		pH	5.5 to 9.0	
		* Final effluent is the combined effluent from (a) cell house, (b) brine plant, (c) chlorine handling, (d) hydrogen handling, (e) hydrochloric acid plant.		
2.	Man-made fibers (synthetic)		Concentration not to exceed, milligram per liter (except for pH)	
		Suspended solids [3][Bio-chemical oxygen demand, (3-days at 27^{0}C)]	100 30	
		PH	5.5 to 9.0	
3.	Oil-refinery industry	Concentration, not to exceed, milligram per liter (except for pH)		
		Oil and grease Phenol Sulphide [5][Bio-chemical oxygen demand, (3-days at 27^{0}C)]	10 1 0.5 0.15	7 0.7 0.35 10.5 14
		Suspended solids pH	20 6 to 8.5	
4.	Sugar industry	[5][Bio-chemical oxygen demand, (3-days at 27^{0}C)] Suspended solids	Concentration not to exceed, milligram per liter 100 for disposal on land 30 for disposal in surface waters 100 for disposal on land 30 for disposal in surface waters	

2 Renumbered as Sch. I by S.O. 82(E), dated 16th February, 1987 (w.e.f. 16.2.1987).
3 Ins. by G.S.R.54(E), dated 5th February, 1990 (w.e.f 05.02.1990).

Sl. No.	Industry	Parameter	Standards
1	2	3	4
5.	Thermal power plants		Maximum, limiting concentration, milligramme per litre (except for pH and temperature)
	Condenser cooling waters (once through cooling system)	pH	6.5 – 8.5
		Temperature	Not more than 5^{0}C higher than the intake water temperature
		Free available chlorine	0.5
	Boiler blowdowns	Suspended solids	100
		Oil and grease	20
		Copper (total)	1.0
		Iron (total)	1.0
	Cooling-tower blowdown	Free available chlorine	0.5
		Zinc	1.0
		Chromium (total)	0.2
		Phosphate	5.0
		Other corrosion inhibiting material	Limit to be established on case by case basis by Central Board in case of Union territories and State Boards in case of States
	Ash.pond effluent	pH Suspended solids Oil and grease	6.5 – 8.5 100 20
6.	Cotton textile industries (composite and processing)		Concentration not to exceed, milligramme per litre (except for pH and bio-assay)
	Common:	pH Suspended solid [4][Bio-chemical oxygen demand, (3 days at 27^{0}C)] Oil and grease Bio-assay test	5.5 to 9 100 150 10 90% survival of fish after 96 hours
	Special:	Total chromium (as Cr) Sulphide (as S) Phenolic compounds (as C_6H_5OH)	2 2 5

The special parameters to be stipulated by the Central Board in case of Union territories and State Boards in case of States depending upon the dye used in the industry. Where the industry uses chrome dyes, sulphur dyes and/or phenolic compounds in the dyeing/printing process, the limits on chromium of 2 mg/liter, sulphides of 2 mg/liter, and phenolic compounds of 5 mg/liter, respectively shall be imposed.

Where the quality requirement of the recipient system so warrants, the limit of BOD should be lowered up to 30 according to the requirement by the State Boards for the States and the Central Board for the Union territories.

A limit on sodium absorption ratio of 26 should be imposed by the State Boards for the States and the Central Board for the Union territories if the disposal of effluent is to be made on land.

Sl. No.	Industry	Parameter	Standards
1	2	3	4
7.	Composite woollen mills		Concentration not to exceed,milligramme per liter (except for pH and bio-assay)
	Common:	Suspended solid pH [5][Bio-chemical oxygen demand, (3 days at 27^{0}C)] Oil and grease Bio-assay test	100 5.5 to 9.0 100 10 90% survival of fish after 96 hours
	Special:	Total chromium (as Cr) Sulphide (as S) Phenolic compounds	2 2 5

4 Subs. By G.S.R. 176(E), dated 2nd April, 1996 (w.e.f. 3.4.1996)
5 Subs. By G.S.R. 176(E), dated 2nd April, 1996 (w.e.f. 3.4.1996)

The special parameters to be stipulated by the Central Board in case of Union territories and State Boards in case of States depending upon the dye used in the industry. Where the industry uses chrome dyes, sulphur dyes and/or phenolic compounds in the dyeing/printing process, the limits on chromium of 2mg/litre, sulphides of 2 mg/litre and phenolic compounds of 5 mg/litre, respectively shall be imposed.

Where the quality requirement of the recipient system so warrants, the limit of BOD should be lowered up to 30 according to the requirement by the State Boards for the State and the Central Board for the Union territories.

A limit on sodium absorption ratio of 26 should be imposed by the State Boards for the States and the Central Board for the Union territories if the disposal of effluent is to be made on land.

Sl. No.	Industry	Parameter	Standards
1	2	3	4
8.	Dye and Dye Intermediate Industries		Concentration not to exceed, milligramme per litre (except for pH, temperature and bio-assay)
		Suspended Solids	100
		pH	6 to 8.5
		Temperature	Shall not exceed 5^0C above the ambient temperature of the receiving body
		Mercury (as Hg)	0.01
		Hexavalent Chromium (as Cr)	0.1
		Total Chromium (as Cr)	2.0
		Copper (as Cu)	3.0
		Zinc (as Zn)	5.0
		Nickel (as Ni)	3.0
		Cadmium (as Cd)	2.0
		Chloride (as Cl)	1000
		Sulphate (as SO_4)	1000
		Phenolic Compounds (as C_6H_5OH)	
		Oil and Grease	10
		Bio-assay Test (with 1:8 dilution of effluents)	90% survival of test animals after 96 hours

The standards of chlorides and sulphates are applicable for discharge into inland and surface water-courses. However, when discharged on land for irrigation, the limit for chloride shall not be more than 600 milligrammes per litre and the sodium absorption ratio shall not exceed 26.

Sl. No.	Industry	Parameter	Standards
1	2	3	4
9.	Electroplating		Concentration not to exceed, milligramme per litre (except for pH and temperature)
		pH	6.0 to 9.0
		Temperature	Shall not exceed 5^0C above, the ambient temperature of the receiving body
		Oil and Grease	10
		Suspended Solids	100
		Cyanides (as CN)	0.2
		Ammonical	50
		Nitrogen (as N)	1.0
		Total Residual Chloride (as Cl)	
		Cadmium (as Cd)	2.0
		Nickel (as Ni)	3.0
		Zinc (as Zn)	5.0
		Hexavalent Chromium (as Cr)	
		Total Chromium (as Cr)	2.0
		Copper (as Cu)	3.0
		Lead (as Pb)	0.1
		Iron (as Fe)	3.0
		Total metal	10.0
10.	Cement Plants		Not to exceed-milligrammes per normal cubic metre
	Plant Capacity:		
	200 tonnes per day	Total dust (All sections)	400
	Greater than 200 tonnes per day	Total dust (All sections)	250

The Central and State Pollution Control Boards may fix stringent standards, not exceeding 250 milligrams per normal cubic meter for smaller plants and 150 milligrams per normal cubic meter for larger plants if the industry is located in an area which, in their opinion, requires more stringent standards.

Where continuous monitoring integrators are provided on dust emission lines, the integrated average values over a period, to be fixed by the Central and State Boards but not exceeding 72 hours shall be considered instead of momentary dust emission values for conformity to standards.

[6][Schedule II]

(See Rule 3)

Ambient Air Quality Standards in Respect of Noise

Area Code	Category of Area	Limits in dB(A)	Leg.
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note-1 Day time is reckoned in between 6 a.m. and 9 p.m.

Note-2 Night time is reckoned in between 9 p.m. and 6 a.m.

Note-3 Silence zone is defined as areas up to 100 metres around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority. Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.

Note-4 Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and corresponding standards shall apply.

[7][Schedule III]

(See Rule 3)

Standards for Emission of Smoke, Vapour, etc. from Motor Vehicles

1. Every motor vehicle shall be manufactured and maintained in such condition and shall be so driven that smoke, visible vapour, sparks, ashes, cinders or oily substance do not emit therefrom.
2. On and from the 1st day of March, 1990, every motor vehicle in use shall comply with the following standards:
   a. Idling CO (Carbon monoxide) emission limit for all four wheeled petrol driven vehicles shall not exceed 3 percent by volume;
   b. Idling CO emission limit for all two and three wheeled petrol driven vehicles shall not exceed 4.5 percent by volume;
   c. Smoke density for all diesel driven vehicles shall be as follows:

Method of Test	Maximum smoke density		
	Light absorption co-efficient m-1	Bosch Units	Harridge Units
(a) Full load at a speed of 60% to 70% of maximum engine rated speed declared	3.1	5.2	75
(b) Free acceleration	2.3		65

3. On and from the 1st day of April, 1991, all petrol driven vehicles shall be so manufactured that they comply with the mass emission standards.

6 Ins by G.S.R. 1063(E), dated 26th December, 1989 (w.e.f. 26.12.1989).
7 Ins. By G.S.R. 54 (E), dated 5th February, 1990 (w.e.f. 05.02.1990).

4. On and from the 1st day of April, 1991 all diesel driven vehicles shall be so manufactured that they comply with the mass emission standards based on exhaust gas opacity.
5. On and from the 1st day of April, 1992, all diesel driven vehicles shall be so manufactured that they comply with the following levels of emissions under the Indian driving cycle:

Mass of Carbon Monoxide (CO) Maxm. Grams per KWH	Mass of Hydro Carbons (HC) Maxm. Grams per KWH	Mass of Nitrogen Oxides (NO) Maxm. Grams per KWH
14	3.5	18

6. Each motor vehicle manufactured on and after the dates specified in paragraphs (2), (3), (4) and (5) shall be certified by the manufacturers to be conforming to the standards specified in the said paragraphs and the manufactures shall further certify that the components liable to effect the emission of gaseous pollutants are so designed, constructed and assembled as to enable the vehicle, in nominal use, despite the vibration to which it may be subjected, to comply with the provisions of the said paragraphs.
7. Test for smoke emission level and Carbon Monoxide level for motor vehicles –
   a. Any officer not below the rank of a Sub-inspector of police or an Inspector of motor vehicles, who has reason to believe that a motor vehicle is by virtue of smoke emitted from it or other pollutants like Carbon Monoxide emitted from it, is likely to cause environmental pollution, endangering the health or safety of any other user of the road or the public, may direct the driver or any person incharge of the vehicle to submit the vehicle for undergoing a test to measure the standard of black smoke or the standard of any other pollutants.
   b. The driver or any person incharge of the vehicle shall upon demand by any officer referred to in sub-paragraph (a), submit the vehicle for testing for the purpose of measuring the standard of smoke or the levels of other pollutants or both.
   c. The measurement of standard of smoke shall be done with a smoke meter or a type approved by the State Government and the measurement of other pollutants like Carbon Monoxide shall be done with instruments of a type approved by the State Government.

Annexure I

Mass Emission Standards for Petrol driven Vehicles

1. Type Approval Tests:

Two and Three Wheeler Vehicles

Reference Mass, R(Kg)	CO (g/km)	HC(g/km)
1	**2**	**3**
$R \leq 150$	12	8
$150R \leq 150$	$12 + \frac{18\ (R-150)}{200}$	$8 + \frac{4\ (R-150)}{200}$
$R > 350$	30	12

Light Duty Vehicles:

Reference Mass, rw(Kg)	CO (g/km)	HC(g/km)
1	**2**	**3**
$rw \leq 1020$	14.3	2.0
$1020 < rw \leq 1250$	16.5	2.1
$1250 < rw \leq 1470$	18.8	2.1
$1470 < rw \leq 1700$	20.7	2.3
$1700 < rw \leq 1930$	22.9	2.5
$1930 < rw \leq 2150$	24.9	2.7
$rw \leq 2150$	27.1	2.9

2. Conformity of Production Tests:

Two and Three Wheeler Vehicles

Reference Mass, rw(Kg)	CO (g/km)	HC(g/km)
1	2	3
R < 150	15	8
150 R < 350	$15 + \frac{25(R - 150)}{200}$	$10 + \frac{5(R - 150)}{200}$
R > 350	40	15
rw ≤ 1020	17.3	2.7
1020 ≤ rw ≤ 1250	19.7	2.7
1250 ≤ rw ≤ 1470	22.5	2.8
1470 ≤ rw ≤ 1700	24.9	3.0
1700 ≤ rw ≤ 1930	27.6	3.3
1930 ≤ rw ≤ 2150	29.9	3.5
rw ≤ 2150	32.6	3.7

For any of the pollutants referred to above of the three results obtained may exceed the limit specified for the vehicle by not more than 10 percent.

Explanation: Mass emission standards refers to the gm. of pollutants emitted per km. run of the vehicle, as determined by a chassis dynamometer test using the Indian Driving Cycle.

Chapter XII

Social Cost Benefit Analysis

After reading this chapter, you will be conversant with:

- The Rationale for SCBA
- UNIDO Approaches for SCBA
- Little-Mirrlees Approach
- SCBA Methods Followed by Financial Institutions
- Public Sector Investment in India

Until now, we were discussing the appraisal mechanisms of investment decisions from the financial angle. However, appraising investments is not complete until they are evaluated from the view point of economy or society as a whole. Referred to as Social Cost Benefit Analysis (SCBA), economic analysis is the methodology developed to evaluate an investment from the social point of view.

The lack of satisfactory methods for evaluating the economic and social benefits and costs of projects in developing countries resulted in the United Nations giving some guidelines for project evaluation.

One way of improving economic efficiency and social equity is to make investment decisions on the basis of shadow prices which reflect the true value to the country of its resources. Market prices do not always reflect the real value. For example, the prices of petroleum products are controlled by the government. If left to free market forces, the price may be lower than what is fixed by the government. Similarly, the wage rates are regulated to a certain extent by the government through laws relating to minimum wage rates. If left to the free market forces, the rate may turn out to be very different from what has been fixed by the government. While evaluating a project from a purely financial angle, only the market prices are considered and the selection of the project is based on the net cash inflows from the project. But, while evaluating from the social point of view, the actual values of the inputs and outputs of the society have to be considered. That is, when labor is expended on a project, from the social angle, the value of the labor is its value to the society and not the wages paid to the worker.

The rationale for economic analysis and different approaches to such analysis are discussed in this chapter.

RATIONALE FOR SCBA

The main reason for doing social cost benefit analysis in projects is to subject a project to a consistent set of general objectives of national policy. The choice of one project rather than another must be viewed in the context of their total national impact, and this total impact has to be evaluated in terms of a consistent and appropriate set of objectives.

The avoidance of a complete dichotomy between project choice and national planning is one of the main reasons for doing SCBA. When one project is chosen rather than another, the choice has its consequences for employment, output, consumption, savings, foreign exchange earning, income distribution and other things of relevance to national objectives. The purpose of SCBA is to see whether these consequences taken together are desirable in the light of the objectives of national planning.

Social costs and benefits of the project is the primary focus of the SCBA and they tend to vary from the monetary costs and benefits of the project. Some of the principal sources of discrepancy are:

MARKET IMPERFECTIONS

The basis for computing the monetary costs and benefits of a project are the market prices. They reflect the social values only when the perfect competition is prevalent which of course is very rare in developing countries. When imperfections are obtained, market prices do not reflect social values.

Rationing, prescription of minimum wage rates and foreign exchange regulations are some of the market imperfections found in the developing nations.

EXTERNALITIES

The effects of the project that work outside the market are called ‘externalities’. For example, an industrial project may produce a great deal of smoke and it may create employment opportunities. The commercial profits do not take into account the pollution that is caused by the project and the employment opportunities created by the project.

In SCBA, the cost of such pollution and the external benefit on account of increased employment are relevant, though monetary costs or benefits are not involved. It is, therefore, emphasized that externalities are relevant in SCBA because in such analysis all costs and benefits, irrespective to whom they accrue and whether they are paid for or not, are relevant.

TAXES AND SUBSIDIES

Taxes are monetary costs and subsidies are monetary gains for a project sponsor. However, from a social point of view, they are generally regarded as transfer payments and hence are irrelevant.

CONCERN FOR SAVINGS

A private firm is not concerned about how benefits are used for consumption and savings and does not put differential valuation on savings and consumption. From a social point of view, this division between savings and consumption is essential. A rupee of benefits saved is deemed more valuable than a rupee of benefits consumed. The concern of society is duly reflected in SCBA wherein a higher valuation is placed on savings and lower valuation on consumption. This is especially true for countries which are capital scarce and whose saving potential is low.

CONCERN FOR REDISTRIBUTION

A private firm is unconcerned about how the benefits are distributed. However, a society is concerned about the redistribution of benefits across various segments. For instance, a project which uses large amount of poor, unskilled labor might be preferable from social point of view than another project which uses factors of production supplied by rich people.

MERIT WANTS

Goals and preferences are not expressed in the market place, but believed by policymakers to be in the larger interest, may be referred to as merit wants. Merit wants are not relevant for a private firm, but are important from the social point of view. When two projects, one proposing to produce liquors and another producing cement are compared, that latter may be considered as more desirable even though the former may be expected to generate more profits.

Significance of SCBA

Firstly, it has to provide a basis for evaluation by providing prices that would be appropriate for social calculations. Secondly, it enables the decision maker to consider the costs and benefits to all those effected by the project, directly or indirectly.

One should remember that SCBA is not a technique, but an approach. It provides rational framework for project choice using national objectives and values. Projects are judged in terms of their precise impact on the economy, and this impact is evaluated by using parameters reflecting national goals, social objectives and global facts. This is relevant not merely for the evaluation of given projects, but also for formulating new ones and implementing the chosen projects.

UNIDO APPROACH FOR SOCIAL COST BENEFIT ANALYSIS

The United Nations Industrial Development Organization (UNIDO) has developed a comprehensive approach to Social Cost Benefit Analysis. The approach is called UNIDO approach after the name of the organization. The approach has evolved through a series of symposia conducted by the UNIDO during the sixties. The final methodology of the approach has been published by the UNIDO in the earlier part of the seventies.

The approach can be studied in the following stages each of which leads towards a measure of the social benefit of the project:

1. Calculation of financial profitability at market prices.
2. Shadow pricing of resources to obtain the net benefit at economic prices.
3. Adjustment for the project's impact on savings and investment.
4. Adjustment for the project's impact on income distribution.
5. Adjustment for the project's production or use of goods whose social values are less than or greater than their economic values.

Each of the above stages is based on modifications of integrated standard analytical tables which along with the graphical analysis help the analyst to do a complete economic evaluation of a project and its quantifiable social impacts.

Again each of the stages is designed to throw light on the project's desirability from a different angle. No single stage of the UNIDO method can provide sufficient information for judging the merit of a project.

While evaluating a project, the following points are to be considered:

– For a meaningful economic evaluation a good technical and financial analysis must be done for which stage one (i.e., financial profitability) becomes a prerequisite.

– In a perfect market (i.e.) where prices reflect the relative scarcity values of various goods, a commercial profitability analysis would be sufficient. However, if the market is imperfect, the economic-benefit analysis of stage two, is required.

– Stage three will be important for projects that generate benefits to groups who save very little out of additional income, especially in countries short of capital because of the gap between the actual and needed savings for investment.

– The importance of stage four depends on the priority the government gives to increasing the income of the poor and on the degree to which the project generates more than average benefits to either the very rich or the very poor.

– Stage five will probably be needed only in unusual instances where the project produces or uses a good whose social value is different from economic value.

These five stages of analysis, combined with the technical and managerial analysis that must be part of the financial analysis, complete the conventional project appraisal.

I. Financial Profitability and the Analytical Framework

This stage produces an estimate of the project's financial profit or the net present value of the project when all inputs and outputs are measured at market prices. Detailed analysis of this stage has already been covered in the earlier chapters.

II. Direct Economic Benefits – General Issues and Principles

Market prices reflect shadow prices only in perfect market conditions.

This stage produces an estimate of the net present value of the project measured at efficiency (shadow) price instead of market prices.

SELECTIVE SHADOW PRICING

Theoretically, all shadow prices should be derived from a comprehensive mathematical model of the economy. Practically, shadow pricing should be done selectively in terms of two criteria: First, which resources figure most prominently in the benefits and costs of the project at market prices? Secondly, what are the resources whose market prices are significantly different from the shadow prices? These criteria concentrate on scarce analytical resources on the most important divergences between market and economic profitability. However, it should be noted that both these criteria must be applied simultaneously.

The following are the obvious items for shadow pricing:

a. Main outputs – They constitute virtually the entire benefit stream if there are no externalities and are often sold at protected prices.

b. Importable material inputs – If domestically produced, they may enjoy substantial protection, if imported, they may be heavily taxed.

c. Major non-imported material inputs – They often involve significant tradable material content that is protected.

d. Unskilled labor – Its market wage often exceeds its shadow wage.

Economic project appraisal in practice is often limited to these items.

FUNDAMENTALS OF SHADOW PRICING

This deals with some of the basic issues of shadow pricing that must be disposed of before we go into the discussion of shadow pricing of specific resources. These issues include the concept of tradability, the sources of shadow prices, the treatment of taxes, the choice of num' eraire, and the use of adjustment factors.

Tradability is whether a good is tradable i.e. whether it can be imported or exported. A good is said to be tradable, if the good can be imported instead of domestic production and can be exported instead of domestic consumption. The economic opportunity cost or its real value to the country in terms of pure efficiency of such a good is the international price.

The major categories related to tradability are:

Tradable – A good that would be imported or exported in the absence of trade barriers such as tariffs and quantitative restrictions.

Traded – A tradable that is actually traded.

Non-tradable – A good whose real domestic cost of production together with its international transport cost is too high to permit export and too low to make import attractive.

Non-traded – A tradable that is not traded because of the trade policies of the country.

Sources of Shadow Prices for any resources in a perfect market would be its market price. In a perfect market, the price that the consumers are willing to pay for one more unit (marginal value) would be exactly equal to the producer's cost of supplying it (marginal cost). If the resources were traded internationally, the market price would also equal the relevant border price. But, because of the existence of market imperfections like tariffs, quotas and monopolies, distortions are created in demand and supply and there is a little chance that the market price will reflect the true economic value and cost of inputs and outputs.

In such imperfect market conditions, the guidelines recommend three sources of shadow prices depending on the project's impact on the national economy. A project through its use and production of resources for any given input or output may affect the:

– Supply available to the rest of the economy

– Level of its production in the rest of the economy

– Level of its imports or exports.

In terms of production of an output the project may:

– Increase total consumption in the economy

– Decrease production in other parts of the economy

– Decrease imports or increase exports.

The corollary impacts of a project's consumption of inputs may be:

– To decrease consumption in the rest of the economy

– To increase production within the economy

– To increase imports or decrease exports.

A project may have all the three of these impacts simultaneously, and they in turn may affect both inputs and outputs.

Taxes often pose problems when efficiency (shadow) prices are being calculated. The general rule is that when a project takes non-traded inputs that are in fixed supply away from other producers or adds non-traded consumer goods, taxes should be included as part of the indication of the consumer willingness to pay the marginal economic value. Taxes should be ignored for fully traded goods and taxes should be excluded if the project increases the production by other domestic producers.

Determination of the num'eraire is one of the foremost steps in shadow pricing. It is the determination of unit of account in which the values of inputs and outputs are to be expressed. A num'eraire is the unit of account in which unlike quantities are expressed so that they can be added up. Its complexity depends on the differences among the items to be summed that are worthy of consideration. Inflation, present value, shadow prices, savings and consumption, distribution are some of the concepts to be taken into consideration while establishing a num'eraire.

A num'eraire if it is to serve the purpose of economic and social project analysis, must include specifications with respect to the:

– unit of currency to express the benefits and exceed costs – domestic or foreign

– value of currency – current or constant value

– point when costs are incurred and benefits are received – past, present or future

– relative price or value system used (domestic market or foreign trade)

– use that will be made of income from the project – consumption or investment

– recipient of the income – rich or poor, government or private, etc.

The full specification of the UNIDO num'eraire in terms of these criteria is "the net present consumption benefits in the hands of people at the base level of consumption in the private sector in terms of constant price domestic accounting rupees."

Direct Economic Benefits – Specific Applications

Shadow Pricing of Specific Resources

Tradable Inputs and Outputs

The guidelines of UNIDO tend to predict that tradable goods that are not freely traded today will not be freely traded in future and should be treated as non-tradable goods. A good is fully tradable if the impact of any increased consumption will result in more imports or fewer exports and increase in production results in fewer imports, and more exports, and other things being equal.

A good that is fully tradable is not necessarily freely traded, encumbered by import or export taxes. To be fully traded, it is not only necessary that domestic changes in demand or supply affect the level of imports or exports, but also for the impact of a project's demand should leave the market price and domestic production unchanged. Thus, for a good to be fully traded it should fulfill the following conditions:

a. If the goods are subject to an import quota, the available quantity at present is only partially taken up or the quota will be expanded to allow additional demand for inputs to be met in the international market.
b. The import supply tends towards perfect elasticity over the relevant range of import volumes, which implies no rise in supply cost and thus no decrease in demand.
c. There is no excess capacity in the domestic industry, all additional supply must come from abroad. If there is any domestic excess capacity, it must be due to shortages not of demand, but of necessary inputs that will remain unavailable.
d. If the additional demand occurs inland, the import price including transport costs from the port of entry do not exceed the marginal cost of local production, so that imported goods are still cheaper.
e. The import price of the input, including taxes, is less than the domestic marginal cost of purchase (including taxes, profit margins, etc.)

The shadow price of a good, if it is fully tradable, is the international price.

A good is non-traded if it is tradable but conditions (a) to (e) do not prevail and are not expected to prevail in the future, so that the border price no longer reflects its economic value. A non-traded good if its production makes additional supplies available to consumers or if its use as an input takes it away from other users must be valued at its marginal economic value, i.e. the amount domestic consumers are willing to pay for an additional unit. A non-traded good if the project induces additional production or decreased production by less efficient domestic competitors must be valued at its marginal economic cost, i.e. the cost of producing an additional unit.

Non-tradable Inputs and Outputs

A good is a natural non-tradable one if the domestic cost of production is above the CIF prices i.e., cost of import or if its FOB or export price is less than its domestic cost of production.

If the only impact of additional production of such a good is to increase consumption within the country, the marginal consumers willingness to pay is the relevant shadow price. If additional production replaces other production of the same non-tradable good within the economy, the alternative production costs avoided are the measure of value. On the input cost side, if additional production of the good reduces the availability of one of its non-tradable inputs to other producers, their willingness to pay for this input is the shadow price. If the project's demand for the input generates additional domestic production of the input, production costs of such input are relevant. In the latter case, the international trading opportunity cost may again become relevant.

Externalities

These may be considered as a special class of non-traded goods that may be either positive or negative. These goods do not have a market price and in some cases may by law or custom be given away. The society has not designed a mechanism for charging beneficiaries or for compensatory payment by producers. Positive externalities arise, for example, from workers' training; but the beneficiaries pay no charge. Equally, negative externalities arise from air pollution, but those adversely affected are not compensated. An economic value can be imputed to some resources such as housing for workers on the basis of comparable facilities for which a price is charged.

In practice, however, knowledge of the economic value of such externalities is limited, but if and when valued, their net present value should be added to the net cash flow in the standard cash flow.

Labor Inputs

Labor is usually thought as a service rather than a good, but the principles of shadow pricing used for goods apply here. The analyst must consider the project's impact on the rest of the economy when it hires labor.

The first type of impact, taking labor away from other users, refers to situations where workers are already employed and thus it is necessary to consider the production that would be given up if they left to work in the proposed project. The second type of impact is that improvement of productivity of underemployed workers, urban employment of rural workers or skilled employment of previously unskilled, but fully occupied workers which involve many variables both in terms of costs and benefits. The third and final type of impact, the hiring of workers from abroad, has a clear-cut economic cost.

At this stage in the UNIDO analysis, the shadow prices reflect only the economic efficiency of labor. The impact on savings and consumption of hiring labor is analyzed separately in stage three while the impact on income distribution is reviewed in stage four. This step-by-step approach sets the UNIDO method apart from the Little-Mirrlees method where the social costs and benefits of employing workers are built into the shadow wage rate. The UNIDO method is, therefore, advantageous as it identifies explicitly the economic cost of pursuing social objectives. It also permits the effects of income distribution that lie outside wage effects to be included.

To sum up, we can say that the shadow wage rate can be determined in a manner directly analogous to that used for other inputs, the impact may fall on other employers, on the production of labor, or on its imports. It should also be noted that the additional consumption of foreign exchange out of additional earnings because of the project or changes induced in consumption patterns by the project should be included as one of the economic costs of employing labor.

Capital Inputs

The capital costs of a project can be seen from two different perspectives for shadow pricing. For practical purposes, let the terms asset and rent components be used. Now, for instance, if Rs.50,000 is invested in a project say A, then two things follow sequentially. Firstly, this Rs.50,000 of financial resources is converted into real physical assets. Secondly, the investor removes this Rs.50,000 of financial resources from the pool of savings that might be used for investment in alternative projects. Once invested in project A, these assets should yield benefit or rent at least equal to what they would have otherwise earned.

The shadow pricing of capital thus presents two problems:

a. how to measure the value of the physical asset *per se*

b. how to measure the rental value or the opportunity cost of capital – the benefits forgone by freezing investible resources as assets in project A instead of using them somewhere else.

Pricing of the asset component is exactly the same as for any other resource. If it is a fully traded good, the value is its border price. If it is partially traded or non-traded, its shadow price is its economic cost of production if the project induces increased domestic production, or its economic value measured in terms of consumer willingness to pay if the project takes it away from alternative users. The labor involved in the construction of the physical facilities is likewise valued according to the guidelines. In each case the adjustment factor is calculated, and an appropriate economic adjustment is added to or subtracted from the net present values of capital investments at market prices. In practice, capital costs with roughly similar adjustment factors can be grouped together to minimize the work.

The second part of the capital cost, is its rent component or the opportunity cost or foregone productivity of the capital in other uses. The analysis here is strictly parallel to that for other resources:

– The economic cost of capital is the cost of generating capital resources through additional savings.

– Its economic value is the value of additional production in alternative uses.

To the extent that capital for the project is generated from additional savings, its economic cost is the price or rent savers must be paid to forgo an additional unit of present consumption, the consumption rate of interest (CRI). To the extent that the capital is taken away from competing investments, its economic value is its marginal product at shadow prices in the marginal investment, the investment rate of interest. In practice, it is not necessary to figure out where the capital came from, and hence a blend of interest rates can be used, because stage three converts the value of all inputs and outputs into their consumption equivalents. It is, therefore, sufficient to use the CRI as the discount rate.

Determination of the CRI poses some problems. However, two approaches can simplify the task considerably. The first is to use the accounting rate of interest or opportunity cost of capital as a crude first estimate of the CRI. The second is to treat the discount rate as a budgetary device rather than as an economic reality that can be verified empirically, if the first estimate of the discount rate indicates that more projects are acceptable that can be financed with the available funds, the discount rate should be raised. Conversely, if the investment implied by the acceptable projects (including investing the money abroad) leaves excess investment funds, the cut-off point for the discount rate should be lowered.

Foreign Exchange

As the UNIDO method uses domestic currency as the num'eraire, the project's foreign exchange impact must be identified so that the project's net present economic value may be adjusted by an appropriate premium, assuming that foreign exchange is more valuable than indicated by the exchange rate. This process increases those economic-efficiency values that were measured in border rupee by the percentage of premium on foreign exchange, a factor that roughly indicates the level of protection in the economy i.e. the difference between average market and average border prices. This adjustment makes the prices established with reference to border prices compatible with prices based on domestic consumer willingness to pay in the protected market. If the foreign exchange impact is positive, the net present value before adjustment will be increased by the adjustment; conversely, if it is negative, the net present value will be reduced.

In principle, all inputs and outputs are either tradable that can be valued directly in terms of foreign exchange or non-tradable whose inputs can be disaggregated in terms of tradable, non-tradable and labor. If the non-tradables identified in the first round of disaggregation are further disaggregated in a similar manner and so on, theoretically any non-tradable can be valued in terms of its foreign exchange, domestic labor and capital content. Thus, it is impossible to say that the project analyst should count only the direct foreign exchange impact of the project in this part of the UNIDO analysis, the line between direct and indirect is too arbitrary.

The shadow price of a foreign exchange is equal to:

$$\sum_{i=1}^{n} F_i \; Q_i \; P_i$$

Where,

F_i = Fraction of foreign exchange, at the margin, spent on importing commodity 'i'

Q_i = Quantity of commodity 'i' that can be bought with the unit of foreign exchange

P_i = Domestic market clearing price of commodity.

The best known approach to determine the cost of producing foreign exchange is the domestic resource cost method proposed by Michael Bruno. While this approach is oriented to the cost of producing foreign exchange by a single project, the same principles apply at the macro level. However, at the gross level the analysis becomes more complex in that elasticities of alternative sources of foreign exchange and of the demand for imports become important.

Measurement of the Distribution Impact

Stages three and four of the UNIDO method deals with the value of the project's impact on savings and investments and that on income distribution. In these stages values would be placed on these impacts so that the economic net present value calculated in stage two is adjusted accordingly. But first of all the magnitude of these impacts must be measured and for such measurement an income flow analysis is designed.

General Concepts

Measurement: The additional income gained or lost by individual groups within the society because of the project must be measured. These gains and losses are assumed here to be equal to the distortion between shadow and market payments to each input or output in the case of physical resources or the distortion between price paid and value received in the case of financial transactions.

Groups: The groups that lose and gain income because of the project may be defined in many ways. For income-distribution analysis, various groups have been identified in a society. The following are some of them:

- Project
- Other private business
- Government
- Workers
- Consumers
- External sector.

Many other equally valid groupings are possible, depending on the degree of sophistication desired in the analysis.

III. Distribution of Benefits Over Time – The Savings Impact

The difference between consumption and savings is, in the final analysis, the difference between consuming now and consuming later. Additional future consumption is made possible when investment yields its returns. For this reason, the impact of a project on savings is often spoken of as intertemporal income distribution.

It is also important to note that the impact of projects on savings and consumption, often is a vital consideration in the choice between a capital-intensive and a labor-intensive project or between different designs of the same project. Stage three is, therefore, designed to:

- Determine the amount of income gained or lost because of the project by different income groups.
- Evaluate the net impact of these gains and losses on savings and give the marginal propensity to save each of these groups.
- Place a premium on the additional savings, the project will induce by its impact on income distribution.

The effect on savings of this income redistribution depends on the percentage of additional income each of these groups save, its marginal propensity to save (MPS), and the rate of return that can be earned on the savings.

The rate of return that can be earned on each additional unit of savings is called the marginal productivity of capital. In other words, it is the income that can be generated from each additional unit of investment, invested at the margin.

If the marginal productivity of capital is ‘s’ and the reinvestment rate on additional income arising from reinvestment is ‘i’, the cash flows can be represented as follows:

Year	0	1	2	3	......n.....
Cumulative Investment	1	1 + si	$(1 + si)^2$	$(1 + si)^3$	$(1 + si)^n$
Income		S	s(1 + si)	$s(1 + si)^2$	$s(1 + si)^{n-1}$
Additional Investment		Si	si(1 + si)	$si(1 + si)^2$	$si(1 + si)^{n-1}$
Consumption		s(1 – i)	s(1 – i) (1 + si)	s(1 – i) $(1 + si)^2$	s(1 – i) $(1 + si)^{n-1}$

Having derived the cash flows, our next job is to calculate their present value, which represents the value of the savings in today’s terms. But, for calculating the present value, we need a discount rate. Which rate should we use? The rate to be used is called the social discount rate. How is it determined? It is generally subjective, and depends on the value placed on savings by the person carrying out the appraisal. Higher the value placed on generation of savings, lower is the discount rate and vice versa. The value of each unit of savings is equal to the present value of the consumption it provides in future. That is, present value of one unit of savings we started with in the table, at a discount rate of ‘d’, is equal to:

$$\frac{s(1-i)}{(1+d)} + \frac{s(1-i)\,(1+si)}{(1+d)^2} + \frac{s(1-i)\,(1+si)^2}{(1+d)^3} + \ldots\ldots + \frac{s(1-i)\,(1+si)^{n-1}}{(1+d)^n}$$ n}}>

The above expression can be simplified to:

$$= \frac{\dfrac{s(1-i)}{(1+d)}}{1-\dfrac{(1-si)}{(1+d)}} = \frac{s(1-i)}{(1+d)} \text{ x } \frac{1+d}{(1+d)-(1+si)} = \frac{s(1-i)}{(d-si)}$$

The sum of the series is $\frac{s(1-i)}{(d+si)}$. It should be noted that what we have calculated is the present value of the additional consumption made possible through saving and investment.

IV. Income Distribution Impact

In many countries the redistribution of income between the public and private sectors to specific regions or to specific income classes is of high priority when projects are selected, because the government has not been able to accomplish this redistribution more directly and efficiently through macroeconomic policy measures such as taxes and subsidies. It then becomes necessary to evaluate the impact on this objective of all projects and to adjust their net present values depending on the importance placed on the objective and on the degree to which they can help accomplish it.

The analysis in this stage is relatively easy because the project’s distribution impact on income flows has been measured in preparation for stage three. Provided that the target groups for income distribution have been identified separately, the net gain or loss of income by each group is known. Treatment by region of payments and receipts for resources, including output, material inputs, labor and capital, requires careful thought regarding the source and estimation of the resources involved and the use to which they would have been put in the project’s absence. After the net impact on the group has been calculated, weights must be assigned to reflect the relative value of income in the hands of the various groups.

Distribution Adjustment Factors

The adjustment of the income of each group is to be done separately to reflect the differential social values, and is then added to the net benefits again to obtain a revised estimate of the net benefit, taking income distribution into account. The income-flow values are then multiplied by the adjustment factors and the product is added to or subtracted from the net present values, which have been adjusted for savings impact, to obtain social net present values that reflect the income-distribution impact of the project. The adjustment factor will naturally be negative for income flows to the rich and positive for those to the poor.

Estimation of Distribution Weights

The guidelines suggest that weights can be determined through an iterative process between the analysts at the bottom and the planners at the top. Using the preference revealed by the planners for projects with different net present values and distribution impacts, the analyst can determine the weights these planners implicitly assign when they accept some and reject others.

Illustration 1

Consider the case where the analysts first present a project with net present value of Rs.1 million. Two income groups have been identified: people with income less than Rs.100 per month and the rest of the economy. Also assume that distributional analysis shows that the project over its life would generate incremental income flows to the low-income group of Rs.5 million in net present-value terms. If the planners accept the project, it implies that they place a premium of at least 20 percent on income going to the poor, for 20 percent of Rs.5 million is Rs.1 million, which, when added to the negative net present value of Rs.1 million, will bring the net present value of the project to zero, the marginally acceptable level. If the planners reject this project, but accept others requiring at least a 15 percent premium on income going to the poor, the project analyst knows that the switching value of the premium lies somewhere between 15 and 20 percent. Provided that the planners are consistent over time and that all other non-quantified factors are equal, a usable weight to be placed on income distribution can be derived by this process.

The above procedure for determining weights and thus adjustment factors, for income distribution works if only two groups are involved. If, however, there are more than two groups, this bottom-up switching value procedure does not do good. In such instances, a slightly more sophisticated method is needed, which focuses on a single factor that determines the income-distribution weights. This single factor is the elasticity of the marginal utility of income, or, in simple terms, the percentage by which the social value placed on additional income falls with a 1 percent rise in income.

For instance, if the value of this indicator is taken as zero, additional income at all levels is equally valuable from a social point of view. If the value is 1.0, a 1 percent increase in income of a person earning Rs.100 per year is just as socially valuable as a 1 percent increase in the income of a person earning Rs.1,000 or Rs.10,000 per year. This would imply a weight of 1/10 at the Rs.1,000 level and of 1/100 at the Rs.10,000 level if the weight at the Rs.100 level is taken as 1.0. With this approach, the sensitivity analysis in the bottom-up procedure focuses on the elasticity of the marginal utility of income.

In general, the weight attached to an income is given by the formula:

$$w_i = \left(\frac{B}{c_i}\right)^n$$

where, w_i = Weight assigned to an income level of c_i
B = Base level of income, which is assigned a weight of 1
n = Elasticity of marginal utility of income

V. Merit and Demerit Goods

If the social value of the good is more than its efficiency value, the good may be called a merit good and an upward adjustment should be made. For instance, a country may want foreign exchange simply to increase its ability to withhold its exports for strategic political reasons.

On the other hand, if the social value of a good is less than its efficiency value, then that good may be called as a demerit good and a downward adjustment should be made. For example, a country may include tobacco/alcohol and luxury consumption items in this category.

The procedure for taking into account the differences between the economic and social values of a good is basically same as in the previous stages. First, its social value is estimated. Next the adjustment factor is calculated by subtracting unity from the ratio of its social value to its economic value. Its efficiency price is then multiplied by the adjustment factor to obtain the adjustment. This adjustment is then added algebraically to the net present value of stage four.

Illustration 2

Consider a cigarette factory whose present economic value of the cigarettes produced in terms of willingness to pay is Rs.10 million. The cigarettes are regarded as having no more social value than their cost of production (assumed to be 60% of the market price).

Under these assumptions, the adjustment factor would be –0.4 or (60%/100% – 1). This factor of – 0.4, reflecting the socially valueless portion would be applied to the entire Rs.10 million. The resulting adjustment of Rs.4 million would then be subtracted from the net present value of the project to obtain the net present value in terms of socially acceptable consumption.

The procedure is slightly different in situations such as employment creation, where the socially valuable product does not even appear as an output in the economic efficiency accounts. In such cases, the annual benefit in social prices is calculated, discounted to the present at 0 percent, 10 percent and 20 percent, added to the basic net present value of the project at each discount rate, and the new adjusted totals are plotted to indicate the rate of return.

Also, it is important to note that even the economically disastrous projects can be made to show good social rates of return. There is no certain way to prevent this, but these dangers can be reduced by following the guidelines stage by stage. This method generates a series of estimates of the project's desirability, thereby making it possible to see the exact cost in terms of net present value.

LITTLE – MIRRLEES APPROACH

The approach developed by Little and Mirrlees for social cost benefit analysis is considerably similar to that of the UNIDO approach. The following are some of the similarities:

- Calculation of accounting (shadow) prices for foreign exchange savings and unskilled labor.
- Consideration of factor of equity.
- Usage of discounted cash flow analysis.

Though certain similarities exist there are also some differences between both the approaches. Some of the dissimilarities are,

- L and M approach measures costs and benefits in terms of international prices (border prices) whereas the UNIDO approach measures costs and benefits in terms of domestic rupees.
- L and M approach measures costs and benefits in terms of uncommitted social income whereas the UNIDO approach measures costs and benefits in terms of consumption.
- The L and M approach considers efficiency, savings and redistribution together for analysis whereas in UNIDO these considerations are looked into and done in different stages.

Shadow Prices

The inputs and outputs of a project are classified into

- traded goods and services
- non-traded goods and services
- labor.

Shadow Prices of Traded Good

The shadow price of a traded good is its border price. If a good is exported, its shadow price is its FOB price and if a good is imported its shadow price is its CIF price. The marginal export revenue is substituted for the FOB price if the foreign demand is not perfectly elastic and if the foreign supply is not perfectly elastic, the marginal import cost is substituted for the CIF price. The reason behind using border prices is that border prices represent correct social opportunity costs or benefits of using or producing a traded good.

Shadow Price of Non-traded Goods

Shadow prices of non-traded goods are defined in terms of marginal social cost and benefit.

The resources used to produce an extra unit of a good is the marginal cost of a good. The value of an extra unit of the good from social point of view is the marginal social benefit. When a good is not taxed and is consumed by only one income group, then its marginal social benefit is equal to its market price multiplied by a factor which represents the value assigned to an increase in the income of that group vis-á-vis an equal increase in uncommitted social income.

The shadow price of a non-traded good is determined by estimating the proportion in which the demand for that input will be met from increased production and decreased consumption elsewhere in the economy. If the proportion of increase in production to decrease in consumption is 2:1, then the shadow price of the non-traded output will be:

2/3 Marginal social cost + 1/3 Marginal social benefit

Use of Conversion Factors

Calculation of marginal social cost and benefit is practically difficult. Therefore, L-M suggested that the monetary cost of a non-traded item is to be broken down into tradable, labor and residual components. The tradable and residual components may then be converted into social cost by applying suitable social conversion factors, the labor component's social cost can be obtained by using shadow wage rate.

Shadow Wage Rate

This is an important, but a difficult factor in social cost benefit analysis as it is a function of several factors:

- The marginal productivity of labor
- The cost associated with urbanization
- The cost of having an additional amount committed to consumption when the consumption of workers increases, as a result of the higher income he enjoys in urban employment.

The following is the formula for calculation of shadow wage rate which has been suggested by L-M:

$$\text{SWR} = c' - \frac{1}{s}(c - m)$$

where SWR = Shadow Wage Rate
c' = Additional resources devoted to consumption
1/s = Value of a unit of committed resource
m = Marginal product of the wage earner

The above formula can be expressed as follows to make the impact of various factors on the shadow wage rate more clear:

$$SWR = m + (c' - c) + \left(1 - \frac{1}{s}\right)(c - m)$$

The first term, m, represents the marginal product of labor. The shadow wage rate increases with increase in m. $(c' - c)$ represents the costs of providing the consumption level of 'c' to the worker. In other words, it is the additional cost to be incurred for providing the worker an urbanized life. Again higher the cost of urbanization, (i.e. $(c' - c)$, higher is the shadow wage rate. 1/s is the value of each unit of committed resource. Higher the value, lower is the shadow wage rate, if c > m.

Accounting Rate of Return

The accounting rate of return is the rate used for discounting social profits. The following factors should be considered for determination of the accounting rate of return:

- The same accounting rate of return should be used for discounting all the future social profits of all projects.
- The accounting rate of return should be so chosen that all projects that are compatible with each other and provide a positive social present value can be accepted.
- The rate selected should enable maintenance of a balance between the investments made and the funds available for investments.
- If certain conditions are satisfied, the rate of return being earned on the current project may be used as the base for selection of the rate. The conditions to be satisfied are,
  - uniform indirect taxes, that is, absence of discrimination in the indirect tax rate of imported and exported commodities.
  - the gap between the social wage rates and actual wages being very low or absent.
- The rate of return should be fixed at such a level that, at the new rate, only few from the best of the projects undertaken in the past get through.
- Availability of funds is also an important factor. If funds are available in abundance, the rate of return may be reduced and more number of projects may be selected.

SCBA METHODS FOLLOWED BY FINANCIAL INSTITUTIONS

The development finance institutions in India, probably because they are (mostly) owned by the Government, evaluate all the projects they fund from the social angle as well. In this section, let us study the methods followed by the Industrial Development Bank of India (IDBI). The social cost benefit analysis carried out by the IDBI is based on three concepts:

i. Economic rate of return.

ii. Effective rate of protection.

iii. Domestic resource cost.

Economic Rate of Return

IDBI follows a modified version of the Little – Mirrlees approach to Social Cost Benefit Analysis. Some prefer to call it 'Partial Little – Mirrlees Approach'. The approach of the IDBI may be summarized as follows:

i. All non-labor inputs and outputs are valued at international prices. The rationale is that the international prices reflect the true economic value.

ii. In the case of tradeable items for which international prices are directly available, international prices are used. Inputs are valued at CIF prices and outputs are valued at FOB prices.

iii. For tradeable items whose international prices are not available, social conversion factors are used. The rupee value of the tradeable goods is multiplied by the social conversion factors to obtain the social value. The rupee value of each good is divided into tradeable, non-tradeable and residual components. This is because the value of goods may contain some inputs that went into their production and are tradeable. The social conversion factors are then applied to the tradeable, non-tradeable and residual components of the rupee value of the good to get the social value of the components. The sum of the social value of the components is taken as the social value of the good.

The social conversion factors and weightage for different components used by the IDBI are:

Social Conversion Factor (SCF) or Proportions of Three Components, Tradeable (T), Labor (L), and Residual (R)

Item	SCF or Proportions
Land	SCF = 1/1.5
Buildings and Construction	Proportions: T = 0.5, L = 0.25, R = 0.25
Indigenous equipment	SCF = 0.70
Transportation	Proportions: T = 0.65, L = 0.25, R = 0.10
Engineering and know-how fees	SCF = 1.50
Bank charges	SCF = 0.02
Preoperative expenses	SCF = 1.00
Labor	SCF = 0.50
Salaries	SCF = 0.80
Repairs and maintenance	SCF = 1/1.5
Water, fuel, etc.	Proportions: T = 0.50, L = 0.25, R = 0.25
Electricity	Proportions: T = 0.71, L = 0.13, R = 0.16
Domestic stores	SCF = 0.80
Other overheads	SCF = 1/1.5

The social conversion factors for various components (tradeable, non-tradeable and residual) are same for all goods. They are:

Tradeable Component	1/1.5
Non-tradeable Component	0.5
Residual Component	0.5

Illustration 3

A and M Ltd. is appraising a project to produce a product which is presently being imported. The proposed project will have a capacity to substitute the entire volume of imports. The life of the project is expected to be eight years. The capital expenditure estimates for the project are as follows:

(Rs. crore)

Land	0.50
Buildings	11.00
Plant and Machinery (Imported) (CIF Value: Rs.9 crore)	7.00
Plant and Machinery (Indigenous) (CIF Value of similar equipment is Rs.50 crore)	60.00
Transportation costs	2.00
Technical know-how Fees	6.00
Preoperative expenses	5.00
Bank charges	0.50
	92.00

The projected annual profitability statement of the company is as follows:

(Rs. crore)

Income	
Net Sales (15,000 tonnes at Rs.90,000 per tonne, CIF value Rs.80,000 per tonne)	135
Expenditure	
Imported raw materials (CIF value Rs.7 crore)	9
Indigenous raw materials	70
Labor	7
Salaries	5
Repairs and maintenance	3
Water, Fuel, etc.	7
Electricity (Rate = 4, duty = 2)	6
Depreciation	10
Other overheads	8
Taxable Profit	10

The working capital requirement is estimated to be Rs.20 crore (CIF value Rs.15 crore) and is expected to contain mostly imported raw materials.

Solution

Let us first calculate the social cost of the initial outlay. This, as already explained, has to be done in two steps: splitting all the capital inputs into tradeable, labor and residual components and then finding the social values of various components.

(Rs. crore)

Item	Financial cost	Basis of conversion	Tradeable value ab initio	T	L	R
Land	0.50	SCF = 1/1.5	0.33	–	–	–
Buildings	11.00	T = 0.50 L = 0.25 R = 0.25	–	5.50	2.75	2.75
Plant & Machinery (Imported)	7.00	CIF Value	9.00	–	–	–

Item	Financial cost	Basis of conversion	Tradeable value ab initio	T	L	R
Plant & Machinery (Indigenous)	60.00	CIF Value	60.00	–	–	–
Transportation costs	2.00	T = 0.65 L = 0.25 R = 0.10	–	1.30	0.50	0.20
Technical know-how	6.00	SCF = 1.50	9.00	–	–	–
Preoperative expenses	5.00	SCF = 1.00	5.00	–	–	–
Bank charges	0.50	SCF = 0.02	0.01	–	–	–
Working capital requirement	20.00	CIF Value	15.00	–	–	–
Total	112.00		98.34	6.80	3.25	2.95

Calculation of Social Value

	(Rs. crore)
Tradeable value ab initio	98.34
Social cost of tradeable component (6.80 ÷ 1.50)	4.53
Social cost of labor component (3.25 x 0.50)	1.63
Social cost of residual component	1.48
	105.98

Similarly, the social value of the various inputs consumed in the process of production can also be estimated:

Item Description	Financial Cost	Basis of Conversion	Tradeable Value ab initio	T	L	R
Imported raw materials	9	CIF Value	7.00	–	–	–
Indigenous raw materials	70	SCF = 0.80	56.00	–	–	–
Labor	7	SCF = 0.50	3.50	–	–	–
Salaries	5	SCF = 0.80	4.00	–	–	–
Repairs and Maintenance	3	SCF = 1/1.5	2.00	–	–	–
Water, Fuel, etc.	7	T = 0.50 L = 0.25 R = 0.25	–	3.50	1.75	1.75
Electricity (rate portion)	4	T = 0.71 L = 0.13 R = 0.16	–	2.84	0.52	0.64
Other overheads	8	SCF = 1/1.5	5.33	–	–	–
Total			77.83	6.34	2.27	2.39

Calculation of Social Value

	Rs.
Tradeable value ab initio	77.83
Social cost of tradeable component (6.34 ÷ 1.50)	4.23
Social cost of labor component (2.27 x 0.50)	1.14
Social cost of residual component	1.20
	84.40

CIF value of output = 15,000 x 80,000 = Rs.120 crore

Social net benefit per annum = 120 – 84.40 = 35.60

Let us assume that at the end of the life of the project, the working capital will be realized at Rs.15 crore and the net salvage value of fixed assets is Rs.2 crore. The flows of social benefits from the project are,

Year	Net Social Benefit (Rs. Crore)
0	– 105.98
1 to 7	35.60
8	35.60 + 2 + 15 = 101.40

The final step is to find the IRR of the flows of social benefits, which is the economic rate of return from this project. The rate is 30.08 percent. The acceptance or rejection of this project now depends on the required social discount rate determined by the appraiser.

Effective Rate of Protection

Governments of almost all the countries try, through various means such as taxes and tariffs, import and export restrictions, and subsidies, to protect the home industry. The degree of protection enjoyed by an industry provides an idea about how vulnerable (or otherwise) the industry is, to competition from overseas if the protection is withdrawn by the government. The degree of protection available to an industry can be gauged by expressing the value added by the industry at domestic prices reduced by the value added at world prices, and dividing the net amount by the value added at the world prices.

Effective Rate of Protection

$$= \frac{\text{Value added at domestic prices} - \text{Value added at world prices}}{\text{Value added at world prices}}$$

For calculating the value added, the cost of traded as well as non-traded inputs is reduced from the selling price.

Value added = Selling Price – Input Costs

The selling price used is the price net of taxes and excise duties, but including selling commission. The world prices for exported goods are FOB prices and the CIF prices for imported goods.

The traded inputs are valued at both world prices and domestic prices while the non-traded inputs are valued only at the domestic prices. The inputs are segregated into tradeable and non-tradeable on the following lines:

i. **Raw materials and stores:** These are, in general, treated as traded goods. The world prices are estimated at CIF prices. Bulky materials such as sand, whose volume is high compared to their value and also involve substantial transportation costs are treated as non-traded goods.

ii. **Power, fuel and water:** These are treated as non-traded goods except when the cost of fuel is significant. In such cases, it should be valued at both domestic and world prices.

iii. **Repairs and maintenance:** Generally a non-traded item, but the value of spares consumed is considered, at both domestic and world prices.

iv. **Selling expenses:** Non-traded item.

v. **Administrative overheads:** Administrative overheads contain two components: labor cost and other expenses. The labor cost is included in the value added. Therefore, it is not considered. The other expenses, like rent, telephone and telegraph, etc. are treated as non-traded items.

The value added, as already mentioned, is the difference between the value of the output and the value of the inputs mentioned above. In other words, value added is the surplus available for the providers of capital and labor.

Illustration 4

The following are the values at domestic and international prices of the inputs and outputs of a project:

(Rs. crore)

	Domestic Prices	World Prices
Inputs		
Tradeable inputs		
Raw Materials	450	350
Consumable Stores	75	40
	525	390
Non-tradeable inputs		
Power, fuel and water	35	—
Repairs and maintenance	20	—
Administrative overheads	45	—
Selling expenses	30	—
	130	—
Total input costs	655	390
Output		
Sales realization	750	450
Value added	95	60

$$\text{Effective rate of Protection (ERP)} = \frac{95-60}{60} \times 100 = 58.33\%$$

If the ERP = 0, it means that the domestic industry does not enjoy any protection from competition overseas. If it is > 0, it indicates presence of protection. If it is < 0, that means the domestic industry is more competitive.

Domestic Resource Cost

The domestic resource cost (DRC) is the spending required in terms of domestic currency to generate a saving of one unit of a foreign currency. The commonly used foreign currency for estimating DRC is the US dollar.

$$\text{Domestic resource cost} = \frac{\text{Value added at domestic prices}}{\text{Value added at world prices}} \times \text{Exchange rate}$$

The amount of value added for computation of DRC is estimated as follows:

	Domestic	International
Selling Price		
Less: Operation Costs:		
Raw Materials		
Power, Fuel, Water		
Repairs and Maintenance		
Administrative Overheads		
Selling Expenses		
Less: Capital Costs		
Charge on Capital Employed		
Depreciation		

It may be observed that there are two additional items in the above format, compared to the format for calculation of effective rate of protection – charge on capital employed and depreciation. The charge on capital employed is imputed at 10 percent. Capital employed is the sum of fixed assets and working capital. The charge of 10 percent is applied after breaking down the value into imported and indigenous components and netting out taxes and duties from the two components.

Depreciation on Capital Equipment is charged at 6 percent. Again, the value of capital equipments is bifurcated into imported and indigenous taxes and duties are netted out before charging depreciation.

The concepts of ERP and DRC are closely related. One of the two can be calculated from the other using the following relationship:

DRC = (ERP + 1) Exchange rate.

Based on this relationship and assuming an exchange rate of Rs.45 to a dollar, the domestic resource cost of the project mentioned in the illustration used for calculating the ERP is: (0.5833 + 1) x 45 = Rs.71.25. That is, for generating a saving of one dollar from the project, a spending of Rs.71.25 is required. Higher the DRC, lower is the desirability of the project.

PUBLIC SECTOR INVESTMENT IN INDIA

Social Cost Benefit Analysis is more relevant for public sector projects than those in the private sector. Public sector projects mooted by the Central Government are appraised by the Project Appraisal Division of the Planning Commission. The methodology followed by the Division for analyzing the projects consists of the following basic principles:

a. Border prices are used to value tradeable inputs.

b. Power, transport and other non-tradeable terms are valued at marginal cost.

c. Foreign exchange, amounts involved in inputs and outputs are valued at predetermined premia.

d. The values of transfer cost items such as taxes and duties are ignored.

e. Semi-skilled and unskilled labor is valued at shadow wage rates.

f. In contrast to the Little-Mirrlees approach, nume'raire is defined as savings in domestic rupees.

Social Cost Benefit Analysis is more important for public sector projects because it is public money that is invested. It is not unnatural to expect it to be invested in projects that are aimed at the highest benefit of the entire society in all the possible ways.

SUMMARY

- Financial benefit analysis alone is not sufficient before starting a project. As a project is set-up in a social system with the help of society, it is essential that benefits and cost of the project should be calculated from the viewpoint of society and economy. These benefits and costs are different from monetary benefits and costs. For example, generation of employment and effect on the environment cannot be measured in monetary terms. The two approaches – a five-stage approach given by United Nations Industrial Development Organization (UNIDO) and Little-Mirrlees Approach – are generally used for measuring the social benefits of a project. Financial institutions have different methods to measure social benefits of a project before financing it. SCBA is more important in public sector projects than in private sector projects.

Chapter XIII

Multiple Projects and Constraints

After reading this chapter, you will be conversant with:

- Conflicts in Ranking of Projects by Different Criteria
- Resolution of the Conflict in Ranking
- Techniques for Selection of more than One Project from a Group

Appraising an individual project using the various appraising techniques has been discussed in the chapter, "Appraisal Criteria". To recapitulate, consider six projects, A, B, C, D, E and F whose net cash flows are as follows:

Year	Cash Flows (Rs. Lakh)					
	A	B	C	D	E	F
0	–12.0	–12.0	–12.0	–12.0	–12.00	–4.0
1	2.5	1.8	8.5	4	1.50	1.5
2	3.5	3.5	6.5	6.0	2.75	2.2
3	4.3	5.0	3.4	7.0	3.00	2.4
4	5.0	7.5	1.7		3.50	
5	5.2	10.0	1.7		4.00	
NPV @ 13%	1.82	5.83	4.93	1.09	(2.12)	0.71
IRR	18	27	36	20	6	22
BCR	1.15	5.83	4.93	1.09	0.82	1.18

According to the appraising techniques the projects, A, B, C, D and F could be accepted as their net present values are greater than zero, BCR is more than 1 and internal rates of return are more than 13%, the cost of capital of the firm, whereas Project E could be rejected as its NPV is negative, BCR is less than zero and IRR is less than the cost of capital.

The following are the implicit assumptions while drawing the above conclusions:

i. The projects proposed and appraised should have the same risk exposure as the overall risk of the firm from whose point of view projects are appraised.

ii. The firm's cost of capital is not effected by the mode of funding of these projects.

iii. Projects under proposal are independent of each other and there should not exist any relationship between the projects nor between the cash flows of any project. There should be total project independence.

iv. Capital markets are perfect. This implies that there are no budget constraints, borrowing and lending can be made without any limits, no bankruptcy and transaction costs, free availability of information, etc.

v. There should not be any difference between the lending rates and borrowing rates.

Given the above assumptions if the projects are viewed individually, all the appraisal techniques give the same result. But, when it is necessary to choose two or more projects (but not all) from those that are acceptable, confusion arises because of conflict in the ranks assigned by different criteria. For instance, consider the six projects individually. All the techniques appraise an individual project alike, but when we compare projects A and F, according to NPV approach, Project A having a higher net present value is preferred and according to BCR and IRR project F having a higher profitability per rupee of investment and higher internal rate of return is preferred. Thus, conflicts may arise while selecting projects from a group. But, why does one need to consider comparison of projects?

There exist certain constraints which necessitate comparison between projects to take a decision. Such constraints may arise because of dependency between projects or insufficiency of funds available to invest in all the acceptable projects or because of the indivisibility of the projects. In effect, in this chapter, we would be considering the relaxation of assumptions (iii) and (iv) above.

Dependency between projects arises when two projects are either mutually exclusive (i.e. the acceptance or rejection of one project is dependent on the rejection or acceptance of another project) or when the cash flows of one affects, either negatively or positively, the cash flows of another. For instance, out of the above six projects assume there exists project dependency between Project A and Project B and further assume that both the projects are negatively dependent, i.e., if Project A is accepted the cash flows of Project B will be reduced and the total cash flows of both the projects will be as follows:

Year	P(A&B)
0	–24
1	4
2	6
3	7.3
4	8.25
5	8.7

The NPV and the IRR of the above cash flows works out to be – Rs.0.92 lakh and 12% respectively. Hence, when the projects were appraised individually both the projects were acceptable, but when project dependency is considered investment in both together is not justified based on both the NPV and IRR criterion and hence selection of one project out of the two is necessary.

Consider another case of project dependency where the projects are positively dependent, that is, acceptance of one project may positively influence the cash flows of another project. Assume, Projects C and E are positively dependent in such a way that Project C when accepted would increase the cash flows of Project E and the combined cash flows of C and E would be as follows:

Year	P(C&E)
0	–24
1	11.5
2	10.5
3	7.9
4	6.7
5	6.9

The NPV and the IRR work out to be Rs.7.73 lakh and 27% respectively. Hence, Project E if considered individually is not acceptable, but can be accepted when the effect of Project C is considered.

Yet, another case of project dependency is mutual exclusiveness. For instance, assume Project D and F are mutually exclusive i.e., if Project D is accepted Project F should be rejected and vice versa. Hence, viewed individually both the projects could be accepted but collectively both cannot be accepted. Hence, selection is necessary.

Thus, in all the above cases, comparison between the projects would be inevitable to take a decision.

The other constraints which necessitate comparison between projects are rationing of capital funds and indivisibility of projects. Assume funds available for investment are only Rs.27 lakh. Obviously, all the projects cannot be considered for investment and hence comparison should be made to decide upon the acceptance/rejection of the projects.

CONFLICTS IN RANKING

Considering the project constraints, to justify an investment the projects should be compared and the one which yields higher value should be considered for investment. Hence, in the first case of project dependency where projects A and B are negatively dependent, we have seen that both the projects should not be considered by comparing the NPV and IRR of the combined project of A and B. Thus, B alone can be accepted as its NPV, BCR and IRR are higher than A.

Similar is the second case of project dependency where projects C and E are positively dependent, and hence both the projects can be taken up collectively. In the third case of Projects D and F which are mutually exclusive projects either Project D or F can be accepted based on their net present values or internal rates of return. In the above case of project dependency between projects D and F, given the cash flows, at the cost of capital of 13%, according to NPV project D would be accepted and according to IRR and BCR, project F can be accepted. Thus, there exists a conflict.

Reasons for Conflicts

Before understanding the reasons of conflict one needs to know that conflict may arise when two or more mutually exclusive projects are considered. If there is only one project obviously there will not be any conflict between the appraising techniques. For instance, consider project A from the six projects given at the beginning.

According to NPV approach and also based on IRR the project is acceptable. Consider an increase in the cost of capital to 21%. The new NPV will be –Rs.0.78, BCR is 0.94 and IRR is calculated as 18%. Based on the NPV approach and BCR approach, as the net present value is negative and BCR is less than 1 the project should be rejected. According to the IRR criterion also, as the IRR is less than the new cost of capital of 21% it should be rejected. Thus, whatever may be the cost of capital, the result whether to accept or reject an individual project would be the same with all the appraising techniques. Thus, we can say that there is a chance of conflict only when there are more than one mutually exclusive projects. However, it should be remembered that conflict may or may not arise.

Conflicts between two appraising techniques while comparing two mutually exclusive projects arises because of the different assumptions of the appraising techniques related to the reinvestment of the cash flows.

Reinvestment Assumption of NPV

As already explained in the chapter ‘Appraisal Criteria’, net present value, which is the present value of the cash flows during the life of the project, assumes that the cash flows are reinvested at the cost of capital. This is based on the same principle of PVIFA i.e. the intermediate cash flows are reinvested at the discount rate. To illustrate take the project D. Its net present value, at the cost of capital of 13% is calculated to be Rs.1.09 lakh. Let us assume that the cash flows are reinvested at x% per annum. The future value of the intermediate cash flows at the end of the project life would be

$$= 4(1 + x)^2 + 6(1 + x) + 7$$

$$= 4 + 4x^2 + 8x + 6 + 6x + 7$$

$$= 4x^2 + 14x + 17$$

The net present value would be

$$\text{NPV} = \frac{4x^2 + 14x + 17}{(1.13)^3} - 12$$

When we equate the above with the net present value of Rs.1.09 lakh we get the reinvestment rate of 13% which is the cost of capital. Now consider the cost of capital to be 19%. The NPV of the project will be –Rs.0.25. By using the above procedure the reinvestment can be calculated as 19%. This implies that the NPV calculation is based on the assumption that the cash flows during the life of the project are reinvested for the remaining life at the cost of capital.

Reinvestment Assumption of Internal Rate of Return

IRR is that rate at which the net present value is zero or the rate at which the present value of the cash inflows is equal to the present value of the cash outflows. Take the same project as above. IRR of project D is calculated to be 19%. Again based on the same principle of PVIFA it can be said that the intermediate cash flows are reinvested at the discount rate which in this case is the IRR. However, this reinvestment rate may or may not be equal to the cost of capital and the conflict may arise if the cost of capital is not equal to the reinvestment rate of IRR.

Illustration 1

Consider the projects B and C. As already seen there is a conflict in ranking according to NPV and IRR. According to NPV, project B is preferred and according to IRR, project C is preferred. Let us consider the rankings according to both techniques at different discount rates. The rankings according to NPV would be as follows:

Discount Rate (%)	Net Present Value		
	Project B	Project C	Rank
16.0	4.26	4.08	I, II
16.9	3.83	3.84	Indifferent
18.0	3.32	3.56	II, I
22.0	1.67	2.6	II, I
26.0	0.26	1.75	II, I
30.0	(2.09)	(0.33)	II, I

As observed from the table above, up to the discount rate of 16.9% project B is preferred to project C and if the discount rate is more than 16.9% C is preferred to B. According to IRR, project C is always preferred to project B. Thus, there is conflict up to the discount rate of 16.9% and no conflict if the discount rate is more than 16.9%. And, at the discount rate of 16.9% both the projects give the same NPV and both are equally preferred. In financial parlance the point where one would be indifferent to both the projects is referred to as the Fisherian rate of return. In other words, Fisherian rate of return[1] is that rate at which the NPVs of two projects are equal. At or above the Fisherian rate of return, both the projects are ranked alike according to NPV and IRR.

Reinvestment Assumption of Benefit Cost Ratio

To understand the reinvestment assumption of BCR let us compare projects A and F. As already seen there is a conflict in ranking according to NPV and BCR. Let us assume that the project with the smaller outlay i.e. Project F is considered and the excess outlay of Rs.8 lakh required for the investment in the other project and the intermediate cash flows of the project considered are reinvested at the cost of capital of 13%. The future value of the reinvested cash flows would be equal to Rs.18.34 lakh. The net present value of the above cash flows would be equal to discounted value of the reinvested cash flows less the total outlay

i.e., $18.34/(1.13)^3 - 12$ = Rs.0.71 Lakh.

We find that the NPV of the above cash flows is equal to the NPV of the Project F because NPV criterion assumes that the cash flows are reinvested at the cost of capital.

The BCR of the project F is equal to 1.18. If we compare with the BCR of the above reinvested cash flows which is equal to the discounted value of the reinvested cash flows divided by the cash outlay required i.e. $[18.34/(1.13)^3]/12 = 1.06$ we find that the two figures are unequal. This implies that according to BCR the intermediate cash flows are not invested at the cost of capital.

To find out the rate at which the cash flows are reinvested according to BCR approach we need to find out the incremental cash flow of the above two projects and the discount rate which equates the above cash flow to zero is the reinvestment

1 A Fisherian rate of return may not always exist. It is possible that the NPV profiles of projects may not become equal at any rate of interest

rate. The discount rate of the incremental cash flows of the Projects A and F would be calculated as follows:

Year	Project A	Project F	Incremental Cash flow
0	–12	–4	–8
1	2.5	1.5	1
2	3.5	2.2	1.3
3	4.3	2.4	1.9
4	5		5
5	5.2		5.2

IRR of the above incremental cash flows is 17.11%. This is the Fisherian rate of return explained earlier. Thus the conflict between NPV and BCR basically means that the intermediate cash flows according to NPV is reinvested at the cost of capital while according to BCR these flows are reinvested at the rate above Fisherian rate of return.

Let us recapitulate the features of the three techniques before analyzing the situations where conflict may arise.

Net Present Value	Internal Rate of Return	Benefit Cost Ratio
• It measures the absolute magnitude of the expected discounted cash inflows reduced by the discounted cash outflows	It measures the compounded rate of return earned over the original investment	It is a relative measure, measures the profitability per rupee of investment
• Favors large investments	Favors small investments	Favors small investments
• Does not penalize the early low cash inflows	Favors early cash inflows	Favors early cash inflows

Specifically conflict may arise when there is size (amount of initial cash outflow) and time disparity among the cash flows. Conflict may also arise when there is difference in the life time of projects.

Resolution of Conflict and Selection of a Project

Size Disparity Between the Cash Outflows of the Projects

Size disparity indicates the disparity in the cash outlay for the investment in the projects. Consider projects D and F where the life of the projects and the timing of the cash flows of the projects are same, but differ in the cash outlay required. Project D requires substantial outlay of Rs.12 Lakh whereas F requires an outlay of Rs.4 Lakh only. As already given the NPV, BCR and IRR are as follows:

	D	F
NPV(Rs. Lakh)	1.53	0.71
BCR	1.13	1.18
IRR(%)	20	22

As can be seen from the above there is a conflict in ranking between NPV, IRR and BCR. According to NPV, D is preferred and according to BCR and IRR F is preferred. This conflict can be resolved by choosing the project with higher NPV if the projects under consideration fulfill all the assumptions required for the appraisal techniques to be used i.e. there is no project dependency, capital constraint, etc. The conflict can be resolved by choosing the project with higher NPV because NPV considers the maximization of the shareholder's wealth. However, if any of the assumptions is relaxed, say for instance that there is capital rationing then the return on the incremental investment required for the larger project i.e., D should be found out and if the net present value of the above incremental cash flows is positive then D should be accepted otherwise F should be accepted.

The net present value of the incremental cash flow of project D is calculated as follows:

Incremental Cash Flows (D – F)

(Rs. Lakh)

Year	
0	–8.0
1	3.0
2	3.8
3	4.6

NPV of the above cash flows is Rs.0.82 lakh. As it is positive, project D can be accepted.

Time Disparity between the Cash Flows of the Projects

Time Disparity among the cash flows refer to the disparity in sequencing of the cash flows among the projects. Consider the projects B and C. Both involve the same initial outlay of Rs.12 lakh and the economic life of both the projects is same i.e. 5 years, but differ in the sequencing of the cash flows. Project B has higher initial cash inflows and the cash inflows of C are higher in the later years. As already seen there is a conflict in rankings because of the different reinvestment assumptions. The conflict because of the time disparity can be resolved by applying a certain reinvestment rate and finding out the net present value of the future reinvested cash flows or the return earned on the reinvested cash flows. The net present value or IRR so found out are the modified NPV and modified IRR respectively which have been explained in the earlier Chapter on Appraisal Criteria. The projects which have a higher modified NPV or Modified IRR should be chosen for investment.

The modified NPV and Modified IRR of the above projects are calculated as follows at the different reinvestment rates of 16%, 16.9% and 18%.

	Mod. NPV		Mod. IRR	
Reinvestment rate of	B	C	B	C
16%	6.54	6.34	0.233	0.230
16.9%	6.73	6.73	0.235	0.235
18%	7.03	7.32	0.239	0.243

If the reinvestment rate is assumed to be less than the Fisherian rate then the project with higher modified NPV and modified IRR should be chosen i.e., B and if the reinvestment rate is above the Fisherian rate C should be preferred.

Unequal Useful Project Lives

Many a times decision-making problems involve making investment decisions between projects with unequal useful lives. Generally in such cases, there would be time or/and size disparity and as such there might be conflicts in ranking based on the different appraising techniques. In such cases, to make correct decision one needs to find the equivalent annual charge or benefit. EAC is the annualized figure of net cash inflows found out by multiplying the discounted net cash flows by the capital recovery factor which is nothing, but the reciprocal of the PV of annuity factor at the given discount rate and life of the project. The above can be illustrated with the help of projects A and D.

The EAC of project A

= NPV x Capital Recovery Factor for 13% and 5 years

$$= \frac{1.82}{\text{PVIFA}(13,5)} = \frac{1.82}{3.517} = 0.52$$

$$\text{The EAC of project D} = \frac{1.09}{\text{PVIFA}(13,3)} = \frac{1.09}{2.361} = 0.46$$

Based on the higher EAC, project A can be chosen.

EAC approach is based on the assumption that each project is replaced with another project with same profitability at the end of the life of the project. In the above example, it is assumed that Project D is replaced by another similar project, at the end of every three years until 15 years and project A is replaced by a like project at the end of 5 years until 15 years.

Capital Budget Constraints

Let us take the case of capital rationing. Consider the same six projects, independent of their interrelations, which projects would one consider given the total funds available are only Rs.36 lakh? To select the projects we need to compare the net present values and internal rates of return of all the projects and rank them in the descending order and accept those which fall within the outlay of Rs.36 lakh. For the above six projects the rankings are as follows:

Projects	Outlay	NPV @ 13% (Rs. Lakh)		IRR (%)	
A	–12	1.82	III	18	V
B	–12	5.83	I	27	II
C	–12	4.93	II	36	I
D	–12	1.09	IV	20	IV
E	–12	(2.12)	VI	6	VI
F	4	0.71	V	22	III

According to the rankings based on the NPV criterion, given the capital budget of Rs.36 lakh, Projects A, B & C could be accepted. However, based on the IRR criterion Projects B, C and F could be accepted. Thus, conflict arises when two different appraising techniques are used.

Reasons of the conflict can be explored and accordingly resolved on the above lines.

PROJECT INDIVISIBILITY AND SELECTION

Choosing the capital budget on the basis of individual ranking has a problem of indivisibility of capital expenditure.

Illustration 2

For illustrating this, consider the set of projects according to the ranking of their NPV which are evaluated by a firm whose capital budget constraint is Rs.22,50,000.

(Rs.)

Project	Outlay	NPV
M	12,50,000	1,38,800
N	10,00,000	1,28,400
O	7,50,000	1,18,000
P	5,00,000	1,07,600
Q	4,00,000	77,400

If selection is based on individual ranking on the basis of NPV, projects M and N would be included in the capital budget. However, these exhaust the capital budget. A close examination suggests that selection of N, O and P is more desirable as these projects can be accommodated within the capital budget and also the NPV of the three combined together would yield a total NPV of Rs.3,54,000.

Feasible Combinations Approach

The following procedure can be used for selecting the set of investments under capital rationing:

- Given the capital budget restriction and project inter-dependence, all the feasible combinations of projects are to be defined.
- The feasible combination with the highest NPV is then to be selected.

Illustration 3

Let us use the same data as in illustration 13.2.

(Rs.)

Project	Outlay	NPV
M	12,50,000	1,38,800
N	10,00,000	1,28,400
O	7,50,000	1,18,000
P	5,00,000	1,07,600
Q	4,00,000	77,400

Projects N and O are mutually exclusive and further assume that others are independent.

The following table shows the feasible combinations and their NPVs:

(Rs.)

Project	Outlay	NPV
M	12,50,000	1,38,800
N	10,00,000	1,28,400
O	7,50,000	1,18,000
P	5,00,000	1,07,600
Q	4,00,000	77,400
M and O	20,00,000	2,56,800
M and P	17,50,000	2,46,400
M and Q	16,50,000	2,16,200
N and P	15,00,000	2,36,000
N and Q	14,00,000	2,05,800
O and P	12,50,000	2,25,600
O and Q	11,50,000	195,400
N, P and Q	19,00,000	313,400
O, P and Q	16,50,000	303,000

From the above table, it is clear that within the budget limit the most desirable feasible combination is that of N, P and Q with the highest NPV of Rs.3,13,400.

Mathematical Programming Approach

Till now we have been discussing feasible combinations procedure for a few projects on hand. However, as the number of projects along with the number of planning years increase it is quite difficult to use the above procedures as it becomes cumbersome. Hence in order to overcome this problem mathematical programming becomes inevitable. The basic advantage of this mathematical programming is that the optimal solution (the most desirable combinations of investments) without evaluating all the possible feasible combinations can be obtained.

Mathematical programming has its base on two broad categories of equations:

– the objective function represents the goal or objective which is to be achieved by the decision maker,

– the constraints equation representing restrictions arising out of certain limitations like managerial policies, resources and production, etc.

Mathematical models are designed to optimize the objective function subject to various constraints. The objective function and constraint equations are defined in terms of parameters and decision variables. Parameters represent the characteristics of the decision environment and decision variables are the variables for which a decision is required to be taken by the decision makers.

Although a number of mathematical programming models are available, the following three models are highly useful and are discussed in detail in the following pages:

– Linear programming model

– Integer programming model

– Goal programming model.

Linear Programming Model

Linear programming which is the most popular mathematical programming model has its beginning in the input-output analysis developed by the well-known economist W.W. Leontief and Hitchcock and Koopman's transportation type problem studied during 1940s. Linear programming model was first used to obtain an optimal solution for Stiglers diet problem developed in 1945. The simplex method is the present day basic tool for solving any linear programming model.

A linear programming problem differs from the other methods of project selection in that a mathematical model or description of the problem can be stated using relationships which are called 'straight-line', or linear. The term 'programming' makes use of certain mathematical techniques to arrive at the best solution.

Mathematically, these relationships are represented as:

$$a_1X_1 + a_2X_2 + \dots + a_jX_j + \dots + a_nX_n = b_1$$

In the above equation, a and b are known as coefficients and the x's are unknown variables. The complete mathematical statement of a linear programming problem includes a set of simultaneous linear equations which represent the conditions of the problem and a linear function which expresses the objective of the problem.

The following are the assumptions of the model:

– All the coefficients in the objective function and constraint equations can be accurately described using linear equations,

– The objective function is unidimensional,

– The decision variables are considered to be continuous,

– Resources are homogenous. i.e. if the raw material available is 100 kgs, every kg. is as productive as any other and can be issued equally well by any activity that requires the material.

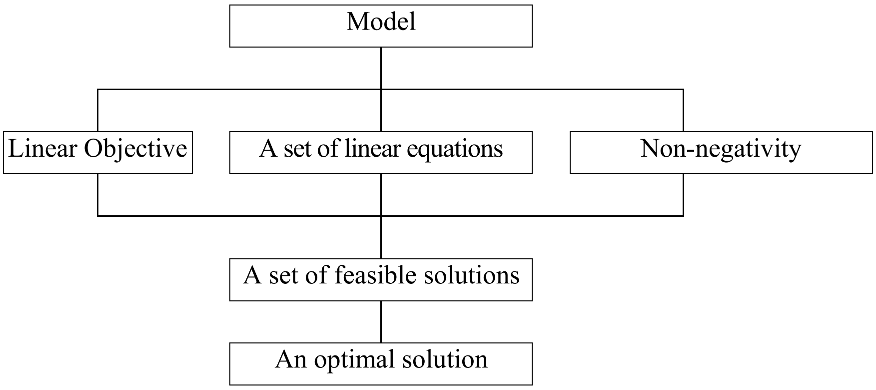
It is necessary to specify the following while formulating the linear programming model:

– Decision variables,

– Objective function, and

– Constraints.

Figure 1: Ingredients of a LP Model



For instance, consider the case of product-mix decision, wherein the decision maker has to decide as to how many units of product X and of product Y are to be produced. Therefore, the decision variables will be: number of units of product X say a_1, and number of units of product Y say a_2. Having defined the decision variables, the decision maker has to now identify the objective function. In this case, the objective of the decision maker is to maximize profits. If the profit per unit from product X is Rs.5 and that of product Y is Rs.6, then the objective function can be written as:

Maximize $Z = 5a_1 + 6a_2$

Having defined the decision variables and the objective function the next step is to identify the constraints. The constraints may relate to machine hour or labor requirements, etc. For instance, product X needs 2 labor hours and product Y requires 3 labor hours and the total labor hours available are 30, then this constraint can be stated as:

$2a_1 + 3a_2 \leq 30$

Having identified the decision variables, the objective function and the constraints the next step is to find the optimal solution.

After having understood the basic formulation of a linear programming model, we now move on to our present topic i.e. of projects. In projects, the objective function is to maximize the appraisal criteria, say, NPV, BCR, IRR, etc. The decision variables are the amount of project that can be accepted and constraints relate the cash budget, machine hours, etc. On similar lines as stated above, the general formulation of a linear programming model for a capital rationing problem is:

Maximize

$$\sum_{a=1}^{n} X_a NPV_a$$

subject to

$$\sum_{a=1}^{n} CF_{at} X_a \leq K_t \ (t = 0, 1 \ldots.. m)$$

$0 \leq X_a \leq 1$

Where,

NPV_a	=	Net present value of project a
X_a	=	Amount of project a accepted
CF_{at}	=	Cash outflow required for project a in period t
K_t	=	Capital budget available in period t.

From the above equations the following are to be noted:

– NPV_a, CF_{at} and K_t the parameters are well-defined.

– The decision variable i.e. X_a is assumed to be continuous, but has a lower limit of 0 and an upper limit of 1.

– NPV is based on the cost of capital figure which is well-defined.

Illustration 4

The following are the cash outflows of five projects in three years.

(Rs. in lakh)

Project	Net present value (NPV_a)	Cash outflow in period 1 (CFa_0)	Cash outflow in period 2 (CFa_2)	Cash outflow in period 3 (CFa_3)
1	12	16	2	5
2	15	48	6	22
3	15	6	6	7
4	13	6	3	9
5	42	35	37	13

The linear programming formulation of this problem is as follows:

Maximize

$12X_1 + 15X_2 + 15X_3 + 13X_4 + 42X_5$

Subject to

Funds constraint for year 1:

$16X_1 + 48X_2 + 6X_3 + 6X_4 + 35X_5 + S_1 = 45$

Funds constraint for year 2:

$2X_1 + 6X_2 + 6X_3 + 3X_4 + 37X_5 + S_2 = 30$

Funds constraint for year 3:

$5X_1 + 22X_2 + 7X_3 + 9X_4 + 13X_5 + S_3 = 15$

$$\left.\begin{array}{ll} X_1 + S_4 = 1 & X_4 + S_7 = 1 \\ X_2 + S_5 = 1 & X_5 + S_8 = 1 \\ X_3 + S_6 = 1 & \end{array}\right] \text{Upper limit on project acceptance}$$

$X_a \geq 0$ (a = 1, 2, ... 5)

$S_i \geq 0$ (i = 1, 2, ... 8)

In the above 'S_i' represents the 'slack variables' which are added to inequality constraints to make them equal constraints. S_1, S_2 & S_3 represent the amount unallocated in year 1, 2 and 3, S_4 to S_8 represents the proportion of projects not accepted.

Extensions to Reflect Other Constraints

Carry Forward of Cash: Practically speaking, funds from one period can be shifted to another period wherein there is a probability of this being reflected in the funds constraints. To highlight this, let us consider the funds constraints for the 1st two years.

$$\sum_{a=1}^{n} CF_{a1}X_a \leq K_1 \qquad \text{———— (1)}$$

$$\sum_{a=1}^{n} CF_{a1}X_a \leq K_2 \qquad \text{———— (2)}$$

Now, if surplus funds of year 1 can be utilized in year two and such shifted funds if they earn a return of 'r' percent, then the above expressions can be re-written as:

$$\sum_{a=1}^{n} CF_{a1}X_a + SF_1 = K_1 \qquad \text{————} \quad (1i)$$

$$\sum_{a=1}^{n} CF_{a2}X_a \leq K_2 + SF_1(1 + r) \qquad \text{————} \quad (2i)$$

In the above expression, SF_1 is the surplus funds transferred from year 1 to year 2. Because negative SF_1 implies borrowing (which is not possible, the constraint $SF_1 > 0$ is added to the above constraint).

Non-Financial Constraints

Besides financial constraints, there may be other constraints viz. legal requirements, managerial policies, labor, material, production, demand, etc. which can be incorporated readily in the linear programming model. The following is an example of labor constraints:

$$\sum l_a X_a \leq L$$

where

l_a = Labor required for project 'a'

X_a = Proportion of project 'a' accepted

L = Total availability of labor

Illustration 5

The following is an illustration of evaluation of nine projects with the following cash flows and NPVs.

(Rs. in Lakh)

Project	Net Present Value (NPV_a)	Cash Outflow in Period 1 (CF_{a1})	Cash Outflow in Period 2 (CF_{a2})
1	7	6	8
2	9	10	6
3	8	12	4
4	6	2	12
5	12	10	17
6	19	20	22
7	21	12	15
8	15	7	8
9	3	3	4

The available funds to the firm is limited to Rs.40 lakh in year 1 and Rs.35 lakh in year 2. Besides the above, there are two constraints: labor constraints and material constraints which are shown below:

(Rs. in Lakh)

Project	Labor Constraint (L_a)	Material Constraint (M_a)
1	4	7
2	6	3
3	5	2
4	3	4
5	2	5
6	4	7
7	7	8
8	2	6
9	4	2
	$\sum X_a L_a \leq 20$	$\sum X_a M_a \leq 25$

The linear programming formulation under various constraints is shown below:

Maximize

$7X_1 + 9X_2 + 8X_3 + 6X_4 + 12X_5 + 19X_6 + 21X_7 + 15X_8 + 3X_9$

Subject to

$6X_1 + 10X_2 + 12X_3 + 2X_4 + 10X + 20X_6 + 12X_7 + 7X_8 + 3X_9 + S_1 = 40$

Funds constraint for year 1

$8X_1 + 6X_2 + 4X_3 + 12X_4 + 17X_5 + 22X_6 + 15X_7 + 8X_8 + 4X_9 + S_2 = 35$

Funds constraint for year 2

$4X_1 + 6X_2 + 5X_3 + 3X_4 + 2X_5 + 4X_6 + 7X_7 + 2X_8 + 4X_9 + S_3 = 20$

Labor constraint

$7X_1 + 3X_2 + 2X_3 + 4X_4 + 5X_5 + 7X_6 + 8X_7 + 6X_8 + 2X_9 + S_4 = 25$

Material constraint

(Rs. Lakh)

$X_1 + S_5 = 1$	$X_5 + S_9 = 1$	$X_9 + S_{13} = 1$	Upper limits on project acceptance
$X_2 + S_6 = 1$	$X_6 + S_10 = 1$		
$X_3 + S_7 = 1$	$X_7 + S_11 = 1$	$X_a \geq 0$ (a = 1, 2, 3, ... 9)	
$X_4 + S_8 = 1$	$X_8 + S_{12} = 1$	$S_i \geq 0$ (a = 1, 2, 3, ... 13)	

It is clear from the above that 'slack variables' have been added to inequality constraints to make it an equal constraint. Slack variables S_1 and S_2 represent the amounts allocated in years 1 and 2; slack variable S_3 represents surplus labor; S_4 represents surplus material; S_5 to S_{13} represents the proportion of projects 1 to 9, respectively which are not accepted.

Integer Linear Programming Model

A class of optimization models that is obtained from the general linear programming model by imposing additional requirements that the variables can take on only integer values is referred to as integer linear programming model. It is adaptable to problems that allow only integer numbers for the final solution. The areas of applications include allocation of salesmen, capital budgeting, research and development, etc. Depending upon the particular type of application, the objective function may be either maximization or minimization. Moreover, an integer linear programming problem may include inequalities and/or equalities.

The model can be applied to capital budgeting problems. The main objectives for the use of this model are that:

– Linear programming model permits problems of partial projects. Integer linear programming overcomes such limitations as it permits only 0 or 1 value for the decision variables.

– Any kind of project interdependency can be handled by this model.

The formulation of the integer linear programming model for capital budgeting under capital rationing is represented as:

Maximize

$$\sum_{a=1}^{n} X_a \, NPV_a$$

subject to

$$\sum_{a=1}^{n} CF_{at} X_a \leq K_t \; (t = 0, 1 \; ..... \; n)$$

$X_a = (0, 1)$

The basic difference between integer linear programming model and that of linear programming is that integer linear programming model ensures that a project is either completely accepted ($X_a = 1$) or completely rejected ($X_a = 0$).

Incorporating Project Interdependencies

Limiting the decision variables to only 0 or 1 makes the integer linear programming model to handle any kind of project interdependency. The following are some of the interdependencies discussed to prove this:

– Mutual Exclusiveness
– Contingency
– Complementarity.

Mutual Exclusiveness

Mutually exclusive projects are defined as a set of projects wherein the acceptance of any one of them precludes the rejection of the other projects in the set. This is reflected in the above model by the following constraint:

$$\sum_{a \in A} X_a \leq 1$$

Where,

A = The set of mutually exclusive projects under consideration

$a \in A$ = An expression which means that project a belongs to set A

The above constraint i.e. $\sum_{a \in A} X_a \leq 1$ implies that 1 is the upper limit for the number of projects that can be selected from the set A. This automatically implies that any one project from the set A can be accepted by the firm. If only one project is chosen then the equation becomes

$$\sum_{a \in A} X_a = 1$$

Delay in Project: One variant of the mutually exclusive model is delay in a project by a year or more.

For instance, the following are the cash flows of a project X.

	(Rs.)
Time	Cash Flow
0	–10,000
1	3,600
2	3,600
3	3,600
4	3,600

At 12% cost of capital, the NPV of the above project works out to be 933. If the project is delayed by a year or two by the firm, then the two projects X_1 and X_2 can be written as:

(Rs.)

Time	Cash flow of the project if delayed by one year	Cash flow of the project if delayed by two years
0	–	–
1	–10,500	–
2	3,600	–10,500
3	3,600	3,600
4	3,600	3,600
5	3,600	3,600
6	–	3,600

The NPVs of projects X_1 and X_2 to be included in objective function are 388 and 346 respectively. It is quite obvious that these values are different from the value of NPV of X because of the delay in the project. Since only one of the projects, i.e. X or X_1 or X_2 can be accepted the following constraint is incorporated in the integer linear programming model:

Contingency

This implies the relationship between the two projects, i.e. the acceptance of one project is dependent on the acceptance of the other project or projects. For instance, if project B cannot be accepted unless project D is accepted, we can say that project B is contingent on project D. In other terms, the prerequisite for accepting Project B is the acceptance of project D which is represented as follows:

$X_B \leq X_D$ .... (1)

It is clear from the above equation that project B can be accepted only on the acceptance of project D. However, it should be noted that project D can be accepted independently.

Furthermore, a project can be contingent on not only one, but on two or more projects. For example, project 'O' can be accepted, only when projects M and N are accepted which can be represented as follows:

$2X_O = X_M + X$ ....(2)

Mutual Exclusiveness and Contingency

Sometimes project dependency may have both features, i.e. mutual exclusiveness as well as contingency. Some examples are:

i. Consider two projects P and Q both of which are mutually exclusive. There is another project R which is contingent on the acceptance of either P or Q. This can be reflected as follows:

   $X_P + X_Q \leq 1$

   $X_R \leq X_P + X_Q$ .... (3)

ii. There is another set of projects I, J, K, L and M out of which only three can be accepted. Moreover, for accepting project N at least two of the above projects should be accepted. This can be represented as follows:

   $X_I + X_J + X_K + X_L + X_M \leq 3$

   $2X_N \leq X_I + X_J + X_K + X_L + X_M + X_N$

Complementariness

If acceptance of two projects has favorable influence on the cash flows of another project, then the two projects are known to be complementary projects. For instance, consider two projects A and B. Either of them can be accepted independently. However, if both are accepted together, the following benefits can be obtained:

– Cost reduction by 6%, and

– Net cash flow increases by 11%.

To reflect the relationship, a composite project AB representing the combination of A and B is set-up, the cash inflows of AB would be 11% higher than the sum of the cash inflows of either A or B. Moreover, since A, B as well as AB cannot be accepted simultaneously, because the latter is a composite one consisting of A and B, the following constraint is incorporated to represent the above which is as follows:

$$X_A + X_B + X_{AB} \leq 1$$

Illustration 6

Consider the following data on 7 projects:

(Rs. in Lakh)

Project	Net present value (NPV_a)	Cash outflow in year 1 (CF_{a1})	Cash outflow in year 2 (CF_{a2})	Cash outflow in year 3 (CF_{a3})
1	46	52	50	48
2	33	41	23	35
3	22	11	45	31
4	26	38	7	15
5	39	27	51	–
6	26	50	13	20
7	52	47	0	29

The funds constraints for the years 1, 2 and 3 are Rs.145 lakh, Rs.182 lakh and Rs.195 lakh respectively. The following are the project interdependencies:

i. Projects 1 and 2 are mutually exclusive.

ii. Out of the set of 3, 4, 5 and 6 at least two must be accepted.

iii. Project 7 cannot be accepted unless 2 and 4 are accepted.

iv. Project 5 can be delayed by a year. Such a delay would not change the cash outflows, but reduces the NPV to Rs.27 lakh.

v. Projects 3 and 4 are complementary. If the two are accepted the total cash outflows will be less by 7% and increase in the NPV is by 12%.

Besides the above decision variables from X_1 to X_7, two more additional decision variables are required.

X_8 is the decision variable to represent the delay of project 5 by a year.

X_9 is the decision variable for the variable for representation of the composite project of 3 and 4.

The following is the formulation of the integer linear programming of the above problem:

Maximize

$$46X_1 + 33X_2 + 22X_3 + 26X_4 + 39X_5 + 26X_6 + 52X_7 + 27X_8 + 53.76X_9$$

Subject to

$$52X_1 + 41X_2 + 11X_3 + 38X_4 + 27X_5 + 50X_6 + 47X_7 + 0X_8 + 45.57X_9 \leq 145$$

$$50X_1 + 23X_2 + 45X_3 + 7X_4 + 51X_5 + 13X_6 + 0X_7 + 27X_8 + 48.36X_9 \leq 182$$

$$48X_1 + 35X_2 + 31X_3 + 15X_4 + 20X_6 + 29X_7 + 51X_8 + 42.78X_9 \leq 195$$

$$X_1 + X_2 \leq 1$$

$$X_3 + X_4 + X_5 + X_6 \geq 2$$

$$2X_7 \leq X_2 + X_4$$

$$X_5 + X_8 \leq 1$$

$$X_3 + X_4 + X_9 \leq 1$$

$$X_a = \{0, 1\} \ a = 1, 2, 3, ... 9$$

Evaluation

The capability of handling any kind of project interdependency and overcoming the problem of partial projects are some of the strengths of integer linear programming model.

However, the following are some of the shortcomings of this model:

i. The time taken for solving a problem by this method is considerably more when compared to linear programming model.
ii. A small problem may take more time than a big problem. Hence the solution time is highly variable.
iii. Small variations may show an increase in the solution time.
iv. No single solution algorithm works best for all types of integer linear programming models.

Goal Programming Model

Linear programming model is applicable only when a firm can identify one goal (objective) such as maximization of profits or minimization of losses. However, there are many imperfections in the market like economic instability, difference in interest rates, etc. due to which a firm may have a set of multiple goals, like employment stability, high product quality, etc. In order to optimize multiple goals of a firm, a different technique known as goal programming technique is to be used for decision-making.

Goal programming technique, a special type of technique was developed by Charnes and Cooper for finding optimum solution to a single dimensional or multi-dimensional objective function with a given set of constraints which are expressed in a linear form. In goal programming model, all management goals whether one or many, are incorporated with the objective of minimizing the deviations from the set of given goals which are ranked priority-wise.

In goal programming, management is made to set some estimated targets for each of their goals and to rank them in the order of their priorities or importance. When this information is supplied, the goal programming tries to minimize the deviations from the targets that were set. It starts with the most important goal and continues until the achievement of a less important goal would cause that management to fail to achieve a more important one.

Mathematical Statement of the Model

Generally, goal programming format is represented as shown below:

Minimize

$$Z = \left\{Q_1\left[f_1\left(a_1^+, a_1^-\right)\right] + Q_2\left[f_2\left(a_2^+, a_2^-\right)\right] + \ldots\ldots\ldots\ldots + Q_m\left[f_m\left(d_m^+, d_m^-\right)\right]\right\}$$

Subject to

$\sum a_{j1} X_j \leq C_1$

$\sum a_{j2} X_j \leq C_2$

.

.

.

.

$\sum a_{jk} X_j \leq C_k$

$\sum b_{j1} X_j + d_1^-, d_1^+ = G_1$

$\sum b_{j2} X_j + d_2^-, d_2^+ = G_2$

.

.

.

.

$\sum b_{jm} X_j + d_m^-, d_m^+ = G_m$

$X_j, d_1^-, d_1^+ \geq 0$

The goal programming model has three basic components of importance:

– Objective Function

– Economic Constraints

– Goal Constraints

Let us study this model with the help of the following illustration.

Illustration 7

SS Ltd. is evaluating two projects. The following is the information relating to them:

Economic Constraints					Managerial Goals			
Project	Cash Outflow Year 1	Cash Outflow Year 2	Management Supervision		NPV	Net Income Year 1	Net Income Year 2	Net Income Year 3
1	20	15	1		9	5	6	7
2	35	10	11		55	1	2	6
Amount Available	25	15	5					
Desired Goal Levels				Maximum		1	3	5

The management has decided that priority levels 1, 2 and 3 may be accorded to the goals of achievement of net income in years 1, 2 and 3 and the goal relating to achievement of the NPV be accorded a priority of 4.

Let us first elaborate on the objective function, and formulate the objective function for the above problem.

Objective Function

This seeks to minimize the deviation from the targets of various objectives in priority. A formal representation of the objective function requires the following:

– the priority level of goals

– the relative weights attached to each goal where there are two or more goals at the same ranking

– the relevant deviational variables which should be minimized with respect to each goal.

The objective function for the above problem will be:

$$\text{Minimize } P_1 d_1^- + P_2 d_2^- + P_3 d_3^- + P_4 \left(d_4^- - d_4^+\right)$$

In this equation, we have used d_i^- to indicate a positive deviation from the goal sought to be achieved and d_i^- to indicate a negative deviation from the goal.

The term $P_1 d_1^-$ indicates that negative deviations from the required goal have to be minimized for the goal accorded first priority. Similarly, both $P_2 d_2^-$ and $P_3 d_3^-$ can be interpreted. $P_4\left(d_4^- - d_4^+\right)$ relates the goal with priority number four. The requirement is to minimize the negative deviations (d_4^-) and maximize the positive deviations ($- d_4^+$).

The various situations relating to minimization of negative deviations can be summarized as follows:

Nature of Achievement Desired	Term to be used
Achieve, but do not exceed a given goal	minimize d^+
At least reach the given goal	minimize d^-
Minimize the achievement relative to a given goal	minimize $(d^+ - d^-)$
Maximize the achievement relative to a given goal	minimize $(d^- - d^+)$
Reach as close as possible to the given goal	minimize $(d^+ + d^-)$

Economic Constraints are those which represent limits or restrictions wherein the decision cannot be violated. Hence they are known as hard constraints. They are similar to the constraints found in a linear programming model and hence require the slack or surplus variables.

The hard constraints of our illustration are:

$$\begin{aligned} 20X_1 + 35X_2 &\leq 25 \\ 15X_1 + 10X_2 &\leq 15 \\ 1X_1 + 11X_2 &\leq 5 \\ X_1 &\leq 1 \\ X_2 &\leq 1 \end{aligned}$$

X_i, d_j^+ and $d_j^- \geq 0$ where $\quad i = 1$ or 2

$P_k >> P_{k+1} \quad j = 1, 2, 3$ or 4

Let us consider each of the above constraints one by one. $20X_1 + 35X_2 \leq 25$ means the cash outflow on account of both projects 1 and 2 put together should be lesser than or equal to the funds available in the year 1, that is, 25. Similarly, in year 2, the outflow on the two projects put together should not cross 15. This implies, obviously, that we cannot accept both project 1 and project 2. We have, therefore, used X_1 and X_2 as the fractions of projects 1 and 2 that can be accepted. This leads us to the constraints $X_1 \leq 1$ and $X_2 \leq 1$, which do not call for any further explanation. The equation $X_1 + 11X_2 \leq 5$ symbolizes the constraint that the inputs in the form of managerial supervision cannot exceed 5. $P_k >> P_{k+1}$ indicates that the priority with a lower numerical is always more dominant than the one with a higher number. That is, priority 1 is always more important than priority 2.

Goal Constraints represent the target levels of various goals that are pursued by the decision maker. Defined as strict equalities, goal constraints contain, in addition to an expression showing the impact of decision variables on goal attainment, two deviational variables denoted by d_1^+ and d_1^-. d_1^+ indicates that the desired level of goal i has been over-achieved, d_1^- indicates that the desired level of goal i has been under-achieved. When the desired level of goal has been over-achieved d_1^+ is non-zero and d_1^- is zero. When the desired level of goal has been under-achieved, d_1^+ is zero, and d_1^- is non zero. When the desired level of goal is exactly achieved, both d_1^+ and d_1^- are zero. The deviational variables tie the goal constraints and the objective function. For each goal, the appropriate deviational variable(s) is (are) placed in the objective function.

The student should observe that the equations relating to goal constraints are equalities.

Let us first see the equations for our illustration:

$$\begin{aligned} 5X_1 + X_2 + d_1^- - d_1^+ &= 1 \\ 6X_1 + 2X_2 + d_2^- - d_2^+ &= 3 \\ 7X_1 + 6X_2 + d_3^- - d_3^+ &= 5 \\ 9X_1 + 55X_2 + d_4^- - d_4^+ &= 50 \end{aligned}$$

The equation $5X_1 + X_2 + d_1^- - d_1^+ = 1$ means that the total net income in year 1, from the fractions of projects 1 and 2 should be equal to 1. The other two equations relating to net income in years 2 and 3 can also be similarly interpreted. The last equation relating to the achievement of NPV is also similar, excepting that the value of 50 has been arbitrarily set and has not been given in information in the illustration.

SUMMARY

- In this chapter, we have discussed the problem of selection of projects when different discounted cash flow criteria point in different directions and when there are various constraints on the selection of projects – whether imposed by the management or by economic realities. We have presented a few mathematical models that facilitate selection in the presence of constraints. Each of the techniques presented is versatile in its own way and should be applied when the constraints which it can best resolve are obtained.

Chapter XIV

Options in Investment Appraisal

After reading this chapter, you will be conversant with:

- The Basics of Options
- Valuation of Options
- Application of Option Valuation Models to Project Appraisal

INTRODUCTION

The word options brings to mind the options traded in the stock markets and forex markets in the US and other major financial centers and their use in risk management. It also makes one recall the fall of mighty financial institutions such as the Barings Bank and the consequences of excessive indulgence in derivatives. But what do derivatives have to do with project appraisal? How can option pricing theory be useful in project appraisal?

Some investments carry with them an opportunity to make an additional investment in future. For example, a company purchasing land as an investment may also be able to build apartments in the land. Or, purchase of land adjacent to the factory may provide it an opportunity to expand capacity in future. Such investments can be evaluated with the discounted cash flow techniques, only if we assume that the firm chooses to exercise the option. The value of the option to make the additional investment itself can be determined only with the option pricing models. We will discuss this in greater detail along with the option valuation models. Before that, it is necessary to understand what exactly is meant by 'options', types of options, and how they can benefit the investor.

What is an Option?

An option contract entitles the holder to buy or sell a designated security or other financial asset such as foreign currency at or within a certain pre-specified time at a particular price. While the option holder is entitled to buy or sell, he is not obliged to. That is, options carry a right without an obligation. From the angle of the seller of the option, who is also called the writer of the option, the liability can be unlimited if the buyer chooses to exercise the option.

Types of Options

There are two types of options:

- **European Options** – are those which can be exercised only at a specified time.
- **American Options** – are those that can be exercised at any time during a specified period [called the time to expiration].

Unless specified otherwise, the discussion will focus on the European options.

SOME BASIC DEFINITIONS AND CONCEPTS

Before proceeding, it is necessary to understand certain terms and concepts:

OPTION PREMIUM

It is the premium paid by the buyer of the option to the seller and is paid at the time of entering into the option contract. In other words, it is the price paid by the buyer for obtaining the option.

EXPIRATION DATE

It is the date on or before which the option should be exercised. If not exercised on or before the date, the option lapses and cannot be exercised thereafter. Therefore, an option is a wasting asset.

STRIKE PRICE

It is the price at which the holder of the option can buy (or sell) the asset on which the option was written. The option can be exercised only at the strike price, irrespective of the price of the asset in the market at the time of exercise.

OPTION SERIES

All options of a type are referred to as belonging to the same class of options. For example, put options are a class.

IN THE MONEY

When an option is 'In the Money', the option, if exercised, will provide the holder with a profit. A call option is 'In the Money', if the market price at the time of exercise is greater than the exercise price.

The reverse applies to a put option.

OUT OF THE MONEY

An out of the money option is worthless. A call option goes out of the money if the market price is less than the exercise price, as the holder will be better off buying the asset from the market.

Again, the reverse applies to a put option.

AT THE MONEY

An option, the holder of which is indifferent between exercising the option and not exercise, is said to be 'At the Money'. This happens when the price of the option is the same as the strike price. The same applies to both put and call options.

Having understood the basic terms and concepts, we can now proceed to study how the profit to the holder and writer changes with changes in the market price of the underlying asset. Now on, we use stock options for our discussion.

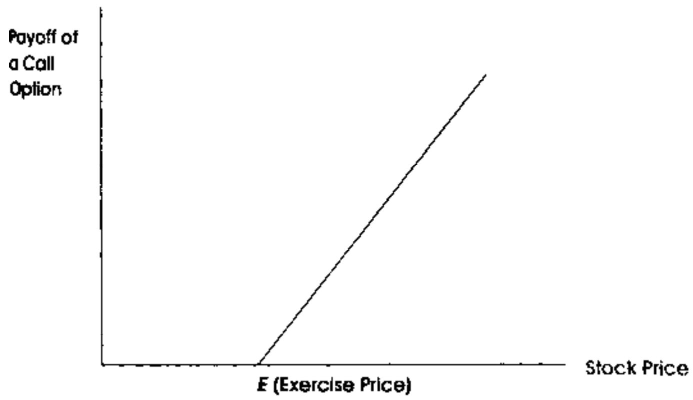
Pay Off from an Option

We have already seen when an option becomes useless to the holder, and when it provides profits to the investor in our discussion on the definitions of 'At the Money', 'In the Money' and 'Out of the Money'. In addition to the profit or loss to the option buyer, we should also study the profit or loss to the seller or writer of the option. And, there also complex hedging strategies with options such as buying the underlying asset and a put option and writing a call option on the asset already owned (the latter is called covered call writing), buying and selling call or put options with the same maturity, but with different exercise prices (called price spreads). Though the complex variants are beyond the scope of this work, we will study some of them to the extent required for our understanding the relationship between the profit or loss on the option, market price of the asset and the exercise price.

The change in the profit from an option is generally studied by plotting the profit on a graph against the market price. Such graphs are called pay off profiles.

1. **Pay off from buying a call option (called a long position):** The pay off can be symbolically expressed as Max (S – E, 0), where S is the market price of the underlying asset and E is the exercise price.

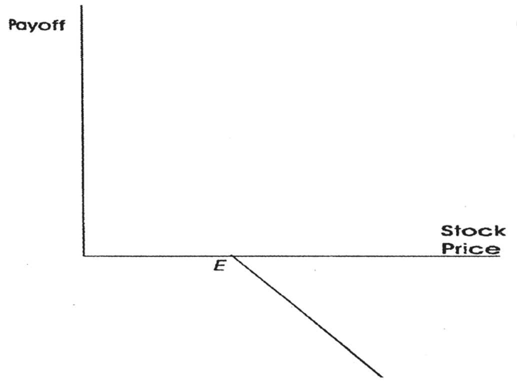
Figure 1: Pay-off of a Call Option



2. **Selling a call option:** Selling or Writing an option is called a 'short position' in option. The pay-off is Min (E – S, 0).

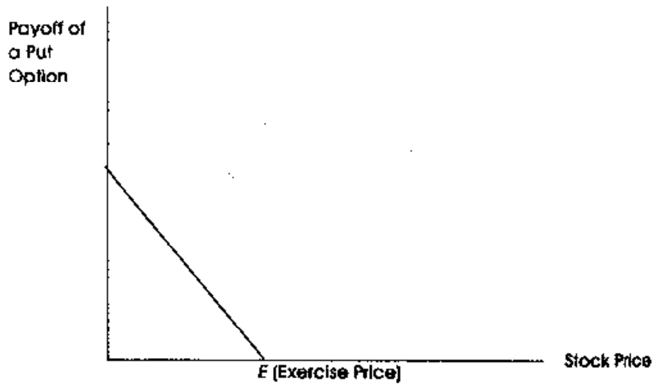
Figure 2: Pay-off to the Seller of Options

A: Sell a Call



3. **Buying a put option (long put):** The pay-off is Max (E – S, 0)

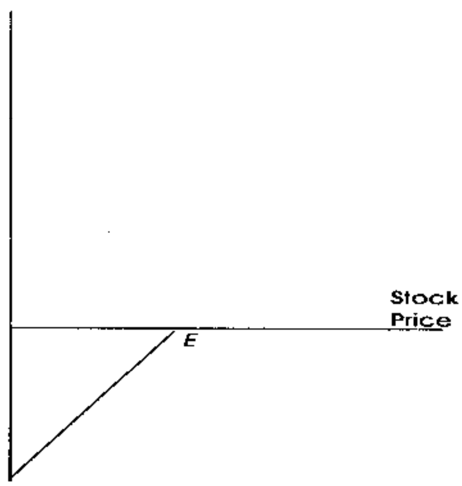
Figure 3: Pay-off of a Put Option



4. **Writing a put option (short position):** The pay-off is Min (S – E, 0)

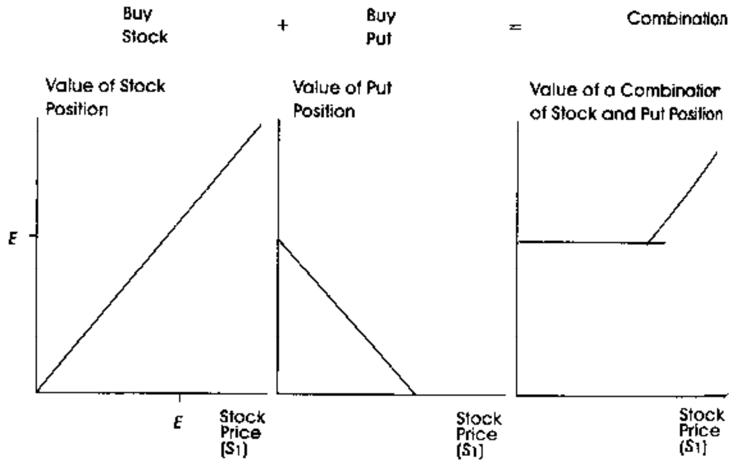
Figure 4: Pay-off to the Seller of Options

B: Sell a Put



5. **Buying a put option and the underlying stock:** Put option: Max (E – S, 0) + Stock : S = combination : Max (ES)

Figure 5: Pay-off of a Combination of Buying Equity Stock and Put Option



PUT-CALL PARITY THEOREM

With these profiles in mind, we can move on to the interrelationship between the pay-offs of the put option and the call option, which is expressed by the 'put-call parity theorem'. The theorem enables us to price one of the options (put or call) if we know the price of the other.

Before attempting to derive the theorem, let us define the variables and state the assumptions:

The Variables

S_o	–	the current stock price
S_1	–	the stock price at the expiration date
E	–	the exercise price
P	–	the put price
C	–	the call price
R	–	the borrowing interest rate
r	–	the lending interest rate

The assumptions:

a. The options are European

b. The underlying stock does not pay any dividend.

Now, suppose an investor holds the following portfolio:

1. A put option
2. One share of stock
3. An amount equal to [E/(1 + R)] borrowed at an interest rate of R%

The pay-offs from the three components of the portfolio are:

1. Max ($E – S_1$, 0)
2. S_1
3. [– E/(1 + R)] (1 + R) = – E. The negative sign is because it is an outflow.

The total pay-off from the portfolio is the sum of the above pay-offs and is equal to: Max (S_1 – E, 0), which is the same as for a call option buyer. That is, the pay-off from a call option is the same as from a combination of buying stock, buying put option and borrowing an amount equal to [E/(1 + R)].

Expressing it in our notation,

$C + E = P + S_1$ or, $C = P + S_1 - E$. This is referred to as the Put-Call Parity theorem.

OPTION PRICING

In the section on pay-off profiles, we have seen that just before expiration, the value of the option depends on the price of the stock in the market and the exercise price of the option. For example, the value of a call option for a holder is Max (S – E, 0). But, prior to the time of expiration, the value of an option depends on some more factors other than the stock price and exercise price. The factors and their impact make an interesting reading:

1. ***The Stock Price (S)*:** It is obvious that the value of a call option increases with increase in stock price. In Max (S – E, 0), the value of (S – E) should be greater than zero if the option should be of any value to the holder. When (S – E) > 0, higher the value of S, greater is the value of the option. The reverse holds good for a put option.
2. ***Exercise Price (e)*:** Following the same logic we used in (1) above, we can infer that the impact of the exercise price on the value of an option is just opposite to that of the stock price. The value of a call option decreases while the value of a put option increases with increase in the exercise price.
3. ***Volatility of Stock Price* (σ) :** Volatility of stock price increases the value of both call and put options. This is because, the possible loss being limited to the premium paid, the possibility of profit varies directly with the anticipated volatility of the stock price.
4. ***Time to Expiration (t)*:** Longer the time to maturity, higher is the value of an option. This is because longer the time available, higher is the possibility of fluctuation in the stock price which increases the possibility of a higher pay-off.
5. ***Interest Rate (r)*:** Higher the interest rate, higher the value of a call option. This is because as interest rates increase, the effective value of the amount payable on exercise of a call option gets reduced, increasing the value of the option, while in the case of a put option, the value of the amount receivable on exercise falls, thus bringing down the value of the option with it.

The effect of the changes in all these variables can be summarized as follows:

If there is an increase in	Change in the price of a call option	Change in the price of a put option
Stock Price	Increase	Decreases
Exercise Price	Decreases	Increase
Interest Rate	Increase	Decrease
Time to Expiration	Increase	Increase
Volatility of the Stock Price	Increase	Increase

Apart from the effects of these variables, there are inherent upper and lower bounds on the values of options.

Upper Bound: The value of the option is always lesser than the price of the stock. If it is more than the price of the stock, investors can buy the stock rather than the option on the stock. Arbitrage profits can also be made by selling the option and buying the stock.

Lower Bound: The price of an option never falls below the pay off possible from immediate exercise. For a European call, the price can never be less than the stock price minus the present value of the exercise price. Generally, the value is a bit higher than the minimum value because the stock price may rise during the time left to expiration giving scope for profits. The additional value is called the time value of the option.

OPTION PRICING MODELS

We are now equipped enough to settle down to the core issue on hand – the pricing of options. The models we will discuss have been designed basically to value European options, though empirical studies reveal that they work equally well for American options.

A. The Binomial Model

This is the earliest option-pricing model and is also the simplest. The model was formulated for calculating the value of a European call option from which the value of a put option can be found. The underlying principles of this model are:

- The current price of the stock, the value of the call option and the interest rates are so aligned that there is no possibility of making a riskless profit by using any combination of calls, puts and borrowing and lending.
- For a portfolio to be perfectly hedged, the combination of calls, stock and lending must be made in such a way that the pay-off from the portfolio at the end of the holding period is independent of the stock price. Investors, being risk-averse, hold only hedged portfolios.
- The maximum and minimum values that can be reached by the stock price by the end of the maturity period are known. That is, the expected values are used.

We will use the following notations to describe the model:

S_0 : Current stock price

E : Exercise price

u : (1 + a) where a is the percentage upward change in the stock price during the maturity period of the option, expressed in decimals

d : (1 – b) where b is the percentage downward change in the stock price during the maturity period of the option, expressed in decimals.

C : The call price

α : The number of shares to be purchased per call

C_u : Value of the call if the stock price increases, i.e. Max (US_0 – E, 0)

C_d : Value of the call if the stock price decreases; i.e., Max (dS_0 – E, 0).

r : (1 + r_f) where r_f is the risk-free rate of interest in percentage expressed in decimals.

Now, let us suppose that a portfolio is set-up by writing a call and buying S_0 number of shares financed with a borrowing of C + S_0. Then, according to the second principle mentioned above, if the portfolio should be perfectly hedged, the pay-off from the portfolio should be the same whether the stock moves up or down.

Symbolically,

$$-C_u + \alpha uS_0 = -C_d + \alpha dS_0$$

$$\text{or } \alpha = \frac{C_u - C_d}{S_0(u-d)}$$

If an amount equal to $[(C_u - \alpha uS_0)/r]$ or $[(C_d - \alpha dS_0)/r]$ is borrowed, the net cash flow at the end of the holding period becomes zero. This is because the outflow would be – $(C_d - \alpha uS_0)$ or $-(C_d - \alpha dS_0)$ towards the repayment of the loan. If the net inflow is zero, then if the investor should not make a loss, the initial investment should also be zero. This holds good, as the portfolio has been set-up in such a way that he does not recall that the portfolio is a mixture of buying and borrowing. The buying has been financed with the borrowing. Now, equating the initial investment and the pay-off if the stock moves down, we get

$$C = \frac{\alpha r S_0 - Cd - \alpha d S_0}{r}$$

Substituting for α in the above equation, with

$$= \frac{C_u - C_d}{S_0(u-d)} \text{ we get}$$

$$C = \frac{C_u \frac{r-d}{u-d} + C_d \frac{u-r}{u-d}}{r}$$

Illustration 1

To understand the application of the model, let us calculate the value of the call option from the following information:

s = 150 u = 1.20 d = 1.10

E = 175 r = 1.15

Now,

C_u = Max (1.20 x 150 – 175, 0) = 5

C_d = Max (1.10 x 150 – 175, 0) = 0

$$C = \frac{\frac{5(1.15-1.10)}{(1.20-1.10)} + \frac{0(1.20-1.15)}{(1.20-1.10)}}{1.15}$$

or C = 2.17

The value of the call option is 2.17

Now that we are familiar with the application of the Binomial Model, let us see how it can be useful in problems of project appraisal.

Illustration 2

A pharmaceutical manufacturer has obtained from a foreign company an exclusive license to produce a life saving drug in the country for domestic consumption. According to the terms of the license agreement, the licenser will not export the drug to the country during license period and the technology is not available with any other company in the world. The license is to produce 2.50 lakh tablets of 400mg and 3 lakh bottles of syrup. If launched immediately, each 400mg tablet is expected to sell at Rs.25 and the selling price of each bottle of syrup is expected to be Rs.45. However, the manufacturer is hesitant to introduce it immediately as the levels of awareness about the drug among the Indian doctors are low. The expected sales if launched immediately are 1.25 lakh tablets of 400mg and 1.50 lakh bottles of syrup. If launched after one year, the entire licensed production can be sold. While the selling price is expected to remain the same if left to the market forces, the manufacturer is apprehensive that the government may impose restrictions on the selling price. The probability of this happening is 40 percent and the price likely to be fixed by the government is Rs.15 for the 400mg tablet and Rs.18 for the syrup. The cost of production is expected to be Rs.8 per tablet of 400mg and Rs.15 for the syrup and is expected to remain constant during the two years. The license expires exactly one year after the commencement of production. The cost of capital is 20 percent.

As already explained, the possibility of postponing the production by one year gives the problem the character of an option. Using the binomial model, it can be valued as follows:

S = Sales revenue if produced immediately

= 25 x 1.25 + 45 x 1.50 = 98.75

r = 1.12, assuming a risk-free interest rate of 12 percent

$$u = \frac{25 \text{ x } 2.5 + 45 \text{ x } 3.0}{25 \text{ x } 1.25 + 45 \text{ x } 1.50} = 2.00$$

$$d = \frac{15 \text{ x } 2.5 + 18 \text{ x } 3.0}{25 \text{ x } 1.25 + 45 \text{ x } 1.50} = 0.93$$

'E' or Exercise Price: The cost of manufacture is the equivalent of the exercise price in the model:

First year : 8.00 x 1.25 + 15.00 x 1.50 = Rs.32.50 lakh

Second year : 8.00 x 2.50 + 15.00 x 3.00 = Rs.65.00 lakh

C_u = Max {(2 x 98.75 – 32.50), 0} = 165.00

C_d = Max {0.93 x 98.75 – 65.00), 0} = 26.84

$$C = \frac{C_u \frac{r-d}{u-d} + C_d \frac{u-r}{u-d}}{r}$$

$$= \frac{\frac{165(1.12-0.93)}{(2.00-0.93)} + \frac{26.84(2.00-1.12)}{2.00-0.93}}{1.12}$$

= Rs.45.87 lakh

The value of the call option, i.e. the profits from the production of the drug is Rs.45.87 lakh. As the revenues, if produced immediately are higher than in the second year, the drug should be produced immediately.

Using the conventional method, the value of the revenues would be

If produced in the first year

(25 – 8) x 1.25 + (45 – 15) x 1.50 = 66.25

Present value of the inflows if produced in the first year (66.25/1.12) = 59.15

If produced in the second year

{(17.00 x 2.50 + 30.00 x 3.00) x 0.60} + {(7.00 x 2.50 + 3.00 x 3.00) x 0.40} = 90.10

Present value (90.10/1.122**)** = 71.83

The answer, obviously, will be to produce in the second year. It can be observed that while the conventional method leads the company to produce in the second year, the option pricing model shows that the best time to produce is the first year, as the value of the option to produce in the second year is less than the present value of cash flows from producing in the first year.

Now, let us go back a little. Recall that one of the assumptions of the binomial model is that the stock price will take one of the two values: one, the highest price that can be reached by the end of the holding period and two, the lowest price to which it may fall. But this situation rarely obtains in real life. Stock prices as well as possible inflows from capital investments undergo continuous changes due to various factors. The assumption was then necessary to enable us to use the binomial distribution for finding the option value. We will now study a model that does not have this weakness, namely the Black and Scholes Model.

B. Black and Scholes Model

We have been, until now, using combinations of stocks, options and loans. In the Put-Call Parity theorem, we used a stock, a put option and a loan in such a way that the pay-offs from the stock, put are equal to the pay-off on the call option. In the binomial model, we used a portfolio of a call option, stock and borrowing. The same procedure can be applied in this model too. We may set-up a portfolio of a stock and a loan in such a way that their pay-off is identical to that of a call option and equate their value to the value of a call option. But if the stock prices change continuously, the proportions of the stock, call and loans will also have to be changed continuously. That makes the pricing process tedious. But, the same can be achieved using the Black and Scholes model for option valuation. The basic formula of the model is

Value of the call option = [delta x share price] – loan

In the formula, delta is the amount to be invested in the underlying stock to build a fully hedged portfolio. The term delta is expressed symbolically as $N(d_1)$ and the loan as $N(d_2)$ x PV (EX). $N(d_1)$ and $N(d_2)$ are the cumulative probabilities of a random variable taking values less than or equal to d_1 and d_2 respectively. The $N(d_1)$ and $N(d_2)$ values can be looked up from the table of areas under the normal distribution curve (table 5) given in the Appendix II to this book.

Now, $d_1 = \dfrac{\ln\left\{\dfrac{S_0}{PV(E)}\right\}}{\sigma\sqrt{t}} + \dfrac{\sigma\sqrt{t}}{2}$

$d_2 = d_1 - \sigma\sqrt{t}$

PV(E) = Present value of the exercise price calculated by discounting at the continuously compounded risk-free rate

t = Number of periods in years

S_o = Price of the stock now

σ = Standard deviation of the continuously compounded rate of return on the stock per period.

Though the formula appears complicated, a little practice will make it easy to use. This formula has been found to be very versatile. It not only gives the option values which conform very closely to the real world situations, but also can be used to value assets with a wide range of features such as foreign currency, bonds, futures and real assets, which is why we are studying the model here.

Illustration 3

To simplify the calculations, a four step procedure has been developed. Let us use the following information to illustrate the procedure:

σ = 0.64, t = 0.25 yrs r_f = 2 percent for 0.25 years;

S = Rs.65; E = 60

Step 1 : Find the product of the standard deviation and the time:
0.64 x sq.rt of 0.25 = 0.32

Step 2 : Find the ratio of the stock price to the present value of exercise price:
65/(60/1.02) = 1.105

Step 3 : Now, turn to table 6 in the Appendix II at the end of the book and look up the value corresponding to the values calculated in steps 1 and 2. There is no reading that corresponds to the values we calculated. We, therefore, have to round off the values to 0.30 and 1.10 respectively. If greater accuracy is desired, then the values have to be calculated by interpolating the readings for the nearest values available in the table. Looking up for 0.30 and 1.10 in the table, we get a value of Rs.16.50, which is the value of the call option we want to calculate. We need to proceed to the next step only if we want to find the value of the corresponding put option.

Step 4 : Find the value of the put option from the Put-Call parity theorem:
Value of the put option
= Value of the call option + Exercise price – Stock price.
That is, P = 16.50 + 60.00 – 65.00 = Rs.11.50.

The value of the put option is Rs.11.50.

We now know the application of the Black and Scholes Model. Let us try to apply it to certain problems of project appraisal.

Call Option on a Follow-on Investment

Sometimes, making an investment at the present, even if it is unprofitable, gives the firm a chance to make a profitable investment in future. Consider the following situation:

Illustration 4

The financial analyst of the newly set-up Automobiles (India) Ltd., is looking at a proposal to produce cars in India. The cash flows relating to the project are as follows:

(Rs. crore)

	Years	1	2	3	4	5
I.	After tax operating income	–50	+55	+80	+150	0
II.	Capital Investment	125	0	0	0	0
III.	Increase in Working Capital	0	25	50	50	–125
IV.	Net Cash Flow (I – II – III)	–175	+30	+30	+100	+125

Net Present Value at 20 percent = –Rs.11.04 crore.

Obviously, the project is not worthwhile. But the analyst perceives that the market for luxury cars is going to pick up strongly three years from now. If the company is not into the cars market now, it may not be able to penetrate the luxury cars market when the demand rises, as the other competitors will firmly entrench themselves in the mean time. The investment required to be made three years from now is Rs.250 crore, and the present value of the cash inflows at the time of making the investment is expected to be Rs.300 crore. The realizability of the inflows is highly uncertain and the analyst estimates the standard deviation of the inflows to be 35 percent per annum. The risk-free rate of interest is 8 percent. This situation presents the company with an option to acquire an inflow worth Rs.(300/(1.20)3 = 173.61) crore three years from now if the company is willing to spend Rs.250 crore. The initial 3 years from now investment is comparable to the exercise price and the present value of cash flows to the current stock price. Applying the Black and Scholes Model, we get:

Step 1 : Standard deviation x Sq. rt. of time
$= 0.35 \text{ x } \sqrt{3} = 0.61$

Step 2 : (Asset value)/(Present value of exercise price)
$= (173.61)/(250/1.08^3) = 0.87.$

Step 3 : Looking up the table 6 in the Appendix II, the reading corresponding to 0.60 and 0.88 is 18.90. That is, the value of the option to make the follow on investment is Rs.18.90 crore.

The value of the option to invest further in future is higher than the negative NPV for the first investment. The combined NPV is positive at Rs.7.86 crore, which makes the whole investment worthwhile.

OTHER APPLICATIONS OF OPTION PRICING MODELS

On the same lines as the above illustration, the option models can be applied to other situations:

ABANDONMENT ANALYSIS

Sometimes, it may be better economically to abandon a project well before the useful life. The value of the project as on the date of abandonment can be compared to the exercise price, the value that can be realized either by sale or alternative use will be the stock price and the option to abandon can be valued as a put option.

TIMING DECISIONS

Consider a project which requires an investment of Rs.180 crore. If set-up immediately, it gives inflows with a present value of Rs.200 crore. If postponed by a year, the present value of cash flows may change to Rs.270 crore or Rs.180 crore. The probability of changing to Rs.270 crore is 35 percent and for Rs.180 crore it is 65 percent.

The project can be viewed as a call option with an exercise price of Rs.180 crore. If exercised immediately, its pay-off is Rs.200 crore, and a later, it is Rs.(270 x 0.35 + 180 x 0.65 = 211.50) crore. It is, therefore, beneficial to exercise the option immediately. Another example of the timing decision has already been given in the illustration following the Binomial Model.

It should be remembered that the analysis is based on the assumption that the present value of cash flows is comparable in its movements to the stock prices and that the company will have the necessary funds to invest after three years. Another serious conceptual defect arises from the method of arriving at the value of the option. The derivation was based on the fact that holding the stock (or the underlying asset) and borrowing a suitable amount can provide the same pay-off as a call option. In such a situation, if the pay-offs from the two are not equal, possibilities of arbitrage arise. There should exist as good a market for real assets as for stocks, to avoid arbitrage opportunities which does not. In fact, many assets are difficult to trade in.

The application can, however, be justified from a different angle. Assume that for each capital investment project, there exists a traded option with the same risk characteristics, that is, the same volatility and exercise period. If we know how the traded option is valued by the market, we can value the capital investment option as well. It is not necessary that such an option should exist. If we can value a hypothetical option with the same characteristics, our job is done.

SUMMARY

- Options can be very useful in evaluating the benefits of a project in which some investments provide an opportunity to make additional investment in the future. This additional investment can be treated as an option whose value can be calculated by using the Binomial and Black and Scholes Model. These models also help in evaluating a project, which is unprofitable today, but may be profitable in the future, if the investment is made in future. They can also be used in taking decision about abandoning a project or the appropriate timing for starting a project.