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"Information technology's youth and dynamism make it highly resilient. New developments and opportunities constantly arise. Its very importance and increasing pervasiveness make it resistant to all but the most ill-conceived and consistently misguided policy initiatives."
— Ralph Weindling

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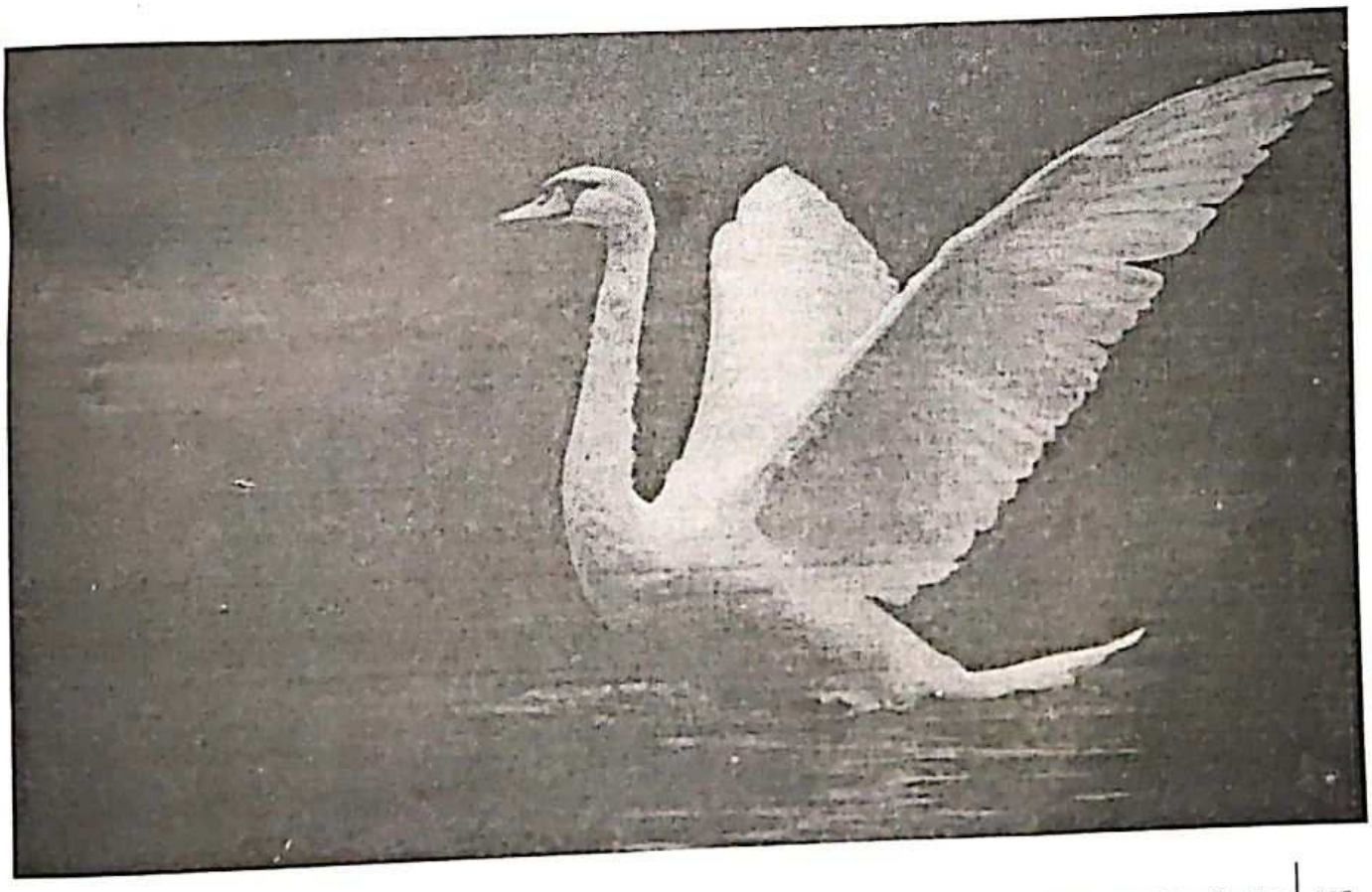
UNIT
PROJECT MANAGEMENT



Entrepreneurial development has assumed great importance and has become one of the dominant topics of discussion with the world moving towards the 21st century — an era of technological advancements and achievements. In the context of rapid industrialisation in India resistance to change can be resolved by involving human resources in the process. The remedy lies in fostering an entrepreneurial spirit among the people.

The professional expertise of entrepreneurs, no doubt, contribute to significant inputs to the country's economic development. The need for a broad-based entrepreneurial class in India arises from the need to speed up the process of activating the factors of production, dispersal of economic activities, creating employment opportunities — thus leading to economic growth. It is now well recognised that entrepreneurs can be developed through appropriately designed entrepreneurship development programmes on a sustained basis.

A Project

It is known that a project is planned to achieve a specific objective which calls for a specific authority to implement it.

Every project has three basic attributes: the input characteristics, output characteristics and the social cost benefit characteristics. The input characteristics define what the project will consume. Projects require raw materials, energy, manpower, financial resources and an organisational set up. In order to make the input characteristics of project explicit, it is necessary to evaluate the nature as well as the magnitude of each of these essential inputs.

The output characteristics of a project define what the project will generate — production of addition goods, provision of additional services. In either case, it is essential to have a broad idea of quantitative as well as qualitative of the project outputs. It also becomes necessary in case of quantifiable projects to assess financial outputs which the project will generate.

Input and output characteristics of a project define the impact of the project on the project implementing body and the environment. Every project, however, has a social cost-benefit aspect which affects the current equilibrium of the availabilities and non-availabilities in an economy and thus involves the entire society in its implications. The sacrifice which the society will be called upon to make and the benefits which will be accrued to the society have therefore to be carefully evaluated.

The identification of the project characteristics provides the basic information, which along with the information obtained from a study of the project implementing body and the environment forms the basis of evaluation of the feasibility prospects of the project idea.

More importantly, an appraisal of a project must be carried out in explicit, well-defined, preferably standardised terms and should be based on sound economic logic. Informal and cursory treatment should give way to thorough and rigorous analysis. The setting up of an enterprise should be based on careful and sound evaluation. Project appraisal brings credibility to a project and protects from in-built weaknesses. And, a healthy and viable industry comes up.

Project Management

Project management is as much an art as science. There seems to be certain pitfalls in project management, noticed across serveral projects in developing countries. Even obvious and common sense things are not paid attention, with the result that they occur with monotonous recurrence. They are no doubt simple to understand, but not simple enough to put into practice. Numerous examples can be cited — less than thorough feasibility studies, selection of inappropriate technology, and so on. A powerful constellation of forces serve as formidable obstacles to change. Continuity of development effort is broken with changes in government. Even in reasonably stable political conditions, officials in charge of development effort have less time for these efforts; often they are more preoccupied with pressing immediate problems. Long-term investment, benefits are sacrificed at the altar of short-term expediency and gains.

Management of investment projects can be considered at three levels — macro or national level, sectoral level and micro or individual project level. At the national level, investment plans are formulated and sectorwise priorities established through a set of macro-economic policies for development. At the sectoral level the issues and problems concerning that sector are analysed and suitable policy measures taken for resolving them. At the project level, attention is paid to the technical, economic, financial, social and other dimensions, in the preparation, evaluation, and implementation of the project.

Steps in Project Management

- Grouping work into packages which acquires the properties of a project.
- Entrusting whole project to a single responsibility/project manager.
- Supporting and servicing project internally.
- Building up commitment through negotiations, co-ordinating, directing.
- Ensuring adherence to goals.

Scope of Project Management

The scope of project management is quite diverse and at the same time interrelated.

The nine project management functions classified into:

- Scope management
- Integration management
- Quality management
- Time management
- Risk management
- Human resources management
- Project Procurement management
- Communications management
- Cost management

In the context of project management cycle, implementation involves allocation of tasks to groups within the project organisation. This stage has to be given utmost importance to derive the intended objectives. Deficiencies in implementation are also found due to inadequate planning of projects at the initial stage.

The purpose of any successful project implementation is to ensure that the project activities are completed within the schedule and the budgeted provisions, leading to desired quantum of benefits flowing therefrom. The project implementation implies initiating the project, specifying and scheduling the work, clarifying authority responsibility relationship, obtaining resources, establishing control system, directing and controlling and finally terminating the project.

16 CHAPTER

PROJECT: CONCEPT AND CLASSIFICATION

"Successful entrepreneurs, whatever their individual motivation — be it money, power, curiosity, or the desire for fame and recognition — try to create value and to make a contribution. Still, successful entrepreneurs aim high. They are not content simply to improve on what already exists, or to modify it. They try to create new and different values and new different satisfactions, to convert a "material" into a "resource", or to combine existing resources in a new and more productive configuration."

— Peter F. Drucker.

INTRODUCTION

The project is an important groundwork of an enterprise and is also very crucial to the entrepreneur. Invariably, an entrepreneur cannot succeed in his venture and/or enterprise without a project. By and large, projectes connotes programme of action. There are agricultural projects with sub-projects relating to land development, irrigation, soil-conservation, fertiliser, seeds etc. There are also research projects and so on. The concept of projects is intrinsically woven with all socio-economic and cultural activities. We have made an attempt in this chapter to analyse the concept of a project, its characteristics and assess its role in the setting up of a venture/enterprise.

The dictionary meaning of project is speculative imagination; a scheme of something to be done; a proposal for an undertaking. In this case, two important aspects have to be borne in mind, viz., a scheme and speculative imagination. In other words, innovation and vision form an integral aspect of a project programme. *Inter alia*, these are also interwoven with the basic characteristics of an entrepreneur.

An Overview

Project is defined as a one-shot, time-tested, goal-directed, major undertaking, requiring the commitment of varied skills and resources. A project is also described as a combination of human and non-human resources pulled together in a temporary organisation to achieve a specified purpose. A project has a single set of objectives, and when these objectives are reached, the project is completed. Therefore, a project has a finite and well-defined life span. Further, management must have a clear idea as to what these objectives are, so that there can be no doubt as to when the project is completed. Some people use the terms "programme" and "project" as synonymous. But there is a difference. A programme is usually larger in scope, is activity-oriented, and is not necessarily time bound. For example, health

programme, educational programme, agricultural or industrial development programme. A programme may encompass a number of projects. An industrial development programme may consist of one or more fertiliser projects, power projects, and so on. The project objectives must aim at meeting the programme objectives. While programme objectives may be broader, the project objectives are more specific and focussed.

A project is a "one-shot" major undertaking. For example, a thermal power project. Even when another thermal power project is undertaken, it will be different from the previous one. In other words, the term "project" may be common, but the "plants" are not.

A project is for setting up a plant and when the plant becomes operational, the project is treated as completed. A project is neither a physical objective, nor is it the end-result. It has something to do with the activities that go on, which must be the same, whether it is to build a nuclear power plant or launching a new detergent.

Meaning of Project

Several economists and bankers have defined a project in different ways. The ECAFE Report by a group of experts has defined it as "the smallest unit of investment activity to be considered in the case of programming." The World Bank has defined project as "an approval for a capital investment to develop facilities to provide goods and services." Little and Mirless meant by a project to any scheme or a part of a scheme for investing resources which can be reasonably analysed and evaluated as an independent unit. It may be any item of investment activity which can separately be evaluated. "That is, a project is an appraisal for investment with the definite aim of producing a flow of output over a specific period of time." Gordon has defined it as "the whole complex of activities involved in using resources to gain benefits." Generally, in agricultural projects, we think of an investment activity where we expend capital resources to create a producing asset from which we expect to realise benefits over an extended period of time.

A project should be understood in terms of economic behaviour. Dr. Albert O. Hirchman has said that "the development project cannotes purposefulness, some minimum size, a specific location, the introduction of something qualitatively new, and the expectation that a sequence of further development moves will be set in motion. Development projects are privileged particles of the development process."

Thus, a project may be defined as a scientifically evolved work plan devised to achieve a specific objective with a specified period of time. The three basic attributes are a course of action, specific objectives and definite time perspective.

A project is a productive activity which can be analysed, appraised and monitored independently. A multi-purpose river valley project is in a sense a gigantic scheme. There are also small projects which call for investments and analysis. A project has specific objectives in terms of geographic location, specific starting and end point, and most important — to serve a target population by achieving good investment returns. What is more, it has an organisation to implement it as shown below:

Project Objectives

Project objective is an important element in the project planning cycle. Project objectives are concerned with defining in a precise manner what the project is expected to achieve and to provide a measure of performance for the project as a whole. Objectives are the foundations on which the entire edifice or the project design is built. The essential requirements for project objectives are:

(a) specific, not general

(b) not overtly complex

(c) measurable, tangible and verifiable

(d) realistic and attainable

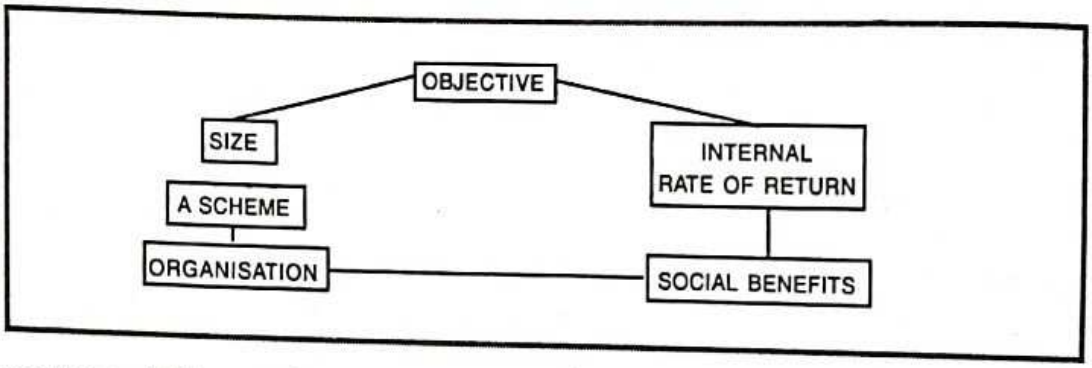
(e) established within resource bounds

Box 16.1 Project

- Project is an organised programme of activity carried out to reach a defined goal, often of a non-recurring nature with a specified terminal point. It is a package of time-bound, scheduled and assembled activities dedicated to the attainment of a specific objective of successful completion of a work on time and within the allotted budget.
- Project is a one-shot, time-tested, goal-directed major undertaking requiring the commitment of varied skills and resources.
- A project is a combination of human and non-human resources pulled together in a temporary organisation to achieve a specified purpose.
- Project is a specific activity on which money is spent in the expectation of return.
- Project is an approval for a capital investment to develop facilities to provide goods and services.
- A project is an appraisal for investment with the definite aim of producing a flow of output over a specific period of time.
- Project is the whole complex of activities involved in using resources to gain benefits.
- Project is a scientifically evolved work plan devised to achieve a specific objective within a specified period of time.
- Project, in the context of development activities, is a kind of investment. It connotes purposefulness, size, location etc.
- Project is a system involving coordination of a number of interrelated activities to achieve a specific objective.

[Source : *The Manager's Advisor, Peter Barron Stark & Associates.(Communication)]*

Fig. 16.1: Basic Components of a Project



(f) consistent with resources available or anticipated

(g) consistent with organisational plans, policies and procedures.

The project objectives are aimed to complete the project on time, within contemplated costs and at a profit. Whereas, the objectives of social projects are service oriented.

Objectives are the foundations on which the entire edifice of the project design rests. They specify the present position, goals and the time duration. The basic objectives of a project are:

(i) Maximisation of the market value of equity.

(ii) Maximisation of net present value.

(iii) Maximisation of return.

(iv) Increase in the internal rate of return (IRR) at low risk.

(v) Increase in the net present value of monetary flows.

These expected results or goals are to be achieved within a specific period of time, so that the entrepreneur can see the fruits of his innovations and entrepreneurship.

Characteristics of a Project

Though various cannotation have been given to the concept of a project, they have four basic characteristics:

(a) Investment pattern;

(b) Benefits or gains;

(c) Time limit; and

(d) Location.

The characteristic features of a project are:

1. Project has a mission or set of objectives
2. The project is one single entity
3. Project calls for team work
4. Project has a life cycle
5. Project is always unique — no two projects are similar
6. Project is always customer-specific
7. Project is a complex set of things
8. Project is exposed to risks and uncertainty
9. Project is a motivated organisation
10. Project has to terminate at some time or the other
11. Project has learning component
12. Project process is flexible
13. Project is interrelated

In addition, project strives to add value to the society:

1. Development project strives to accelerate the process of development
2. Projects thrive with community participation
3. Project involves varied analyses in its successful completion
4. Each activity in the project is crucial for its success
5. Project implementation calls for monitoring and control
6. Planning is core of a project
7. Project management coordinates all the activities from conception to completion of project.

In short, "the project is an economic activity with well-defined objectives and having a specific beginning and end." It should be amenable to planning, financing and implementation as a unit where both costs and returns are measurable. A well-planned project includes a correct consideration of alternatives, identification of key issues, broad participation, compactness and enforceability. It should be, neat, clear-cut and of course, spcific.

From the point of view of resource allocation, a project can be considered as a proposal involving capital investment for the purpose of developing facilities to provide goods and services. The goods or services which the project seeks

to provide differ widely. A project may involve the establishment of a new plant for the manufacture of steel ingots, it may involve the provision of additional educational facilities to a particular age group in the community, or it may aim at developing infrastrcture facilities for the marketing of agricultural commodities. Whatever be the nature of the project, a project will involve allocation and consumption of resources, on the one hand and generation of resources, goods, or services, on the other.

Project Approach

The discussion above also indicates that project designing should address itself to possible approaches to areawise development projects. Three possible approaches are usually accomplished. These are described briefly below:

(i) Sub-sector or product approach: The effort is restricted to a sub-sector of production or one product which covers a broad geographical area. Examples, of such an approach are found in the projects involving tea, coffee, rubber or horticultural projects and dairy, poultry or sheep farming etc.

(ii) Functional approach: The effort here is restricted to certain development functions like marketing research or agricultural extension projects. The emphasis is on the services and not on the output or a specific product.

(iii) Regional approach: The effort is limited to a geographically bounded area, within which the tasks are usually broadly conceived. The best example is the Integrated Rural Development Scheme (IRDS) as applicable to each of the blocks.

All these approaches have the same goals, that is, the gradual development of the total economy of the country. The subsector approach seeks to involve ever-increasing number of subsectors of development. The functional approach aims at increasing the services and the regional approach implies a commitment to more and more regions. But the experience in project financing has clearly shown that no distinct demarcation could be made as above, notwithstanding the fact that all these become compartmentalised in cases where state level projects are involved. Otherwise, these are, in fact, parts of a project approach. This could probably be best illustrated with an example, say, of milch animal financing.

The financing bank, as per the above, would develop the scheme as a subsector approach. The definition of project given in the earlier pages underlines that the location should specifically be mentioned. Thus, the regional approach criterion is also satisfied. Mere supply of a high-yielding buffalo or a cow would not solve the problem. The functional approach would now come in when the extension/veterinary services are included in the project.

Project Features

Every project must have certain features to maintain uniformity and ensure success. In short, these are:

(a) Simplicity and clarity.
(b) Availability of attractive technology to promote the project.
(c) Integration of basic production services, especially those of input supply, credit, marketing and extension.
(d) Compatability of the project within the existing administrative mix.

Compliance of the above features and various other factors discussed earlier do not necessarily ensure effective project financing. A most carefully designed project may fail due to faulty management, while a badly designed project may succeed given a rich component of good management. Thus, the above list is not comprehensive but is indicative. All these are like tools in the hands of the mechanic or a sculptor. It is ultimately through the management of the resources by application of tools that success is ensured in project financing.

Project Levels

Project work in its broadest sense takes place at three levels:

- At the national level, where national investment plans are formulated, priorities among sectors are established, and the macroeconomic framework of policies for economic growth is put in place.
- At the sector level, where priorities for investment within each sector are determined and the issues and problems affecting the development of the sector are addressed.
- At the project level, where individual projects are identified, prepared, and implemented and attention is given to their technical, economic, financial, social, institutional, and other dimensions.

Only in the abstract can the project process be described as a sequence of steps proceeding in logical order from the national to the project level. Project work is in fact a continuum; decisions or actions affecting individual projects may take place at each of the three levels simultaneously and in interactive ways.

Project Classification

A natural corollary to the study of project idea is the classification of the project. Project classification helps in graphically expressing and highlighting the essential features of the project be it quantifiable or non-quantifiable, be it any potential sector, be it capital-intensive or labour-intensive, whether it will involve small or large-scale investment — will materially affect the project's feasibility evaluation is undertaken. As seen already, a project is a proposal for investment to create, expand and/or develop certain facilities in order to increase the production of goods and/or services in a community during a certain period of time. In a very broad sense, a project includes all activities which are aimed at —

1. Increased production of goods and/or services,
2. Increasing the capacity of the existing projects, and
3. Increasing the productivity of these goods/services.

To carry out these activities capital assets are acquired to replace worn-out machinery for upgrading and restructuring for modernisation purposes by new technologies.

The real bottleneck for economic development in general and development of backward areas in particular, seems to be a dearth of well-worked out projects which can be implemented at short notice. This has been a characteristic deficiency of project planning. It is of utmost importance to have a large number of well-worked-out projects in various sectors so that the pace as well as the pattern of investments can be carefully regulated in the context of an emerging economic situation. The establishment of a new business unit to manufacture some product or arrange for the distribution of products of another concern is beset with a number of problems. The entrepreneur's job is, therefore, one of the most difficult and trying in the world.

Projects can be classified into public sector, private sector, and joint sector. State owns public sector projects; joint sector projects are owned by both State and entrepreneurs. The considerations for setting up joint sector projects are: desire on the part of the state to utilise the entrepreneurial and managerial skills of private sector, the ability of the State to commit huge funds for investment, which private sector by itself cannot afford.

Modernisation projects are those, where the existing plant is entirely remodelled taking advantage of the new technology/process to produce more cost effective products/services.

Projects have been classified in various ways by different authorities:

1. Quantifiable and Non-Quantifiable Projects

Little and Mirrless have divided projects into broad categories, viz., quantifiable projects and non-quantifiable projects. Quantifiable projects are those in which a plausible quantitative assessment of benefits can be made. Non-quantifiable projects are those where such an assessment is not possible. Projects concerned with industrial development, power generation, mineral development fall in the first category while projects involving health, education and defence fall in the second category.

2. Sectoral Projects

The Planning Commission in India accepted this sectoral bias as the criterion for classification of projects. A project may, under this classification, fall into any one of the following sectors:

(a) Agriculture & Allied sector

(b) Irrigation and Power sector

(c) Industry and Mining sector

(d) Transport and Communication sector

(e) Social Service sector

(f) Miscellaneous.

This system of classification has been found useful in resource allocation at macro-level.

3. Techno-Economic Projects

Projects are sometimes classified on the basis of their techno-economic characteristics. Three main groups of classification can be identified here:

(a) Factor Intensity-oriented classification: On the basis of this classification, projects may be classified as capital-intensive or labour-intensive depending upon whether large-scale investment in plant and machinery or human resources is involved.

(b) Causation-oriented classification: Here projects are classified as demand-based or raw material-based projects — depending on the non-availability of certain goods or services and consequent demand for such goods or services or the availability of certain raw materials, skills or other inputs as the dominant reason for starting the project.

(c) Margnitude-oriented classification: In this the size of investment forms the basis of classification. Projects may thus be classified as large-scale, medium-scale, or small-scale projects depending upon the total project investment.

Techno-economic characteristics based classification is useful in facilitating the process of feasibility appraisal. United Nations and its specialised agencies are reportedly using the International Standard Industrial Classification of all economic activities (ISIC) in collection and compilation of economic data. Since this classification covers the entire field of human economic endeavour, it forms a useful basis for classification of projects. Economic activities under this classification are grouped into ten divisions, which are sub-divided into ninety sub-divisions. The divisions are:

Division 0	Agriculture, Forestry, Hunting and Fishing
Division 1	Mining and Quarrying
Division 2	
Division 3	Manufacturing
Division 4	Construction
Division 5	Electricity, gas, water and sanitary services

Division 6	Commerce
Division 7	Transport, storage and communications
Division 8	Services and others
Division 9	Activities not adequately described.

4. Financial Institutions Classification

All India and State Financial Institutions classify the projects according to their age and experience and the purpose for which the project is being taken up. They are as follows:

(i) New Projects

(ii) Expansion Projects

(iii) Modernisation Projects

(iv) Diversification Projects.

The projects listed above are generally profit-oriented.

5. Services Projects

The services oriented projects are classified as under:

(i) Welfare Projects

(ii) Service Projects

(iii) Reserach and Devleopment Projects

(iv) Educational Projects

Other classification of projects include:

(i) New projects

(ii) Expansion projects

(iii) Modernisation projects

(iv) Diversification projects

(v) Other projects.

Importance of a Project

The project is of great importance to entrepreneurs for setting up of new ventures and for their smooth running on an ongoing basis without any hindrances.

Dimensions of a Project

1. They become the catalytic agents of economic development.
2. They initiative the process of development — production, employment, income generation and so on.
3. They have consequnces which are long-term in nature.
4. Projects provide the framework of the future activities of the enterprises.

5. They also shape the future pattern of services.
6. Projects usually involve substantial financial outlays.
7. They also initiate development of basic infrastructure and environment.
8. Project commitments cannot be easily reversed.
9. Project Identification brings the necessary changes in society in course of time.
10. Projects accelerate the process of socio-cultural development.

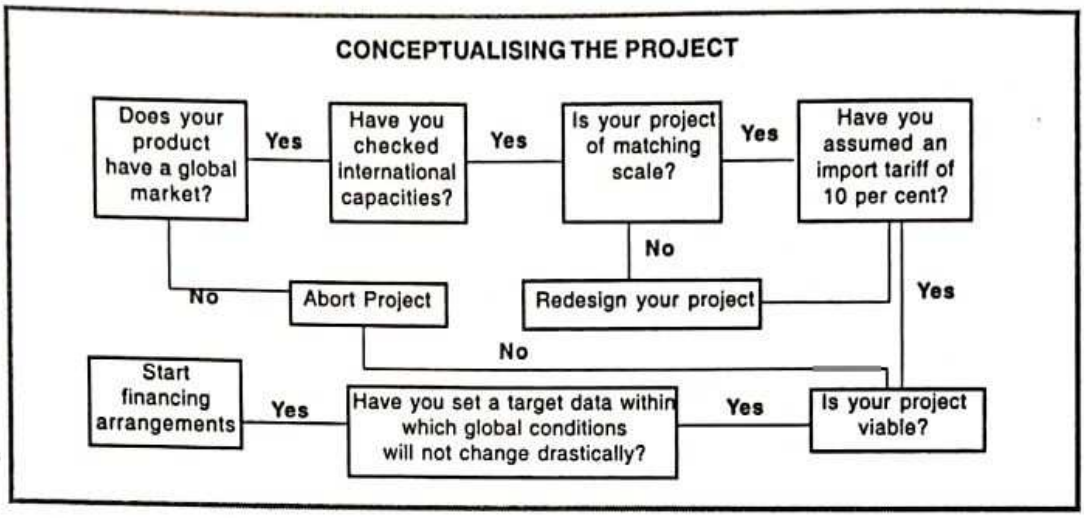


Fig. 16.2: Basic Components of a Project

Project Form

A project consists of unique time-consuming activities performed in a sequence. Each prject has some definite completion time and the cost associated with all the activities of the project till its completion is called project cost. Here there are many complex-tasks, involving a multi-disciplinary approach. The tasks have a dead-line.

Some projects generate a product as a output like a ship or an air-craft. Here, during the transformation process, there is immobility of the product, it remaining in the fixed man, materials, machines etc. to diffferent activities. Some materials do get consumed in the process, whereas some machines and manpower are capable of being re-deployed in other project activities.

The following is an illustrative list of projects:

1. Setting up a Nuclear Power Plant.
2. Lauching a new product in the market like Hot-Shot camera.
3. Construction of civil works like bridges, buildings, roads etc.
4. Conducting an Executive Development Programme like Finance for Non-Financial Executives.
5. Organising an annual Sales Conference.
6. Computerisation of Human Resources Inventory.
7. Building a modern hospital or stadium or stadia for sports meets.
8. Modernisation of outdated textile mills.
9. Community development projects — travel, tourism, integrated rural development, technology missions, family planning etc.
10. Implementation of a change due to technological advance in manufacturing, packaging, material handling etc.
11. Competition-stimulated projects related to cost-reduction, productivity improvement etc.

In other words, project form suits inter-disciplinary sets of activities to be performed under severe time and cost constraints, which may result in penalties if there are time and cost over-runs with time wages of labour and jacked-up prices of equipment, project approach is finding favour all the more.

Aspects of a Project

There are two aspects of a project. First, a preliminary aspect of analysing the product, its marketing, technical, financial and economic aspects. Second, the feasibility aspects. It contains adequate information for decision-making and sometimes, even implementation.

The important aspects of a project are as shown below:

Table 16.1 Aspects of Projects

Aspects	*Concerned with*
	I. Preliminary
Product/Service	*(i)* Choice of a product/service *(ii)* Technical characteristics of the product/service *(iii)* Uses of the product/service
Marketing	*(i)* Consumer preferences *(ii)* Nature of competition *(iii)* Potential aggregate demand *(iv)* Likely share of the project
Technical	*(i)* Location *(ii)* Scale of operation *(iii)* Manufacturing process *(iv)* Plant and machinery *(v)* Plant layout *(vi)* Work schedule
Financial	*(i)* Outlay on fixed assets *(ii)* Current assets *(iii)* Working capital *(iv)* Short and long-term finance *(v)* Bills etc.
Economic	*(i)* Utility to society *(ii)* Employment generation *(iii)* Ancillary development *(iv)* Scope for area development *(v)* Social benefits
	II. Feasibility
Financial viability	*(i)* Costs and benefits *(ii)* Risk characteristics *(iii)* Viability *(iv)* Internal rate of return (IRR)
Profitability	*(i)* Revenues, earnings *(ii)* Costs *(iii)* Profits *(iv)* Break-even level of operations
Financial Projections	*(i)* Proforma balance sheet *(ii)* Sources and use of funds
Socio-economic desirability	*(i)* Social goals *(ii)* Desirability of the project from the larger social angle *(iii)* Maximum Returns.

Most of the various aspects of a project presented above are studied simultaneously because they are interrelated. Primarily, the project is assessed for its economic viability in terms of marketing, technical, production, financial and economic aspects. If this analysis suggests that the project is *prima facie* worthwhile, a more detailed investigation is conducted. It examines the feasibility of the project. The detailed analysis at various stages provides stimulus to its smooth implementation. The project has a number of sub-projects within a project. Detailed examination of all these projects pave the way for assessing the soundness of a project. A sound project is one which is socio-economically desirable and it aims at social good of a larger segment of the society.

The Project Cycle

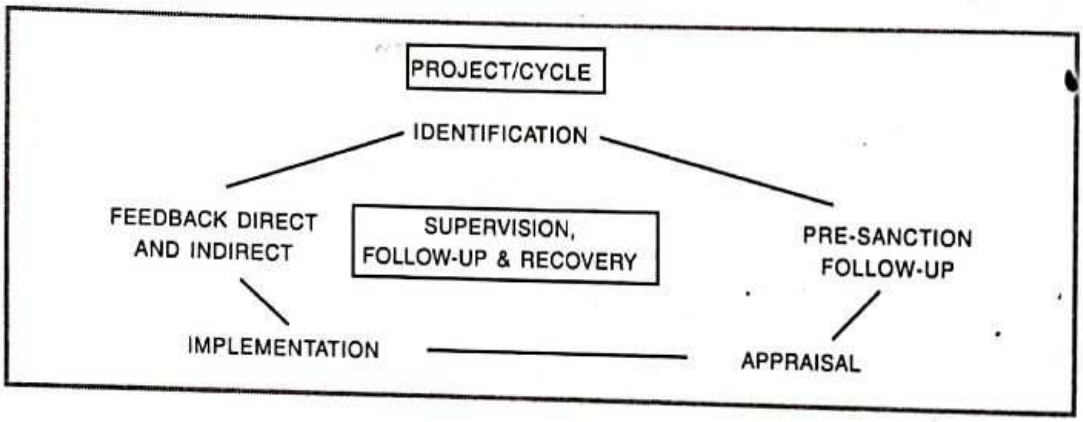
The project work comprises of several distinct stages, commonly referred to collectively as the project cycle. The stages are closely linked and follow a logical progression, with the later stages providing the basis for a renewal of the cycle. The principal stages of the cycle are the identification of a project; its design, preparation and appraisal; its implementation; and its evaluation once the investment phase has been completed.

The project life cycle consists of three main stages:

1. The Pre-Investment Phase —The first phase of a project.
2. The Construction Phase —This phase consists mainly of developing the infrastructure for the project as well as creation of assets.
3. The Normalisation Phase —The Primary objective of this phase is to produce goods and services for which a project is established.

The Project cycle is illustrated in the diagram.

Fig. 16.3:



Project Identification

The project cycle begins with the identification of project ideas that appear to represent a high-priority to achieve important development objectives.

Project Preparation

At the next stage, a feasibility study should be taken in its principal dimensions technical, economic, financial, social and so forth to establish the justification of the project.

Projects should be designed with a view to how they will be implemented. Appropriate design is essential. The design of projects need to be adopted to lcoal, political, administrative, economic, and cultural conditions, particularly if success hinges on changing behaviour.

The entire project should be objectively appraised.

Project Implementation

All project identification and preparation work is directed toward facilitating project implementation and helping to ensure its success. Implementation is a critical stage of project work.

Ex-post Evaluation

The project cycle does not end when implementation is completed and the project goes into operation. The main purpose is to learn lessons for the design of future projects and help ensure accountability. Ex-post evaluation should provide a comprehensive and detailed review of the elements of success and failure of the project for enhancing the development impact of project work.

Priority Projects

India being basically an agricultural country must give top priority to rural development. For this, rural development projects intend to provide a sustained increase in agricultural output and generation of adequate gainful employment. Rural development programmes can be accomplished only by uplifting the individual or the family. As already mentioned, taking up schemes or projects for development of rural population on individual sporadic basis would at best touch only the fringe of the problem of mass rural development. This scattered development effort leads to waste of resources. Therefore a package of programme projects, area development schemes and other means should be systematically evolved.

Project Planning

Projects neither come out of nothing, nor would they fall from the blue. They have to be planned. Investment projects should be planned within the framework of national policy directives. Priorities should be fixed. Planning is the most important aspect of project preparation.

Planning is thinking deeply through a problem, examining all the logical paths and writing down all the times in their logical and time order. Planning in any project sector should justify the following:

(a) Planning would help to optimise the use of scarce resources.

(b) Optimisation and better utilisation of the existing resources.

(c) Results in the desired benefits.

(d) Within the budgetary provisions of a financing institution.

The need for a well-planned project is now well established. Lack of proper planning, for example, had exhausted the ground water potential in some states or are being over-exploited. Improper planning again had resulted in financing the farmers desirous of taking hybrid/graded milch animals, going for country breeds, as the advances have not considered the seasonality and adequacy or availability of breeds.

Project Planning Matrix

The Project Planning Matrix is the crux of the entire project planning approach. It consists of the overall goal; the project purpose; the results/outputs which the project manager must achieve and sustain; and activities necessary to achieve results/outputs.

Table 16.2 Project Planning Matrix

	Project Title *Project No.* *Est. Project Duration*	*Country*	*PPM prepared (date)*
Summary of objectives/ activities	Objectively verifiable indicators	Means/Sources of verification	Important assumptions
Overal Goal (OG) to which the project contributes	Indicators that OG is reached		For sustainability of Overall Goal
Project purpose	Indicators which show the achievement of a successful PP		For the achievement of the OG
Results/outputs	Indicators, describing the Results		For the achievement of the PP
Activities	Specification of Quantities and Unit/ Costs for each individual Activity	Information from the accounts	For obtaining the results

The interesting feature of the matrix is that it forces planners to come out clearly with objectively verifiable indicators and the means of verification. This ensures that vague objectives are not entertained.

The PPM also lays down the resources needed for various activities. The specification of input is important for the calculation of costs.

This stage involves the preparation of the feasibility report of the project conceived. The feasibility report relates to technical, economic, financial and managerial feasibility. This will indicate the technical, financial and marketing aspects of the project conceived. For the purpose of preparation of this report, information is, collected, compiled and analysed in the concerned areas like requirements of raw materials, target market for the product, the technology of production, the financial requirements, the requirement of skilled and unskilled labour, etc. Understanding the market for the product is important and a detailed study must be undertaken, depending upon the various data collected. The market may be regional, national or international, which indicates the probable volume of production that can be undertaken. Also information relating to the existing producers manufacturing similar products, the end users of the project, the potential manufacturers of the product, the potential end-users of the product and any other possible new uses for which the product could be put to must be gathered and the report must be prepared accordingly. Useful information can be obtained for the above purpose from the Annual Reports prepared by the Directorate General of Technical Development (DGTD) guidelines for industries, and the industry-wise notes prepared by development corporation.

Understanding demand for the product is another area which is significant at this stage. Whether the demand is for original requirements or for replacement should be examined. The sensitivity of the buyers to the quality and price of the product and whether the demand is seasonal and norms that are to be maintained while manufacturing the product, institutional demand, etc. must be carefully considered before arriving at the demand for the product to be manufactured and marketed.

CONCLUSION

A project is a scheme for investing resources in an enterprise. It can be a gigantic scheme like a multipurpose river valley project or a venture small investment. It contains a blue print of a venture. The project provides enough details and analysis of technical, financial, marketing and economic aspects. It also contains plans and programmes for implementation. Normally, project serves as the basis for bodies. To entrepreneurs, it opens up a programme of action, profitability and economic viability. A project comprises of several stages with sub-projects interwoven and interlinked. A sound project will definitely work towards economic development.

The matrix form of organisation is suitable when multiple projects are being handled. Here there are functional specialists who hold the resources and allow the project manager to co-ordinate these resources through his subordinates. Each functional specialist co-ordinates several project managers. There is therefore co-ordination across functional departments. However, the principle of unity of command is violated, and hence there is a need for a better rapport between the functional specialist and the project manager in his line capacity.

Each project consists of a cost of activities having inter-dependence. Some activities cannot start till the predecessor activities are completed. The project delayed results in cost over-run. Scheduling and controlling of project activities by OR techniques like PERT/CPM is therefore vitally important.

18 CHAPTER

PROJECT IDENTIFICATION

"The identification of opportunities for project investments requires an understanding of the environment in which one operates, sensitivity to emerging investment possibilities, imaginative analysis of tangible and intangible factors, and also an element of luck."

INTRODUCTION

Project identification is the first step of a new venture. A right direction may enable an entrepreneur to scale new heights. Otherwise, he has to undergo a number of hurdles in his way. It is therefore, very crucial to entrepreneurs to identify projects. We have made an attempt in this chapter to analyse the various aspects of project identification.

Theoretically, an entrepreneur has an infinitely wide choice with respect to this project. The important dimensions of choice are: product/service, market, technology, equipment, scale of production, location, incentives, and time phasing. The task of identifying a feasible and promising project is somewhat difficult. Moreover it is interrelated with the government policies, infrastructural development and skills of people.

Project identification is concerned with collection, compilation and analysis of economic data for the eventual purpose of locating possible opportunities for investment and with the development of such opportunities.

Opportunities according to Drucker are of three kinds: *additive, complementary* and *breakthrough.* Additive opportunities are those opportunities which enable the decision-maker to better utilise the existing resources without in any way involving a change in the character of business. These opportunities involve minimum disturbance to the existing state of affairs and hence the least risk. Complementary opportunities involve the introduction of new ideas and as such do lead to a certain amount of change in the existing structure. Breakthrough opportunities, on the other hand involve fundamental changes in both the structure and character of business. These opportunities involve minimum disturbance to the existing state of affairs and hence the least risk. The element of risk is greater in the case of complementary opportunities and is greatest in the case of breakthrough opportunities. As the element of risk increases, it becomes more and more important to precisely define the scope and nature of the project objectives and to select the best possible approach so as to minimise both resource consumption and risks and to optimise the return or gains.

Human mind has an infinite capacity to observe and to innovate and deduct. Observation is one of the most important sources of project ideas. The observant mind continuously comes across situations which can be utilised to develop investment opportunities. The observation may be made during the course of one's routine occupation or otherwise. The dearth of a particular article or service may for instance lead to the development of an industry which can provide the article or service in short supply. The availability of a specified type of raw material or skill may lead to yet another type of industrial activity. The observant mind is always on the look out for opportunities which can form the basis for the development of new project ideas. Observation of the existing processes can sometimes lead to new opportunities and financially beneficial project ideas.

This would for instance be the case when a processing unit decides to manufacture machines which it has so far been using for processing purpose only. The process of deduction is on many occasions used to supplement and rationalise project ideas based on pure observations. In innovative units, it often becomes necessary to depend upon the deductive process for the development of new approaches to the solution of existing problems.

Trade and professional magazines provide a very fertile source of project ideas. The statistics and information given by these magazines and reports and records of professional bodies often reveal opportunities which can be eventually developed into investment propositions. It is very important for every person who is involved in the development of new investment opportunities to remain in touch with the latest developments in his own field of specialisation. It is also necessary for him to keep in touch with developments in the fields which may be horizontally or even vertically liked with his own line of specialisation. Study of technical and professional literature, besides keeping a personal touch, also stimulates thinking and helps in the process of development of new project ideas.

Bulletins of Research Institutes are also a very fertile source of information for new project ideas and opportunities. These bulletins generally give the broad outlines of the new processes or products developed by research institutions. However, the information made available in the research Bulletin may not be adequate for concretisation of ideas. Further correspondence with the research institute may become necessary.

In most developing countries where planned development has been accepted as an approach towards the removal of poverty, the plan document published by the Government provides a very useful source of project ideas. The plan document generally analyses the existing economic situation in a country and also pinpoints the investment opportunities which fit into the overall planning effort. Considerable information can, therefore, be gathered from the plan document.

Departmental publications of various departments of Governments also provide useful information which can help in the development of new project ideas. These publications are either periodical in character or are issued on special occasions. The census document which is a periodical publication is a very useful source of information about the economic structure of the society and various trends in the growth of economy and purchasing power and can be used to develop new ideas.

The project idea is a user friendly concept of what a project should be like. It is the raw expression of the desire of the project sponsoring body to achieve something. The exact form in which the project idea is expressed is immaterial. In order to avoid unnecessary communications between the project sponsoring body and the project formulation team, the project idea should indicate broad objectives of the sponsor and limit these in time, space, function and structure. In case no limitations are envisaged, the sponsoring body should state so and leave the project formulation team in no doubt about it.

Criteria for Selecting a Particular Project

After gathering a large number of project profiles, the entrepreneur should consider the following criteria for selecting a particular project:

Investment size: Professional managers, who have worked in multinational companies or large Indian companies, should think of starting medium-sized or large-sized units only. The investment size (project cost) should be at least Rs. 3 to 5 crore. They should not commit the common mistake of restricting the project size to less than Rs. 2 crores

so that they need go to all financial institutions. In fact, under the present circumstances, it will be much easier to get projects cleared by the all-India institutions, requiring even lesser promoter's contribution.

Location: A new entrepreneur should locate his project to the extent possible, in and around the State headquarters. There are many backward areas around such cities. It is necessary to have such a location so to attract competent managers. This will also facilitate liaison with the State Electricity Board, State Industrial Development Corporation and various other agencies.

Technology: The first project should not be for a product which requires high technology, necessitating foreign technical collaboration. It is better to go in for product with a proven technology that is indigenously available. It makes life easier to begin with.

Equipment: The entrepreneur should select the best equipment as per advice of experienced technical consultants. He should not compromise on the quality of the equipment. Many entrepreneurs enter into some sort of a deal with the equipment manufacturers for a "kick-back" and in the process sacrifice quality. One should not be short-sighted and come to grief by going in for poor quality equipment.

Marketing: It is not advisable to get into a project particularly the first, which would mean survival amidst cut-throat competition involving direct selling to the ultimate consumer. One should go in for products with a limited number (say 10 to 20) of industrial customers.

Project Ideas — Scanning of Business Environs and Identifying a Project

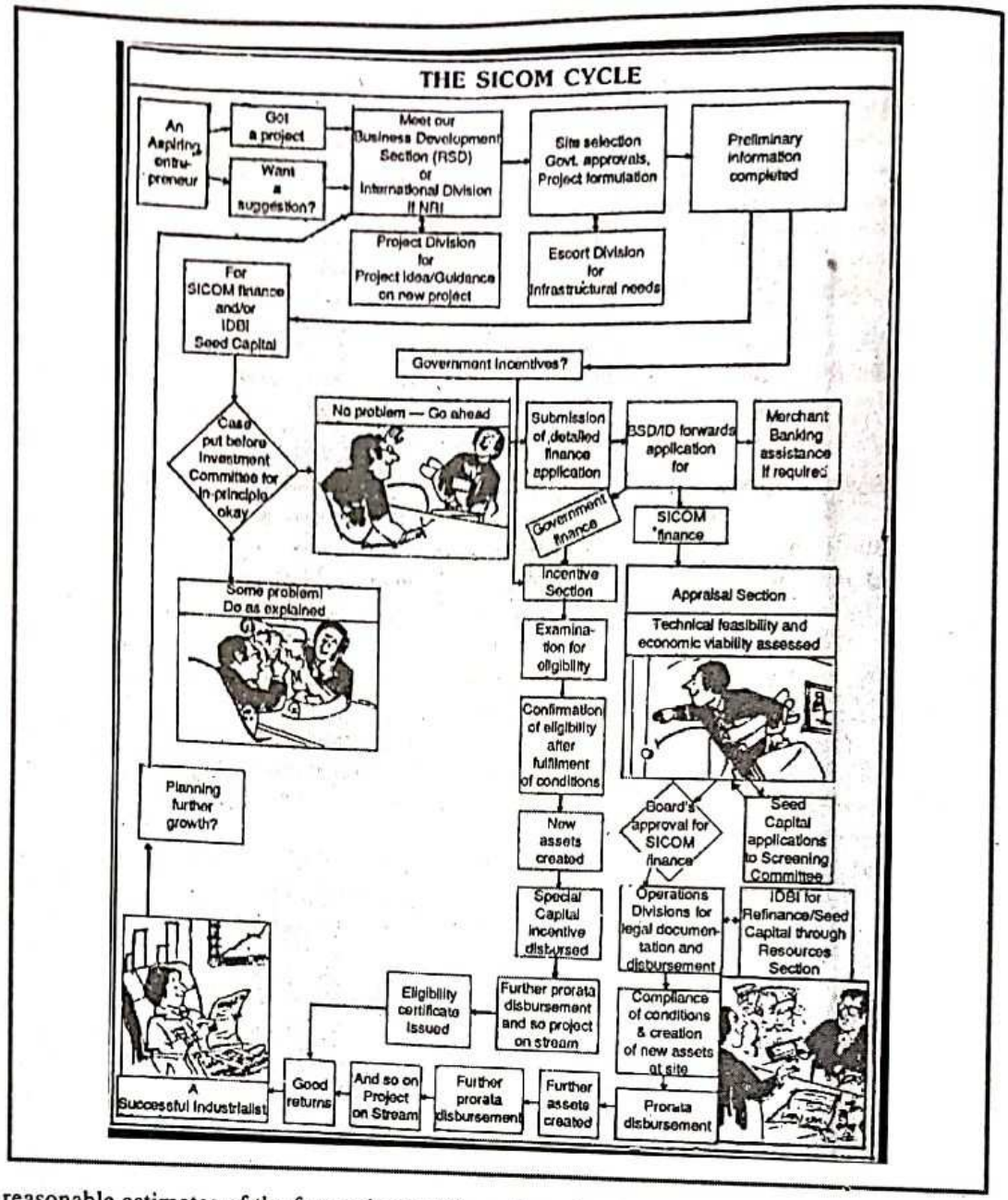
Project ideas originate from various sources or due to different reasons like the success story of a friend/relative, experience of others in manufacture/sale of product, demand for certain products, chances of producing a substitute of an article imported for which there is good demand etc., and of course, the motivation, background and skill of the entrepreneur and his associates.

One major aspect while choosing a project idea should be to ascertain the extent of the marketability of the product proposed to be manufactured, its general use, industries which use it, its end-use and its buyers. You should, therefore, study the demand and supply of the product over the last few years to estimate its future demand based on the past trend. While doing so, it would be necessary to take into consideration the anticipated changes in fashions, technology and levels of income of the people. If the product proposed to be manufactured has a market throughout the country, the study should take into account the demand and supply of the product for the whole country. However, if the market for the product would be confined to one/two states/or a particular region, the study may be confined to the concerned states/region. Many units function as ancillaries to major industries. In such a case, their fortunes being very closely dependent and liked to that of the 'parent unit', it is very important that detailed anlalyses are made on various areas before the decision to become an ancillary is made, i.e., areas like, will the unit be totally dependent on the parent unit, the potential for reasonable profit and future growth, the experience of similar ancillary units, whether there are any problems in obtaining payments or supportive know-how, whether the investment in fixed assets will be such as to facilitate easy branching off into a new product line in case the ancillary arrangement does not yield anticipated benefits, etc.

It will be equally important to judge market demand even when you are setting up a 'general purpose' workshop or service industry. In such cases, it will be necessary to have a clear idea of the industrial environment, the type of job orders you may obtain, whether they will be repeated, who will be giving them local competition, whether there are any large projects/establishments which promise potential for assured orders, whether your unit will have specialisation in a particular type of work which will give an edge over competitors, etc.

An import-substitute product, basically, should have a good market in view of the general policy to encourage indigenous production. It would, however, be necessary to have a clear idea of the government's import policy, present demand, the landed price of the imported item and how your price will compare with it, quality differences, etc.

Fig. 18.1:



In order to arrive at reasonable estimates of the future demand for and supply of a product, information relating to the capacity of existing unit manufacturing that product, the extent of its utilisation, the capacity of the units that have already been granted licences but are in the process of being established, import and export potentiality of the product etc., should be taken into consideration.

Although it is difficult to arrive at a precise forecast for demand and supply of a particular product, specially since reliable and up-to-date information is difficult to obtain, on the basis of the available data it should be possible to decide on future prospects of the item proposed to be selected by you. Towards this, capacity utilisation of the existing units could be taken as a broad indication of market for the product. Similarly, underutilisation of the existing capacity could be taken as a signal for little or no scope for setting up a new unit.

An SSI unit generally enters the market which is localised and already has existing manufacturers. The success of the new unit in competing with the existing manufacturers would demand on a combination of its capability to identify

and approach its targeted customer group and its marketing features like price, quality, delivery schedule, sales promotion, etc.

Initial Selection of Projects

A potential entrepreneur can gather a number of project opportunities from the wide variety of sources enumerated in the previous section. Some of the project ideas which appear to be prima facie not promising have to be eliminated.

In the entire process of project evaluation, project selection criteria constitutes the most critical choice, since it affects the allocation of investible resources of the firm. The criteria will broadly depend on the kind of project evaluation to be undertaken. Where economic evaluation is undertaken, the focus should be on social profitability rather than on financial profitability. General social profitability has been the prime consideration for project evaluation in the context of public investment projects or financing of private investment projects by public financial institutions. However for private sector investments, financial profitability has been the prime consideration. Financial profitability signifies the relationship between financial costs and benefits. The incremental expenses of the project are related to the incremental revenues arising from the project. The various financial parameters, viz. the payback period, accounting rate of return, Net present value, Internal Rate of Return, Profitability index, are combined in a variety of ways to assess the financial profitability of the project.

The analysis of non-financial aspects in project selection are as important as financial considerations relevant to a project. The non-financial consideration could be economic, social or environmental considerations as well as benefits accruing to the economy or society at large. A project for manufacture of aluminum would be a substitute for imported copper and thus would have a favourable impact on the foreign exchange of the country. This involves saving of Foreign Exchange which is an economic benefit from the output of the project. Again the commissioning of a specific project, would create educational and health facilities to the society at large. In such cases social benefits and costs of the project are traced to the benefits accruing to the society. A coal fired thermal power plant would inflict higher cost on society through pollution of smoke, dirtying the clothes quicker, inhaling of smoke with resultant health hazards etc. This involves social costs, which is to be reckoned in project evaluation. A hydro-electro project may convert a rugged rocky barren environment into a lush green vast stretches of lands, besides power generation. This is the environment consideration. Or it may deny the existing facility to down-stream inhabitants leading to additional cost and suffering to the people. This is the environmental cost. Thus, project selection is not an isolated activity. It has a social economic and environmental context, besides financial viability.

Importance of Project Identification

Project identification is often of great importance for the following reasons:

1. They become the catalytic agents of economic development.
2. They initiate the process of development in terms of employment and income generation.
3. They have beneficial consequences which are long-term in nature.
4. Projects provide the framework of the future pattern of activities and services of the enterprises.
5. Projects usually involve substantial financial outlays.
6. They also initiate development of basic infrastructure and environment.
7. Project commitments cannot be easily reversed.
8. Project identification brings the necessary changes in society in course of time.
9. Project accelerate the process of socio-cultural development.

The Enterprise Development Centre

The integrated method for facilitating the formation of new enterprises is known as the enterprise development centre. This brings together the key inputs face to face with the new generation entrepreneurs. It comprises of five principle components, viz., (1) the intrapreneurship centre; (2) the venture capital exchange; (3) the innovation centre; and (4) the incubation centre.

The *intrapreneurship centre* conducts research, creates skills, and an appropriate environment to facilitate the setting up of a new enterprises.

The *venture capital exchange* provides the needed seed capital for new enterprise.

The *innovation centre* provides theological evaluation, entrepreneurial assessment, project planning, evaluation, commercial feasibility studies, and the product development assistance to entrepreneurs.

The *incubation centre* provides the needed impetus to new enterprises to succeed and grow.

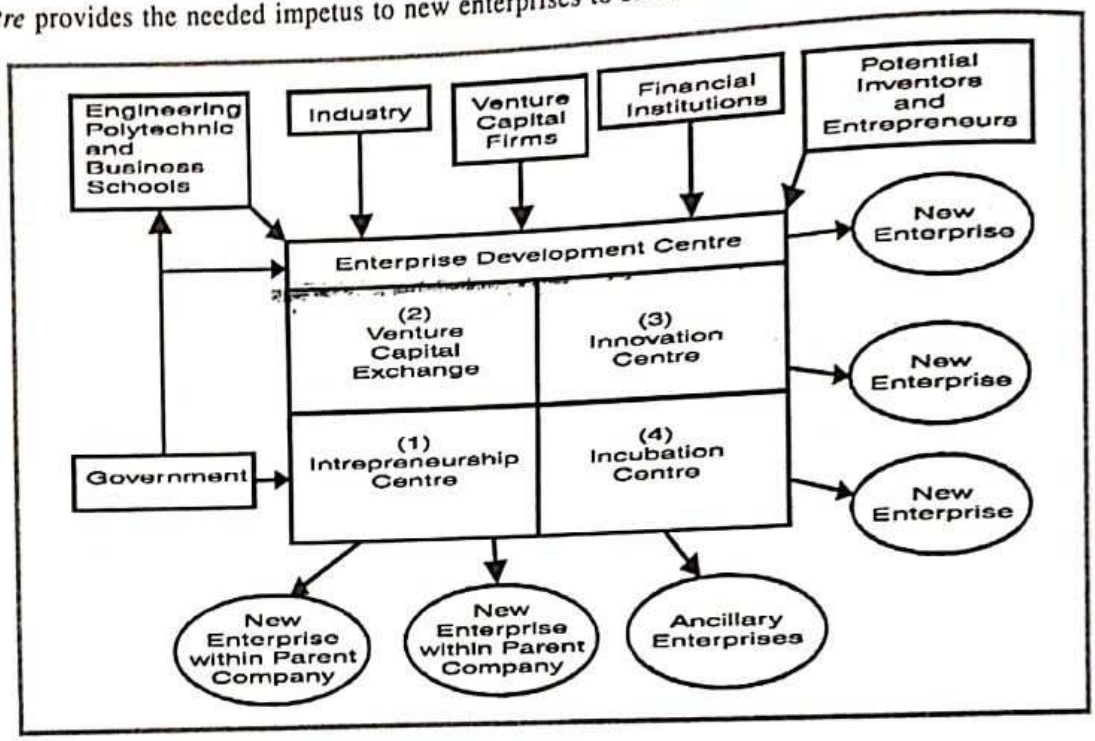


Fig. 18.2: The Enterprise Development Centre

Feasibility Report

Before starting a small-scale industry, it is mandatory for entrepreneurs to consult the Director of Industries Service Institute (SISI) located in one's state. The SISI guides entrepreneurs as to the type of industry to start, where to start and how to start it. The SISI help them to select the various items of manufacture which have scope for development in different areas. It suggests the lines on which project reports for the proposed units should be prepared for the consideration of various financial institutions with a view to securing financial assistance. Similarly, technical guidance in the selection of proper raw materials and type of machinery is also provided. Apart from this, the SISI gives valuable information on various incentives available to the small-scale industries from various organisations.

Project Feasibility Analyis

A project feasibility analysis includes market analysis, technical analysis, financial analysis and social profitability analysis. Although every feasibility analysis is different and is tailored to suit the product, its goal is to identify the existing strengths and weakness of the project.

The starting point of a project analysis is the establishment of objectives to be attained. The next stage is the pre-selection stage — the advisability of having an in-depth study. The analysis stage consists mainly of three factors — market, technical and financial analysis. A market analysis is a method of screening project ideas as well as means of evaluating a project's feasibility in terms of the market. A market analysis should cover the following areas:

(i) A brief market description including the market area, methods of transportation, existing rates of transport, channels of distribution, and general trade practices.

(ii) An analysis of past and present demand, determination of quantity value of consumption and identification of the major consumers of the product.

(iii) An analysis of past and present supply, broken down as source (whether imported or domestic), as well as information to assist in determining the competitive position of the product, such as selling prices, quality and marketing practices of competitors.

The technical analysis of a project feasibility study establishes whether the project is technically feasible or not, and whether it offers basis for the estimation of costs. Moreover, it provides an opportunity for a consideration of the effect of various technical alternatives on employment, ecology, infrastructure demands, capital services, support of other industries, balance of payments, and other factors. A technical analysis should review the techniques or processes to be applied and should incorporate:

(i) A description of the product, including specification relating to its physical, mechanical and chemical properties, as well as the uses of the product.

(ii) A description of the selected manufacturing process, showing detailed flow charts and presenting alternative processes which may have been considered and the justification for the adoption of the selected process.

(iii) A determination of the plant size and production schedule, which includes the expected volume for a given time period on the basis of start-up and technical factors.

(iv) Selection of machinery and equipment, including specifications, equipment to be purchases and its origin, quotations from suppliers, delivery dates, terms of payment, and a comparative analysis of alternatives in terms of cost, reliability performance, and spare parts availability.

(v) An identification of plant's location and an assessment of its desirability in terms of its distance from raw material sources and markets. For a new project, this part may include a comparative study of different sites, indicating the advantages and disadvantages of each.

(vi) A design of the plant layout and an estimate of the cost of the erection of the proposed buildings and land improvements.

(vii) A study of the availability of raw materials and utilities including a description of physical and chemical properties, quantities needed, current and prospective costs, terms of payment, location of sources of supply, and continuity of supply.

(viii) An estimate of labour requirements, including a detailed break-down of direct and indirect labour requirements, and the supervision required for the manufacture of the product.

(ix) A determination of the type and quantity of waste to be disposed of, together with a description of the waste disposal method, its costs, and the necessary clearance from proper authorities.

(x) An estimate of the production cost of the product.

In the financial analysis of this feasibility study, the emphasis is on the preparation of financial statements, so that the project may be evaluated in terms of the different measures of commercial profitability followed by the magnitude of financing which requires the assembly of the market and also technical cost estimated in various proforma statements. If it is necessary to have more information on which to base an investment decision, a sensitivity analysis or, possibly, a risk analysis may be conducted. This financial analysis should include:

(i) For projects that involve new companies, statements of total project cost, initial capital requirements, and cash flows relative to the project schedule.

For all projects, financial projections for future time periods, including income statements, cash flows, and balance sheets.

(ii) For all projects, supporting schedules for financial projection, stating the assumption made as to the collection period of sales, inventory levels, payment period of purchases and expenses, and the element of production cost, selling, administrative, and financial expenses.

(iii) For all projects, a financial analysis showing returns on investments, returns on equity, break-even volume, and price analysis.

(iv) For all projects, if necessary, a sensitivity analysis to identify items which have a substantial impact on profitability or possibly a risk analysis.

For the small entrepreneur, the studies conducted during the analysis stage of the project provide the material for an assessment. If positive results are obtained, the entrepreneur, in seeking finance, will want to prepare an investment proposal. The planners or government officials, however, having obtained positive conclusions from the economic feasibility study will want to evaluate the element of social profitability.

The purpose of the investment or loan application is to convince a lender (financial institution) that the project is a desirable investment; that it not only possesses the potential for profit but that the proposed management team has the capability to achieve the potential. The investment proposal normally contains:

(i) General information on the product, company history, the nature of the industry and the reputation and qualifications of the existing or proposed management.

(ii) A description of the project, which usually consists of extracts from economic feasibility studies and includes information on such items as market, production, selected manufacturing methods (with detailed indication of the cost of equipment and operational expenses), and a financial statement.

(iii) Miscellaneous information, such as the steps taken for the implementation of the project and the qualifications of the technical partners envisaged or selected.

CONCLUSION

It can thus be said that project identification is an important dimension of entrepreneurship. Also, more important is its classification which goes towards the emergence of three dimensions — inputs, outputs and social costs and benefits and finally economic development of the country.

19 CHAPTER

PROJECT FORMULATION

"A project is considered to have crossed the identification stage when: (a) initial screening is made from the alternatives, (b) policy issues affecting the project have been resolved, (c) project costs and benefits, on the basis of estimates are justified, (d) project receives support from the beneficiaries as well as political authorities, (e) prospects of funding are available from local and external sources, (f) specific project plan is established."

"The objectives of pre-feasibility study are: (a) investment opportunity is promising, (b) the project justifies detailed analysis, (c) support/functional studies are needed for a feasibility study, (d) establish viability of project from the investor point of view."

INTRODUCTION

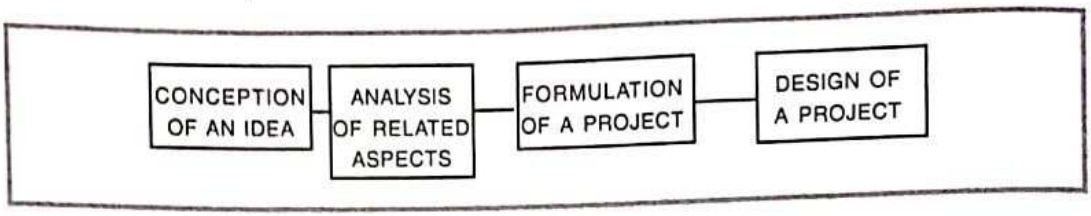
But in reality, the case is quite different. A major constraint faced especially in developing countries is the resources constraint. Hence it becomes imperative that certain project ideas are only taken up or pursued in preference to others. How to make this decision or choose only a few projects for implementation? Project formulation, techniques help us in making a choice. When we say project formulation, we mean that a project idea is presented in such a form that it can be subjected to comparative appraisal. This process will aid in definitely determining the priority of projects from the point of view of resource allocation. The project ideas can be analysed from the point of view of inputs as well as outputs. such an analysis when presented to a decision-maker or to consulting agencies will help them in decision-making. This strategy analyses project ideas not only from the viewpoint of technical feasibility and financial viability but also evaluates the sum total effect which the project will have on the society and the immediate environment.

What is Project Formulation?

Project formulation is defined as *taking a first look carefully and critically at a project idea by an entrepreneur to build up an all-round beneficial to project after carefully weighing its various components.* It is formulated by the entrepreneur with the assistance of specialists or consultants. Project formulation is, therefore, a process whereby the entrepreneur makes an objective and independent assessment of the various aspects of an investment proposition of a project idea for determining its total impact and also its liability. By all means, this strategy forms an important stage in

the pre-investment phase — that is the period from the conception of an idea until the final analysis to decide about the future of a project idea. This makes it an analytical management aid. The aim of project formulation is to achieve the project objectives with the minimum expenditure and adequate resources. In other words, it is to derive maximum benefits from minimum expenses in a short span of time.

Fig. 19.1: Phases of Project Formulation



It is assessment of the feasibility of a proposal or a scheme of a borrower based on the examination of factors like the capacity of the unit or farm to produce, the repaying capacity generated by the funds asked for, the assets and liabilities and so on. These factors are technical, economic, managerial, financial, commercial, organisational and legal.

The project size is determined by taking into consideration factors like the area of operation, the types and levels of activities undertaken, the type and size of the organisation, amount of investment necessary and the time required for the completion of the activities contemplated under the project.

Steps in Project Formulation

As mentioned earlier, a project comprises a series of activities for achieving predetermined objective or set of objectives. In view of this, to begin with, the objective (s) of the project should be defined as precisely as possible. The objectives may be social, economic or a combination of both and they can be defined under the following categories:

(i) General objectives and

(ii) Operational objectives.

A *general objective* merely states in broad terms the achievements expected whereas an *operational objective* specifically mentions results expected from the implementation of the project or scheme. The definition of objective in clear terms helps in quantifying physical, financial, human and other resources requirements.

Following this, the next strategy concerns itself with the location and size of the project. The location of the project is influenced by the availability or existence of various resources and the infrastructural facilities. Examination of availability/existence of these resources/facilities at one or more sites should lead to a decision on the selection of the location of the project and thus facilitate exploitation of the available resources/facilities to the advantage of the investor or the community at large or both.

Sequential Stages of Project Formulation

The process of project development has been categorised into seven distinct and sequential stages. They are:

1. Feasibility Analysis.
2. Techno-Economic Analysis.
3. Project Design and Network Analysis.
4. Input Analysis.
5. Financial Analysis.
6. Social Cost-Benefit Analysis.
7. Pre-Investment Analysis.

Thus, project formulation takes into consideration the above seven important aspects of a project, as shown in Fig. 19.2.

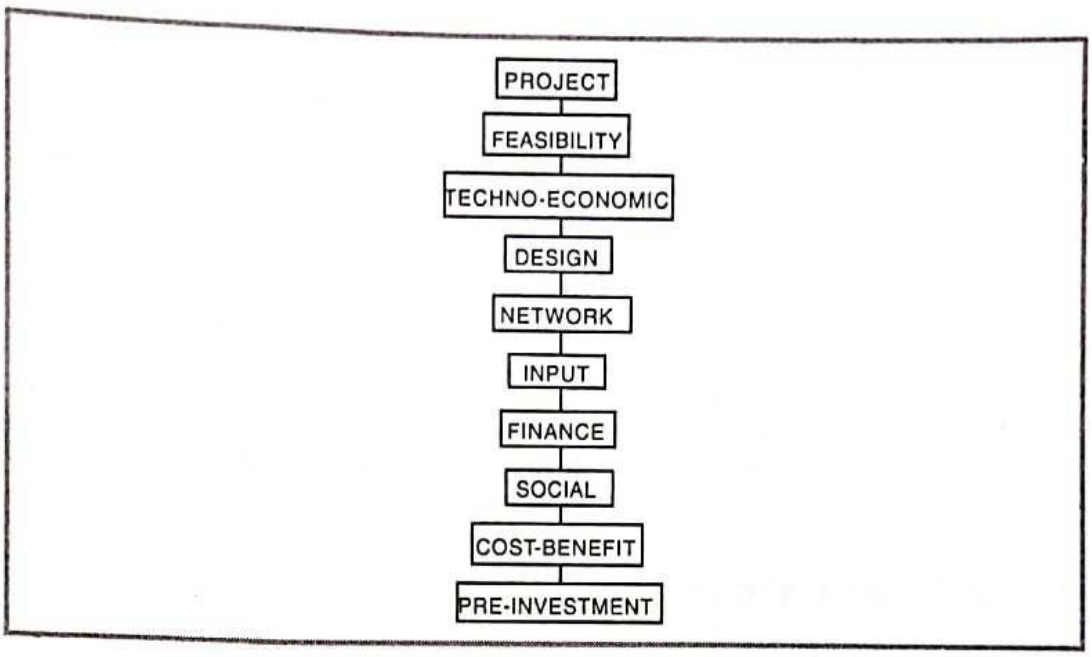


Fig. 19.2: Sequential Stages of Project Formulation

1. Feasibility Analysis: This is the very first stage in project formulation. At this stage, the project idea is examined from the point of view of whether to go in for a detailed investment proposal or not. As project idea is examined in the context of internal and external constraints three alternatives could be considered. First, the project idea seems to be feasible, second, the project idea is not a feasible one and third, unable to arrive at a conclusion for want of adequate data. If it is feasible, we proceed to the second step, if not feasible, we abandon the idea and if sufficient data are not available, we make more efforts to collect the required data and design development.

2. *Techno-Economic Analysis:* In this step, estimation of project demand potential and choice of optimal technology is made. As the project may produce goods or services, it is imperative to know the market for such goods or services produced. Market analysis is also in-built in this step. The choice of technology itself will be based on the demand potential and aid in project design. Techno-economic analysis gives the project a unique individuality and sets the stage for detailed design development.

3. *Project Design and Network Analysis:* This important step defines individual activities which constitute the project and their inter-relationship with each other. The sequence of events of the project is presented. A detailed work plan of the project is prepared with time allocation for each activity and presented in a network drawing. Project design is the heart of the project entity. This paves the way for detailed identification and qualification of the project inputs, an essential step in the development of the financial and cost-benefit profile of the project.

4. *Input Analysis:* The step assesses the input requirements during the construction of the project and also during the operation of the project. In the earlier step, a project was divided into several activities. Now it is better to see to the inputs required for each activity and sum it up to get at the total input requirements on qualitative and quantitative terms. Inputs include materials, human resources. Input analysis also considers the recurring as well as non-recurring resource requirements of the project and evaluate the feasibility of the project from the point of view of the availability of these resources. This will aid in assessing the project cost itself which in turn is necessary for financial analysis or cost-benefit analysis.

5. *Financial Analysis:* This stage mainly involves estimating the project costs, estimating its operating costs and fund requirements. Financial analysis also helps in comparing various project proposals on a common scale, thereby aiding the decision-maker. Some of the analytical tools used in financial analysis are discounted cash flow, cost-volume — profit relationship and ratio analysis. It is very essential to take caution in preparing financial estimates. The

objective of this strategy caution is to develop the project taking into consideration resources and also to identify these characteristics. Investment decisions whether made for the provision of goods or services involve commitment of resources in future. Since investment proposition has a very long time-horizon, it is absolutely necessary to exercise due care and foresight in developing project financial forecasts.

6. *Cost-Benefit Analysis:* The overall worth of a project is the main consideration here. While financial analysis will go to justify a project from the profitability point of view, cost-benefit analysis will consider the project from the national viability point of view. Here again, the project design forms the basis of evaluation. When we talk of cost-benefit analysis, we not only take into account the apparent direct costs and direct benefits of the project but also the costs which all entities connected with the project have to bear and the benefits which will be enjoyed by all such entities. This strategy is now taken to be the internationally recognised system of project formulation.

7. *Pre-investment Analysis:* The project proposal gets a formal and final shape at this stage. All the results obtained in the above steps are consolidated and various conclusions arrived at to present a clear picture. At this stage, the project is presented in such a way that the project-sponsoring body, the project-implementing body and the external consulting agencies are able to decide whether to accept the proposal or not. The sum total of the pre-investment appraisal is to present the project idea in a form in which the project-sponsoring body, the project-implementing body can take an investment decision regarding the project.

Project Implementation

When a network design is prepared, the groundwork for the project implementation is said to be in existence. In preparing the network design, the Programme Evaluation Review Technique (PERT) and Critical Path Method (CPM) are widely used. Briefly, it has already been mentioned that to develop the project design, there is a need to identify the project activities, determination of their interdependencies and the geographical representation of the activities in a logical sequence. This dimension will actually be the work plan for project implementation. The network design also gives time and resource requirement for each activity.

The network design so developed provides a monitoring aid and a controlling instrument. The design helps in avoiding unnecessary expenditure leading to optimal utilisation of resources. For any type of project, the PERT/CPM can be applied at the implementation stage. This network design when developed will help in completing the project in time. Even though if some activity is delayed, the project still has a chance of getting completed in time by utilising the staff, if available. This is an important technique of project management.

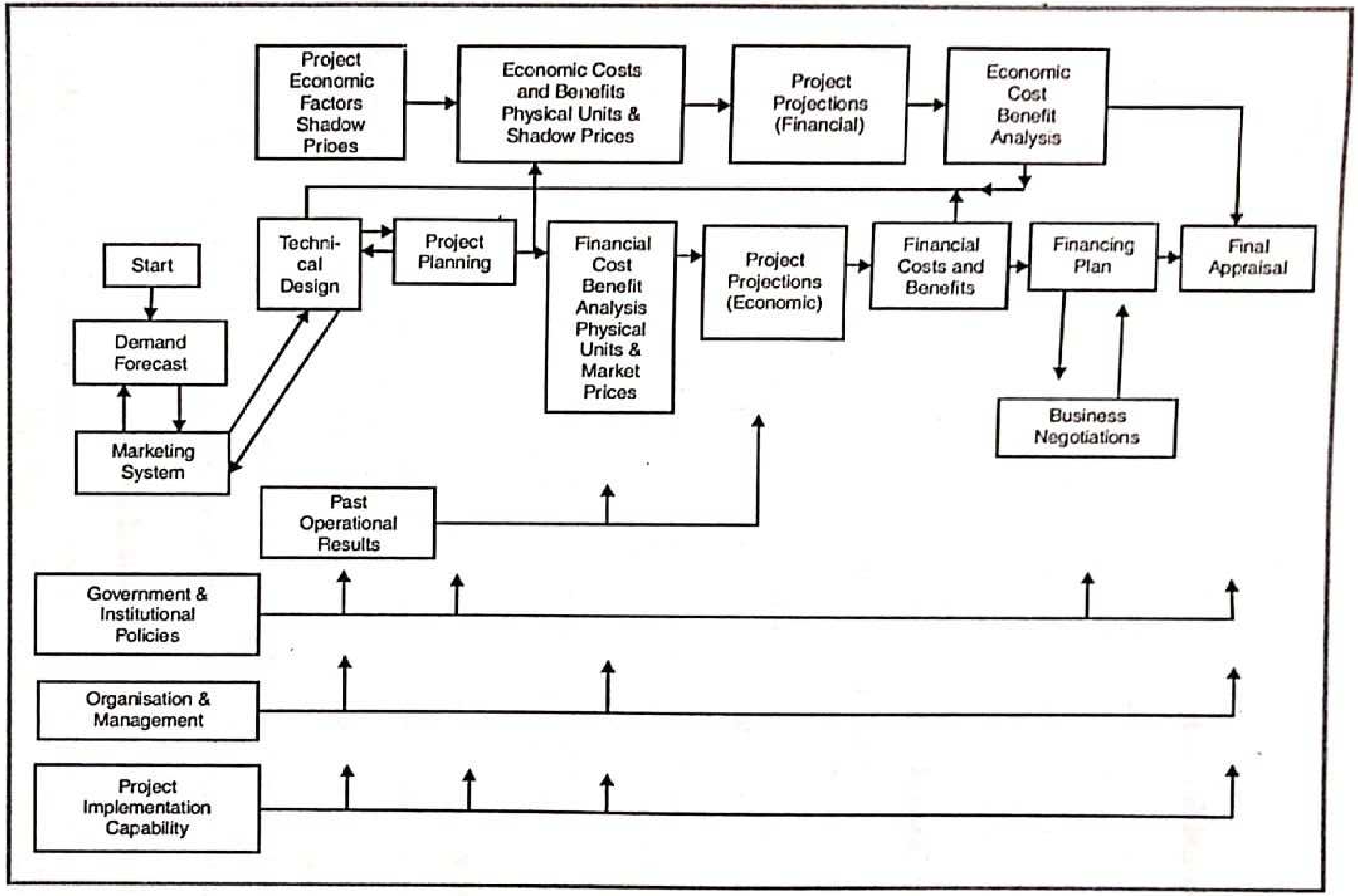
Project Evaluation

Apart from looking into the financial viability of a project in terms of investment costs and benefits which accrue to the project directly, it is necessary to consider the total impact of the project on the economy of the nation. With a view to evaluate the project, the social cost-benefit analysis is used. Most of the data required for the analysis would have already been gathered in the earlier stages. Social cost-benefit analysis does not look as just an investment proposition. Whatever be the impact of the project on the nation, it is taken into account just as the existing equilibrium of the economy. In the cost-benefit analysis also, the extent to which the project will help the society to improve its image or profile is indicated.

All costs and benefits can be classified into three categories as *primary costs and benefits, secondary costs and benefits and tertiary costs and benefits.* Primary costs and benefits is a category which will be exclusively incurred and which will accrue to the project-implementing body respectively.

Secondary costs and benefits accrue to parties other than the project-implementing body. Most of the projects contribute to the national exchequer by way of direct or indirect taxes. Besides, a project has a direct impact on the community or the area of operation. This is what is called the spill-over effects and multiplier effect. Projects can also have an impact on individual welfare.

Fig. 19.3: Project Formulation Technique



While primary and secondary costs and benefits are quantifiable, tertiary costs and benefits include all non-quantifiable spill-over and multiplier effects. Where the impact cannot be quantified, it is stated in descriptive terms. There are certain values which cannot be quantified at all.

Organisational Aspect

For the successful implementation of the scheme/project and for the day-to-day functioning of farm/enterprise, it may be necessary to have sufficient technical, skilled or unskilled manpower. For example, at the stage of establishment of a big dairy, it may call for assistance from Dairy Engineers or Dairy Experts and other technicians apart from the skilled personnel. These personnel should be available to the entrepreneur at the time he needs them. After the implementation of the project, the entrepreneur may need only some technical and other labour for daily operation and maintenance of the dairy.

Commercial Aspect

This involves the examination of the arrangements for buying or acquiring necessary inputs required for the implementation of the project as raw materials, labour, power, fertiliser, pesticides, etc. Adequacy and timeliness of the availability of these factors influence project implementation to a considerable extent. For example, in digging or deepening of wells, the non-availability of blasting material, bricks or cement may hold up the work of any length of time. In the case of dairy development, non-availability of improved breeds of cattle may hinder the progress of the scheme.

In the case of H.Y. variety crop cultivation, non-availability of improved seeds, fertilizers, etc. may prevent farmers from achieving optimum yields. Existence of suitable facilities for the marketing of the produce, market outlets and adequate demand should also be ensured.

While formulating the scheme, this factor should be examined carefully and the possibility of making the necessary arrangements to overcome any difficulty should be explored.

Legal Aspect

Adequate security for different types of loans should be made available to the banks as per their requirements. Legal problems relating to title deeds, land legislations, etc. that influence the decision with regard to the mortgage or hypothecation of assets or implementation of the project or scheme should be looked into in depth before the scheme or project is financed.

It may be mentioned here that everywhere all the requirements for the successful implementation of a project may not exist or be available. On examining the various aspects, if some lacunae or gaps are found, possible alternatives of meeting these requirements should be considered and suggestions in this regard are incorporated in the project report.

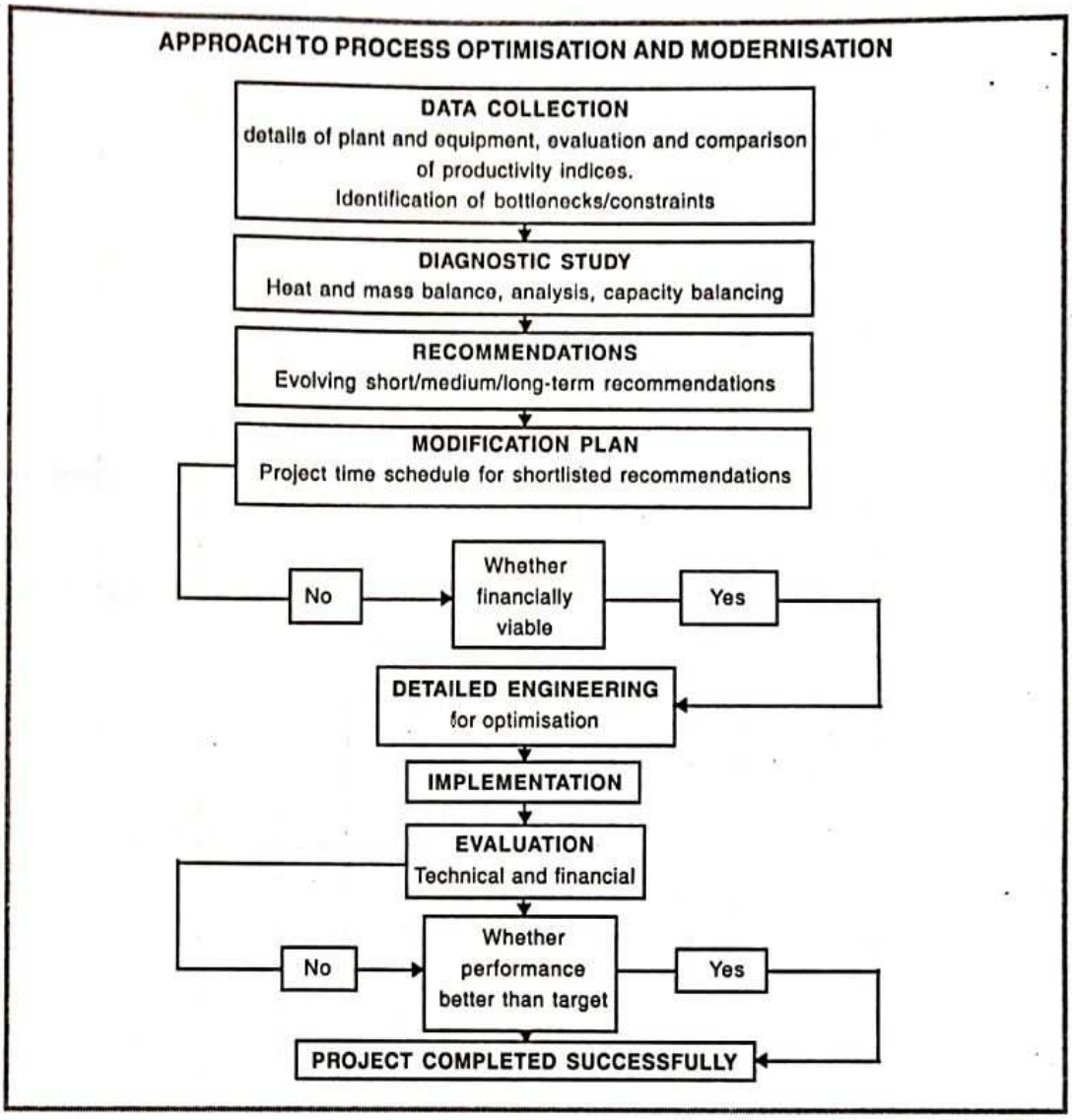
Risk and Uncertainty in Investment Decisions

Each project is characterised by a certain amount of risk and uncertainty. As a matter of fact, each basic variable entering the project evaluation could be a source of uncertainty because it is not possible to predict or anticipate perfectly the future changes that will take place in respect of these variables.

The feasibility of a project depends, *inter alia*, on the size of investment, operating costs and sales revenue. Each of these is composed of quantity and price and a change in the estimated quantity or price may divert the actual from the estimated result.

There are two types of uncertainties relating to the project itself and the environment in which it operates.

Fig. 19.4:



Uncertainty usually arises because it is impossible to predict the different variables and consequently, the magnitude of the benefits and costs exactly as they will occur.

The important causes of uncertainty are:

(i) Changes in the price of inputs and/or outputs.

(ii) Changes in technology.

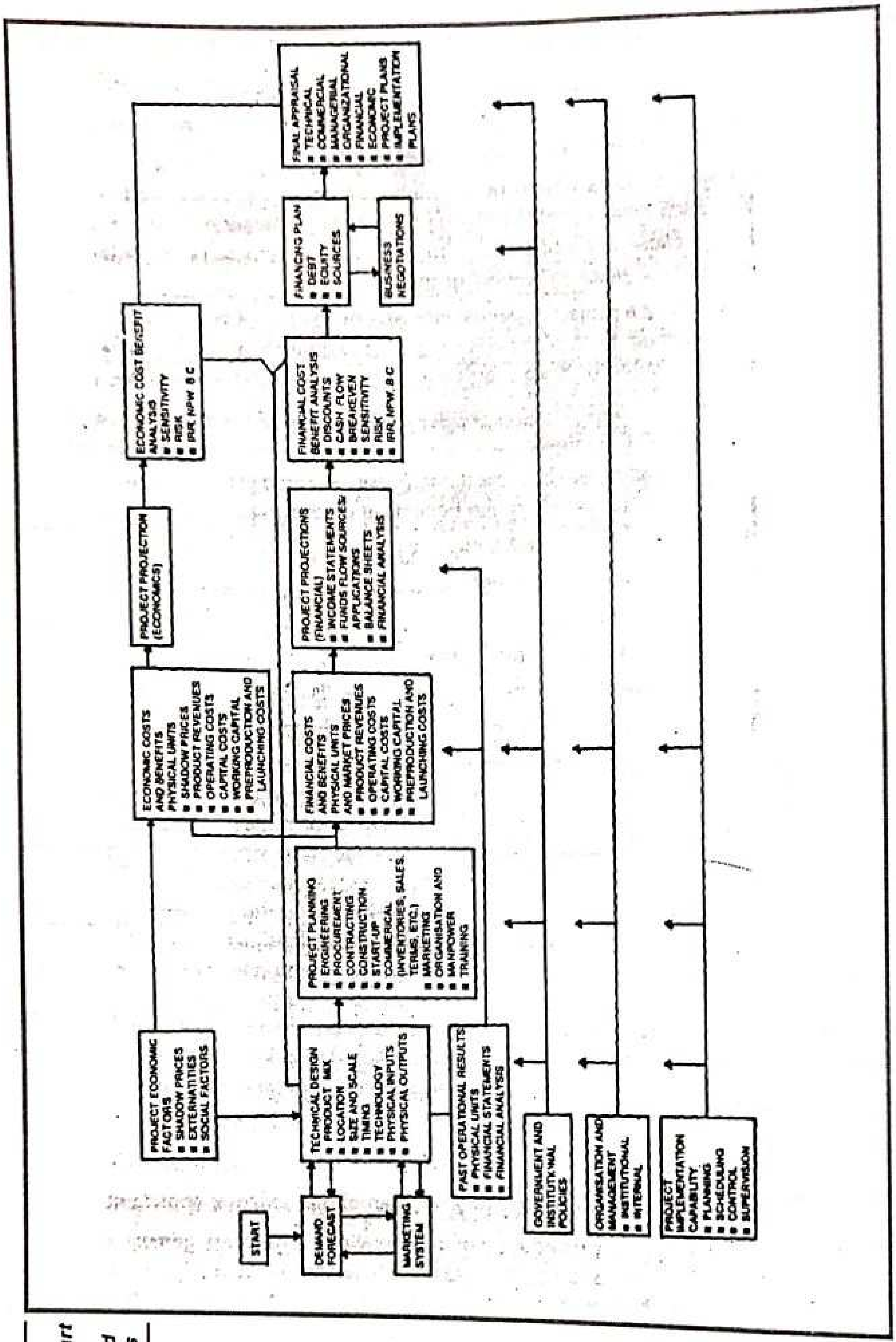
(iii) False estimation of the rated capacity.

(iv) Length of construction and running-in periods.

(v) Changes in the environment like changes in the tastes or preferences or the introduction of new substitutes etc.

However, distinction has to be drawn between project formulation and the preparation of the detailed project report. The object of project formulation is the preparation of the pre-investment report. This strategy is, therefore, an investigation process which precedes investment decision. A project idea is examined from the point of view of the overall objectives of the sponsoring body and the country as a whole, from the point of view of techno-economic and

Fig. 19.5: Detailed Flowchart of the Project Formulation and Analysis Process



financial feasibility and of the social cost-benefit prospects. The purpose is to present whether a go-ahead signal should be given for the project or not. Detailed project report preparation is a post-investment decision exercise. It involves the preparation of detailed specifications and designs, engineering drawings, site investigation and foundation design for the project premises, detailed design of the process or other equipment and time schedules for the implementation of the project.

Project Constraints

Project formulation is accompanied with internal and external constraints.

Internal constraints arise on account of the limitations of the management system which will eventually be responsible for the implementation of a project. Inputs, resources and outputs are the three major elements of the structural aspects of an existing management system.

External constraints depend upon the environment which imposes limitations on the size, nature, location and the extent of the project.

Project Formulation and the Entrepreneur

During the course of establishment of a new project, the entrepreneur has to contend with a series of almost impossible situations. The spread of technology being sporadic, the first difficulty he faces is the matter of selection of appropriate technology for his enterprise. Modern technology developed in the highly industrialised countries does not suit the conditions available in the developing countries. The same applied to the optimal size of plants on account of the limitations of the market which is available for products. Present-day advanced technology being a product of economies that have a scarcity of labour and a relative abundance of capital is oriented towards heavy initial investment. Obviously, heavy investments cannot be sustained by developing countries. The entrepreneur has, therefore, to scan the entire chain of activities — research development, design, production, marketing, sale and post-sales service — and arrive at conclusions which will form the basis of the operations to plan his project.

The second fact which the entrepreneur has to reckon with is the absence or non-availability of external economies. As has been pointed out by Everett Hagen, every Western industry depends for its efficiency on other industries. It assumes the ready availability of materials, components and tools. It depends also on auxiliary enterprises for technical, financial and managerial services on demand, on a complex network of communication and transportation facilities, and on an intricate system of business practices. A Western economy is a technically and culturally complex, not a set of isolated pieces of technology. The entrepreneur in developing countries must, therefore, consider not only the basic costs of the project, but also the ancillary costs which in industrially advanced countries would have been contributed by the external economies.

The third problem is the non-availability of technically qualified and adequate personnel. The extent of expertise is limited and finding people to handle new jobs is extremely difficult. As Myrdal (1968) put it, the use of modern technology calls for a certain minimum supply of various skills that are generally lacking in developing countries. Not only is a somewhat more skilled labour force needed but a greater number of technicians and managers as well.

Resource mobilisation is the fourth major problem. In the context of present-day magnitude and complexity of projects, it is really very difficult for an entrepreneur to be in a position to provide the entire development capital which a project will need. The standard of living and income being already low, savings are also not available in abundance for investment in economic development in the developing countries. The capital market not being developed also does not provide enough relief. Under these circumstances, collection of enough resources to go ahead with the project assumes critical proportions.

Over and above the economic hurdles mentioned, the entrepreneur has to contend with a spate of government directives, licensing procedures, import and export policies, price controls, limits on expansion and a host of other formalities. It is obviously hard task for any individual to be familiar with all the intricacies of these directives and

procedures. Further, these directives, orders and instructions are also not available in a consolidated and detailed form in most of developing countries, with the result that a considerable amount of time is spent in sorting out these formalities. In India, the need for providing a hand-book incorporating all the relevant constraints and procedures has led to the publication of a compendium entitled *Guidelines for Industries.*

Project Profitability Projections

The results project evaluation depend upon the cost and profitability projections. A thorough examination is, therefore, made during the appraisal of the assumptions/parameters on which the cost of production and profitability statements for future operating years have been based.

The objectives in the estimation of cost of production and profitability are primarily to assess —

- the capacity of the unit to amortise and service the borrowed funds;
- the earning capacity of the project;
- the capability to service the share capital; and
- the surplus available to finance future growth.

In estimating the cost of production, assessment is made of various inputs and also of production capacity build-up. Some of the aspects connected with the build-up of production capacity over the years are discussed below:

(i) Installed Capacity: The installed capacity of the entire plant is assessed in the first instance. For this purpose, it is necessary to furnish the rated capacity and the capacity guaranteed by the supplier for each equipment/section of the plant. The guaranteed capacities of the equipment are indicated in terms of physical quantities per unit of time. The installed capacity of the plant is determined by the capacity of that section of the plant which has the lowest capacity. The installed capacity need not necessarily be static throughout the existence of the plant. It may vary according to the changes in direct inputs, product-mix etc.

(ii) Capacity Utilisation: It may not be possible to fully utilise the capacity of the plant due to several factors. In some industries, a 100 per cent utilisation of capacity seems a distant dream even during the entire life of a project due to several constraints. The factors which, either singly or in combination with other factors restrict during the initial years a fuller utilisation of capacity are as under:

— teething problems in the plant and machinery;
— time taken in the development of a satisfactory product;
— development of operating skills;
— technological/process constraints;
— time taken for building the market.

The factors responsible for the low utilisation of capacity during the life of project after the initial problems have been overcome are as follows:

— technical constraints;
— market constraints;
— frequent changes in product-mix;
— inherent characteristics of the industry.

For deciding the build-up of production capacity over a period, the institutions collect the data of average capacity utilisation of the industry over the past few years and the capacity build-up achieved by similar units during the early stages of their operations.

(iii) Product-mix: Selection of a product-mix for computing future cost of production and profitability depends upon the demand projections. Given adequate demand for each product, the product-mix would generally depend upon the contribution of each product towards profitability and the adequacy of the plant and utilisation.

(iv) Selling Price: Abundant care is taken by financial institutions in fixing the selling price for the purpose of profitability projections. In the case of a new product which is not manufactured locally, the basis of assuming a selling price is the landed cost of a similar imported product. For products which are being manufactured in the country and whose price is controlled by the Government, the pricing pattern as laid down by the Government is adopted. In respect of products whose prices are not controlled, the current market price as also the price trends in the past are taken into consideration. In the case of variations in the current selling price, it is advisable to assume the lowest selling price.

Effluent Disposal

Process of effluent disposal entirety depends upon the analysis of effluents from the industry as also the rules and regulations laid down by the Government authorities in this regard. It may sometimes be necessary to obtain the analysis report of the effluents and the details of their treatment.

In terms of industrial licensing conditions every industrial undertaking is required to take adequate steps as per the Government rules and regulations to prevent air, water and soil pollution. Further, such antipollution measures to be installed should conform to the effluent and emission standards prescribed by the State Government in which the industrial undertaking is to be located. The formulator would keep in mind the implications of the aforesaid provisions while evaluating the project.

Energy Conservation

The conservation of energy through better energy management is another area which is gaining importance amongst the institutions in view of its scarcity and its increasing demand.

In the case of appraisal of new projects, the following additional information regarding energy conservation is obtained and reviewed:

- Steps proposed to be taken for energy conservation. Whether the project envisages provision of any metering in main and sub-circuits, both electrical and steam or proposes to install any power factor correction equipment.
- Particulars of monitoring equipment envisaged for periodic detection and measurement of energy losses.
- Particulars of energy saving features in the main process plant and equipment.
- The projected energy input cost per unit of output and its comparison with other units in the same industry.
- Scope for use of solar/other renewable sources of energy.

The financial institutions also seek steam and energy plan diagrams as also the data relating to the total energy proposed to be generated/purchased and theoretical and expected requirements of energy in various production departments. The institutions examine whether any alternative process is available, and if so, the comparative energy consumption figures for the various processes are obtained and evaluated.

Utilisation of By-Products

In certain industries, proper and efficient utilisation/recovery of by-products constitutes a major factor for their economic viability and selection of process know-how. In some cases, the appraiser may insist on a pilot plant study with a view to ensure that a proper process is adopted for the optimal utilisation/recovery of by-products.

Choice of Technical Process

Technology refers to such modes of production as are not only technically sound and economically viable but are also suitable to local, social and cultural conditions and are in line with national goals and objectives. In respect of certain projects, there is hardly any choice in technology, while a wide variety of projects have options of many manufacturing technologies. Whenever such choice is available, a detailed examination and evaluation of all the processes already established and those under development is carried out. Some of the important aspects examined while deciding upon a particular manufacturing technology are as under:

- The technology should, as far as possible, be already established.
- If not already established, but expected to be advantageous, the degree of success is assessed and risks calculated.
- The technology should be based on indigenous raw materials and resources; if raw materials are not available indigenously, continuing availability of raw materials from imported sources in the light of Government legislation are examined in depth.
- The technology should be workable under local conditions, e.g., temperature, humidity, quality and availability of raw materials, availability of skilled labour, transportation, power, etc.
- The technology should be in tune with the national goals and objectives, e.g., employment potential vis-a-vis social responsibility for creating as much employment as possible, scope for ancillarisation, import substitution, export promotion, maintenance of ecological balance, etc.
- In selecting a particular technology, the risk of obsolescence and the scope for continuous updating of technology is examined and kept in view.
- Climatic conditions, nature and quality of the product as also the size of the project are invariably taken into account while adopting a particular process/technology.

Where the process/technology proposed to be adopted is not well established, the following factors are examined:

- whether the technology/process is patented or not;
- degree of realiability of the proposed process;
- scale of development, i.e., whether laboratory scale, pilot plant scale, etc.;
- flexibility, i.e., whether the equipment for the process can be used for alternative processes/products.

It is possible that the effect of some of the above-mentioned factors might be found conflicting. In such cases, each process is separately evaluated keeping in view the effect of the various factors and the process with optimum advantages is selected. In certain fields, where technological progress has been rapid and new improved processes are being developed fast, the risk of obsolescence is also determined.

In order to expedite the examination of technological aspects, the borrower should be fully prepared with explanations for selecting a particular process, technology and its techno-economic advantages over other available processes. The borrower should also prepare process flow charts, material balance-sheet, requirement of utilities and specifications of process parameters.

Check List for Feasibility Report

1. Examination of public policy with respect to the industry.
2. Broad specifications of outputs and alternative techniques of production.
3. Listing and description of alternative locations.
4. Preliminary estimates of sales revenue, capital costs and operating costs of different alternatives.
5. Preliminary analysis of profitability for different alternatives.
6. Marketing analysis.
7. Specification of product pattern and product prices.
8. Raw material investigation and specification of sources of raw material supply.
9. Estimation of material energy, flow balance and input prices.
10. Listing of major equipment by type, size and cost.
11. Listing of auxiliary equipment by type, size and cost.
12. Specification of sources of supply for equipment and process know-how.
13. Specification of site and completion of necessary investigation.
14. Listing of buildings, structures and yard facilities by type, size and cost.
15. Specification of supply sources, connection costs and other costs for transportation services, water supply and power.
16. Preparation of lay-out.
17. Specification of skill-wise labour requirements and labour costs.
18. Estimation of working capital requirements.
19. Phasing of activities and expenditure during construction.
20. Analysis of profitability.
21. Determination of measures for combating environmental problems.
22. Analysis of the past performance of the enterprise responsible for implementing and running the project with respect to project completion, capacity utilisation and profitability.
23. State of preparedness to implement the project rapidly.

Planning Commission's Guidelines for Project Formulation/Feasibility Reports for Industrial Projects

In order to process investment proposals and arrive at investment decisions, the Planning Commission's guidelines for preparing/formulating industrial projects by preparing feasibility reports.

The feasibility report lies in between the project formulating stage and the appraisal and sanction stage. The project formulating stage involves the identification of investment options by the enterprise in consultation with the Administrative Ministry, the Planning Commission and other concerned authorities.

The guidelines have been summarised below:

1. *General Information:* The feasibility report should include an analysis of the industry to which the project belongs. It should deal with the past performance of the industry. The description of the type of industry should also be given, i.e., the priority of the industry, increase in production, role of the public sector, allocation of investment of funds, choice of technique etc. This should also contain information about the enterprise submitting the feasibility report.

2. *Preliminary Analysis of Alternatives:* This should contain present data on the gap between demand and supply for the outputs which are to be produced, data on the capacity that would be available from projects that are in production or under implementation at the time the report is prepared, a complete list of all existing plans in the industry, giving their capacity and level of production actually attained, a list of all projects for which letters of intent/ licences have been issued and a list of proposed projects. All options that are technically feasible should be considered at this preliminary stage. The location of the project and its implications should also be looked into. An account of the foreign exchange requirement should be taken. The profitability of different options should also be given. The rate of return on investment should be calculated and presented in the report. Alternative cost calculations vis-a-vis return should be presented.

3. *Project Description:* The feasibility report should mention the technology/process chosen for the project. Information relevant to determining the optimality of the location chosen should also be included. To assist in the assessment of the environmental effects of a project, every feasibility report must present the information on specific points, i.e., population, water, land, air, flora and fauna, effects arising out of project's pollution, other environmental disruption, etc. The report should contain a list of important items of capital equipment and operational requirements of the plant, requirements of water and power personnel, organisational structure envisaged, transport costs, activity wise phasing of construction and factors affecting it.

4. *Marketing Plan:* It should contain the following items. Data on the marketing plan. Demand and prospective supply in each of the areas to be served.

The methods and the data used for main estimates of domestic supply and selection of the market areas should be presented. Estimates of the degree of price sensitivity should be presented.

It should contain an analysis of past trends in prices.

5. *Capital Requirements and Costs:* The estimates should be reasonably complete and properly estimated. Information on all items of costs should be carefully collected and presented.

6. *Operating Requirements and Costs:* Operating costs are essentially those costs incurred after the commencement of commercial production. Information about all items of operating cost should be collected. Operating costs relate to the cost of raw materials and intermediates, fuel, utilities, labour, repair and maintenance, selling expenses and other expenses.

7. *Financial Analysis:* This strategy is to present some measures to assess the financial viability of the project. A proforma balance sheet for the project data should be presented. Depreciation should be allowed for on the basis specified by the Bureau of Public Enterprises. Foreign exchange requirements should be cleared by the Department of Economic Affairs. The feasibility report should take into account income tax rebates for priority industries, incentives for backward areas, accelerated depreciation etc. The sensitivity analysis should also be presented — that is the sensitivity of the rate of return of change in the level and pattern of product prices.

8. *Economic Analysis:* Social profitability analysis needs some adjustment in the data relating to the costs and returns to the enterprise. One important type of adjustment involves a correction in input and costs, to reflect the true value of foreign exchange, labour and capital. The enterprise should try to assess the impact of its operations on foreign trade. Indirect costs and benefits should also be included in the report. If they cannot be quantified, they should be analysed and their importance emphasised.

To assess major projects, the questionnaire Ministry of Technology, UK can be considered in the Indian context:

1. Would your project, if carried through, promise benefits to the community, and, if so, what are these benefits, how will they be distributed and to whom and when would they accrue?
2. What disadvantages would you expect might flow from your work? Who would experience them? What, if any, remedies would correct them? Is the technology for correcting them sufficiently advanced for the remedies to be available when the disadvantages begin to accrue?
3. What demands would the development of your project make upon your resources of skilled manpower and are these resources likely to be available?
4. Is there a cheaper, simpler and less sophisticated way of achieving at least part of the objective that you have in mind? If so, what would it be and what proportion of your total objective would have to be sacrificed if we adopted it?
5. What new skills would have to be acquired by people who would be called upon to use the product or project which you are recommending and how could these skills in application be created?
6. What skills would be rendered obsolete by the development you propose and how serious a problem would the obsolescence of these skills create for the people who had them?
7. Is the work upon which you are engaged being done or has it been done or has it been started and stopped in other parts of the world and what experience is available from abroad that might help us to assess our own proposal?
8. If what you propose is not done, what disadvantages or penalties you believe will accrue to the community and what alternative projects might be considered?
9. If your proposition is accepted, what other work in the form of a supporting system should be set in hand simultaneously, either to cope with the consequences of it, or to operate for the next stage and what would that next stage be?
10. If an initial decision to proceed is made, for how long will the option to stop remain open and how reversible will this decision be at progressive stages beyond that?

CONCLUSION

Project formulation is a key input of management aid. The process of project formulation involves a detailed study of the environment, weighing objectively the internal and external constraints and development of the project idea, stage by stage, into an investment proposition. The conclusion drawn at the end of each stage forms the basis of development of the next stage. At each stage, the entrepreneur/intrapreneur or a team of consultants have to look not only forward but also backward. The forward look is necessary to take the project formulation forward and the backward look is to re-check and if necessary, strengthen or modify the project on the basis of experience gained in the project formulation. Thus, project formulation is a significant link between project identification and project appraisal by financial institutions.

Thus, we find right from the time of conceiving of the profitable opportunity to converting the idea from the mind to the marketable product, many complications are involved. Therefore, an entrepreneur has to carefully study the various determinants which will ultimately result in the success or failure of the establishment of an industrial unit. During this period of time, the entrepreneur is expected to weigh each factor carefully and take decisions on the basis of the merits and the advantages of each factor so that the profitable opportunity conceived can be transformed into a reality with an appreciable degree of success.

20 CHAPTER

PROJECT DESIGN AND NETWORK ANALYSIS

"For the proper planning, scheduling and control of the numerous activities of a project, given their interrelationship and constraints on the availability of resources, project design and network techniques have been found quite useful. The technique shows the activities and events of the project, time estimation and the development of project schedule."

INTRODUCTION

The execution of a Project follows a definite path of planning, scheduling and controlling. The first and the foremost aspect of a project is the project design. It is in fact the heart of the project entity. It defines the individual activities which go into the corpus of the project and their interrelationship with each other. Project design enables to identify the flow of event which must take place for the successful implementation of the project.

Network techniques help the management of an organisation in performing these functions efficiently and effectively. Together they stand concerned with the development of the project work plan and the duration time — estimate and evaluation of these in the light of the constraints of the project situation.

The strategy selected as a result of the techno-economic analysis forms the initiation of the project design development. Briefly, project design is the framework of a project formulated with detailed sequences and develops an acceptable work plan for the project. It helps the entrepreneur to implement the project as scheduled without any hindrances.

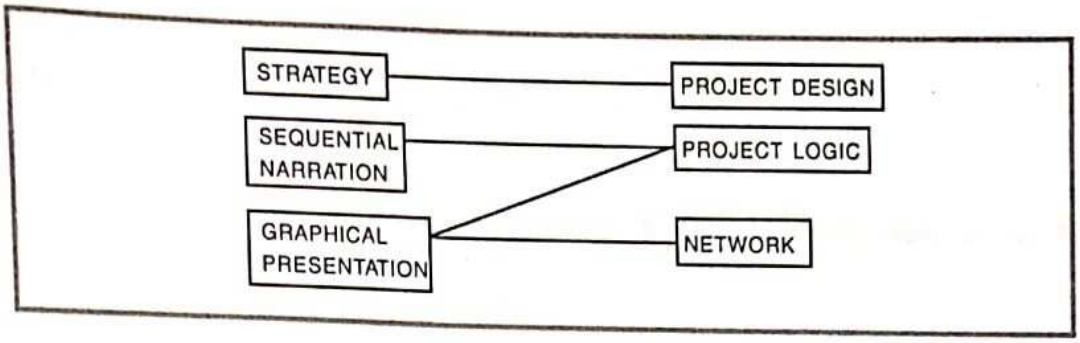
The strategy is examined in detail and the details are utilised to compile the sequential narration of the constituent activities of the project. This compilation of the sequential narration is known as the Project Logic. When it is represented in the form of graphical pattern, it is known as a network.

In this chapter, project design and network intricacies are discussed, so that the students can have an understanding and their key role in the success of a project

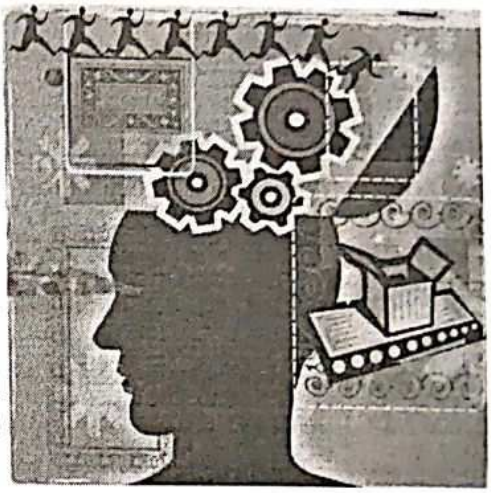
Project Design

A project can achieve breakthrough innovation? The answer is — through the use of design thinking. Design thinking is collaborative — keeping account of different experiences by different stakeholders and generating new

Fig. 20.1: Relation between Project Design and Network



products. It is inventing new options to find new and better solutions to new problems. It is experimental — building prototypes, testing them and iterating this activity to find what works and what does not to manage risk. It is also being emphatnetic to user's needs and wants organisations have woken up to the fact that in order to remain in today's markets and have an edge over competitiors, they have to innovate and to achieve breakthrough innovation they have to make use of design thinking skills.



Organisations can no longer count on quality, performance or price alone to sustain leadership in the global marketplace. Design has emerged as a new competitive weapon and key driver of innovation.

By consciously fostering the right kind of emotional environment and following the seven guidelines outlined here, your organisation will be well equipped to translate inspiration into implementation.

For design to become culturally embedded in an organisation, three 'forces' have to coverage: a deep user understanding, multiple prototyping, and strategic business design. We call these forces 'the three gears of design.'

What most well-established companies do as a matter of practice is begin by examining their 'big gear' — the existing business model. This focuses on how to make the most of their current capabilities and capacity. Most 'growth initiatives' take the form of line extensions and expansions' concepts are developed, and then tested with the consumer they know in a certain way for specific products or categories. If research suggests incremental sales with minimal investment risk, it's 'all systems go.' This is a very responsible way to stretch more out of your current activity system, with largely incremental results.

Creating the Right Conditions

With the 'big idea' in hand, you then take on lever three strategic business design, to model a unique system of 'strategic hubs' and 'supporting activities' that will not only deliver value to the user, but also competitive advantage and profit to you. Pushing the concept through to a point that it is viable and profitable is not easy — this is where the 'no trade-offs' attitude pays off. It requires a lot of hard work and many iterations, but every team behind a great breakthrough will tell you that their conviction and collaboration pushed the project through to fruition. Southwest Airlines' activity system has allowed it to become one of the most innovative providers of consumer value in a highly-competitive industry, becoming a sustainable competitive advantage that other airlines have attempted (in vain) to mimic.

For each of the three gears, there are many tools and techniques that are used by great design teams, but the depth and rigour behind each gear cannot be compromised. Moreover, it is never a clean and linear pass-through process; it is very, very iterative. It's not about using a restricitve set of rules — but instead creating the right conditions under which some core pillars (user — idea — business model) serve as the touch points throughout an iterative development process. It is about liberating oneself and the team from the constraints of early perfection and not being preoccupied

with getting it right too early, so that you limit your possibilities. What companies find when they practice iterative prototyping — be it a product concept or a business model — is that they work their ideas through earlier and faster, leveraging the experience and perspective or senior management — rather than waiting until all of the I's are dotted and T's crossed to get their approval.

Design Principles Pay Off

When conditions are ripe for innovation and the general principles and methodology of design are put into play, it is remarkable how big and broad the impact can be. Following are some wide-ranging examples that demonstrate how 'design doing' can deliver breakthrough results in any field, on every level.

Design Thinking: Seven steps to putting organisation on top of its game

1. Make a long-term commitment: GE's strong track record of investing in management practices that push for continuous product and business model improvement have made it an innovation behemoth.

2. Build it into your corporate strategy: Samsung's embrace of design at all organisational levels has allowed it to move from a commodity producer to a brand leader — in the US, it now regularly trounces Sony and Panasonic in sales.

3. Assign a leader, but don't limit it to a function: Innovation involves everyone, not just the "design department" or "innovation team." Claudia Kotchka's appointment as head of Design Strategy at P&G has served to institutionalise design across the organisation, making it one of the most innovative and consumer-centric companies.

4. Collaborate & internalise it: Don't hire someone to do it for you, team up with experts who will teach you along the way; hire a 'design coach'.

5. Inspire, don't legislate: It's not about establishing a new set of rules. It's a new way to think, not just about projects but the way you work together day-to-day to solve problems and create breakthrough opportunities.

6. Feed it and reward it: Design needs to be part of an organisation's cultural development program and reward system in order to be validated. 3M's strong 'culture of innovation' that rewards creativity at every organisatinal level has made the company a leader in delivering breakthrough solutions throughout much of its history.

7. The future starts today: While a sustained shift in culture takes time to gain traction, it is important to get started, and implement what you can today.

Importance of Network Analysis

The network analysis has the potential of unfolding unknown snags involved in project estimates which, when detected, may provide management not only to improve on the ongoing project estimates but also to take serious lesson for future application. This would, of course, require seriousness and sincere application of different niceties of the technique of network analysis which require, among other things, that —

(a) The whole project should be considered with reference to the sequence of activities and events. Sequence here is not a mere mathematical problem. It underlines activities that are to follow one after another leading to an event.

(b) This would also require that the events should be thought of in different steams of operations and their relationship understood clearly.

(c) The whole project may be put on one network while different segments of the project may be detailed out in separate networks for final integration in the overall network. This would imply that no important detail of any operation in the project, from beginning to end, would miss the attention of the management.

(d) The time estimates may be made taking into view two discrete aspects: one projects in which previous experience does not exist at all and time estimates would have to be based on probabilities and two, time estimates may be deterministic, being based on previous experience of similar types of operations in different other projects.

(e) Cost estimates would depend on the project time estimates and the changes in the prices of different factors of production. In this specific context, mere provision of escalation clauses would not be enough. Inflationary changes would have to be attempted so that management may know for certain what slippage in time would mean in terms of cost. This is apart from efficiency variations — both favourable and unfavourable — depending on circumstances not quite foreseen at the time the estimates were made.

(f) The physical progress of the projects, individuality and simultaneity of events, jobs framed out, snags in different areas of project work would all require adequate notice and application of correctives in proper time. It is also possible that management may think it appropriate and economical to speed up completion of projects by what is known as 'crashing.' The concept of crashing is particularly relevant in view of the avoidance of huge constructive total loss that slippage, dilly-dallying or other factor may cause.

Origin of PERT and CPM

Incidentally, PERT, CPM and MOST are but three of some 40 different names given to network analysis. It is believed and underlined that network is a logical extension of the old Grant Bar Chart. PERT and CPM techniques were developed in the U.S. independently, while CPM came into focus about 1957 as an offshoot of collaboration between Du Pont and Remington Rand. While different distinctions are often ascribed to CPM and PERT, the basic distinction is perhaps that the emphasis of CPM is essentially on the activities themselves, the costs associated with completion of each activity and optimum plan for the project as a whole. PERT, which was developed about 1958 as a result of collaboration between the Operational Research Division of the United States Navy and a firm of business consultants, had for emphasis the events rather than the activities leading to events. Most of the distinctions have, however, dissolved while both PERT and CPM underwent different measures for attaining perfection through their application as tools.

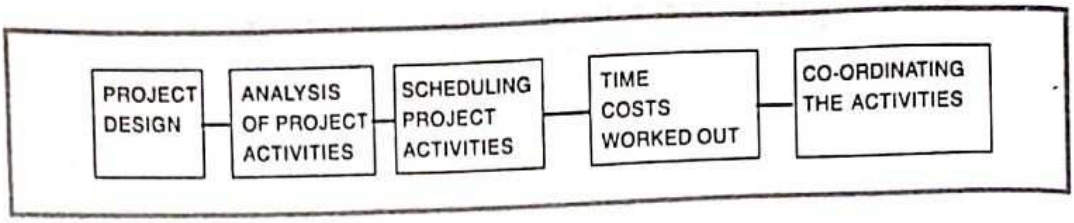
PERT was applied to help solve problems of producing the Polaris Missile system to a very tight schedule. Application of PERT has been based on probability estimates covering those pessimistic, those optimistic and those considered normal. In unique types of projects like the Polaris Missile, since previous experience in similar types of activities do not exist, probability calculations have occupied a significant place. However, considering that all these techniques concerned with planning and control of projects have network analysis as a common denominator, it is relevant to point out that MOST emphasises more on building up of Gantt type charts covering each activity, event, time, cost, projects farming out, employment of different classes of managers and workers, procurement of materials, deployment of materials relating to the completion of the project. Unlike PERT and CPM diagrams, MOST diagrams actually begin at the end of the project, working back towards the start of the activities. Instead of 'beginning to end' emphasis in PERT and CPM, in MOST the emphasis is on 'end to beginning.' One advantage of MOST diagrams is that it can be converted into PERT-CPM type diagram depending on the requirements of management.

Network Design

A network comprises a set of exponents connected with each other in a sequential relationship with each step till the completion of a project.

Network analysis is a system which plans both large and small projects by analysing the project activities. Projects are broken down into simple activities, which are then arranged in a logical sequence. It is also decided as to which task will be performed simultaneously and which others sequentially. A network diagram constructed below presents the relationship between all the activities involved (see Fig. 23.2). Time, costs and other resources are allocated to different activities.

Fig. 20.2: Network Design



Network Techniques

In a project, there may be two categories of jobs or activities — which can be taken up concurrently and which can be taken up only after completing some other activities — either completely or partially. Hence, in a bar chart, some of the bars may run parallel or overlap each other time-wise while some may run serially. The scheduling of construction and identification of potential causes of delay form an important part of a project appraisal. Timing and sequencing of various activities involved in project implantation are reviewed, keeping in view the conditions regrading the availability of construction materials, labour, procurement and delivery periods of plant and machinery, erection and commission, start-up and trial-runs, training of staff, etc. The implementation schedule also takes into account seasonal and other variations in working conditions which might interfere with the implementation of the project. Several techniques of project scheduling and control such as Bar Charts, Programme Evaluation and Review Techniques (PERT), Critical Path Method (CPM) etc. are used.

Of these CPM have come to be widely used in project management as they are very useful in the basic management functions of planning, scheduling and control. These techniques can be applied in diverse kinds of projects like construction of a building or a highway, planning and launching of new product, large maintenance projects, scheduling ship construction and repairs, end-of-the month closing of accounts, large, research projects, etc.

Need for Network Techniques

Network analysis helps in designing, planning, coordinating, controlling and decision-making in order to accomplish the project economically in the minimum available time with the limited available resources. Network techniques were developed from the Milestone Chart and Bar Chart. These conventional planning methods, because of their inherent limitations, could not be utilised for planning large and complex projects. They had the following disadvantages:

(a) A bar chart becomes too cumbersome while dealing with big and complex projects when the activities are to be considered in detail and their interaction or interdependencies are to be studied clearly.

(b) A bar chart does not point out which tasks should be given priority as regards resources (i.e., men, money, materials and machinery).

(c) The effects of changes in schedule cannot be evaluated with the help of a bar chart.

(d) A bar chart neither satisfactorily tells the time at which the activities begin and end nor does it indicate tolerances in activity timings.

The functions of planning, organising, directing and controlling are essential to every enterprise regardless of the type, size, purpose, or complexity of the operation. Techniques, of course, vary because they must be adapted to and appropriate for each individual firm and its own circumstances. PERT is one of the management techniques which is considerably more useful to some managers than to others. It is of the tested tools of management in industrially-developed countries.

It works a method of minimising production delays, inerruptions, and conflicts; of co-ordinating and synchronising the various parts of the overall job; and of expediting the completion of projects towards scheduling and budgeting resources so as to accomplish a predetermined job. It is a communication facility in that it can report developments and keep the managers posted and informed.

PERT is concerned with two concepts:

1. *Events:* An event is a specific accomplishment that occurs at a recognisable point of time and does not call for either the need of time or resources.

2. *Activities:* An activity is the work required to complete a specific event.

In PERT, the activities, the events, require time, money, and resources for its completion. In this sense, H.L. Gantt was quite right in referring to his events as milestones.

H.L. Gantt, a contemporary of the Father of Scientific Management, F.W. Taylor, developed the GANTT Chart. He called it "Gantt Milestone Chart." This chart depicts work to be done, but what is more important, it also denotes the interrelationships between and among all phases of the work. Fig. 20.3 illustrates one of Gantt's milestone charts.

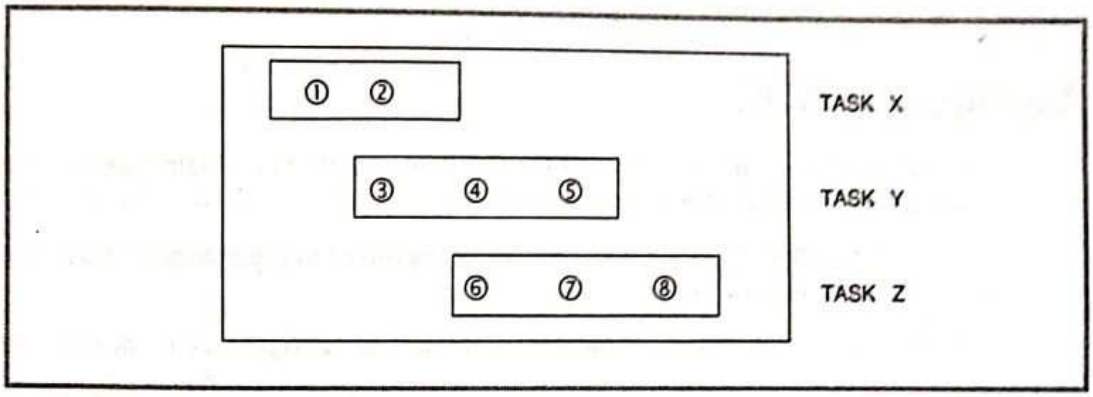


Fig. 20.3: Gantt Milestone Chart

Each of the circles (milestones) represent the accomplishment of a specific phase of the total undertaking, and, of course, each of the rectangles represents a task. The three rectangles taken represent the entire project.

Steps in PERT

The first step in the development of a PERT network is the establishment of objectives. There will be a major objectives to be accomplished, linked by supporting objectives. When these are identified, they must be linked together so as to enable to planner to see the project in its true perspective and also see the relationships between and among all the steps. The second step is to schedule work breakdown in great detail. In the third step, both technical and managerial persons should begin to work together. The fourth step is that each person who participates in the application of PERT to the control of the project should have some basic familiarity with the general nature of the work and with the ultimate objective desired.

Some authors have also indicated the following steps involved in PERT analysis:

1. Development of project network.
2. Time estimation.
3. Determination of critical path, event slacks, and activity floats.
4. Development of project schedule.
5. Calculation of variability duration and the probability of completion in a given time.

PERT deals with the problem of uncertain activity time by the application of statistical analysis to the determination of estimated time for each activity of the project. This technique, as a manager's tool, defines and coordinates what must be done to successfully accomplish the objectives of a project on time. It aids the decision-maker but does to not make decisions for him.

In PERT, time is the basic measure. It is usually expressed in calendar weeks. The project should be completed within the stipulated optimistic time.

In order to arrive at the most reliable estimate of time, three time estimates are usually employed under this technique as given below:

(i) The optimistic time: It is the shortest time possible if everything goes perfectly well with no complications, the chance of this optimum actually occurring might be one in a hundred;

(ii) the pessimistic time: It is longest time conceivable; it includes time for unusual delays and thus the chance of its happening might be only one in a hundred;

(iii) The most likely time: It would be the best estimate of what normally would occur.

The differences in these three times give a measure of the relative uncertainty involved in the activity.

Advantages of PERT

(a) This technique gives the management the ability to plan the best possible use of resources to achieve a given goal within the overall time and cost limitations.

(b) It helps management to handle the uncertainties involved in programmes where no standard time data of the Taylor-Gantt variety are available.

(c) It presses for the right action, at the right point, and at that right time in the organisation.

Limitations of PERT

(a) The basic difficulty comes in the way of time estimates for the completion of activities because activities are of non-repetitive type.

(b) This technique does not consider resources required at various stages of the project.

(c) Use of this technique for active control of a project requires frequent updating and revising the PERT calculations and this proves quite a costly affair.

Critical Path Method (CPM)

Next to PERT, the CPM for planning and controlling projects has enjoyed the widest use among all the systems that follow the networking principles. CPM was developed in 1956 at the E.I. Dupont Nemours & Co., U.S.A., in connection with the periodic overhauling and maintenance of a chemical plant. It resulted in reducing the shut-down period from 130 hours to 90 hours and saving hours and saving the company $1 million. CPM has two time-cost estimates for each activity (one time-cost estimate for the normal situation and the other estimate for the crash situation) but does not incorporate any statistical analysis in determining such time estimates. CPM operates on the assumption that there is a precise known time that each activity in the project will take.

Advantages of CPM

Besides being applicable to schedule large and small projects it has some of the important advantages listed below:

(a) It helps in ascertaining the time schedule.

(b) With its aid, control by the management is made easy.

(c) It makes better and detailed planning possible.

(d) It provides a standard method for communicating project plans, schedules, time and cost performance.

(e) It identifies the most critical elements and thus more attention can be paid to these activities.

Limitations of CPM

(a) CPM fails to incorporate statistical analysis in determining the time estimates.

(b) It operates on the assumption that there is a precise known time that each activity in the project will take but this may not be true in actual life.

(c) It is difficult to use CPM as a controlling device for the simple reason that one must repeat the entire evaluation of the project each time when changes are introduced into the network. It may be remembered that CPM was initially developed as a static planning model and not as a dynamic controlling device.

Differences between PERT and CPM

Though the fundamental network of PERT and CPM are identical, yet there are certain differences in details as listed in Chart I.

Application of Network Analysis

For the purpose of application of PERT/CPM, a project is conceived as a collection in independent activities of *jobs*. If one job has to be completed before another can begin, the first job is described as an *immediate predecessor* of the job following or in other words, the latter is an *immediate successor* of the former.

Two types of graphs are used in PERT/CPM. They are:

(i) Activity on the Arrow (AOA) system.

(ii) Activity on Node (AON) system.

In the AOA system, or the Arrow Diagram Method, an activity is graphically represented by an arrow. The tail end of the arrow represents the start and the head represents the end of an activity. The description of the activity is written alongside the arrow. In Fig. 20.5 for example, *a* and *b* describe activities. (For example, in building construction, *a* may be used to denote an activity like excavation and *b* to denote concreting). Alternatively, the activity can be denoted by the numbers of the nodes. For example, activity can be denoted by the numbers of the nodes. For example, activity *a* can also be denoted as (1, 2) and activity *b* as (2, 3).

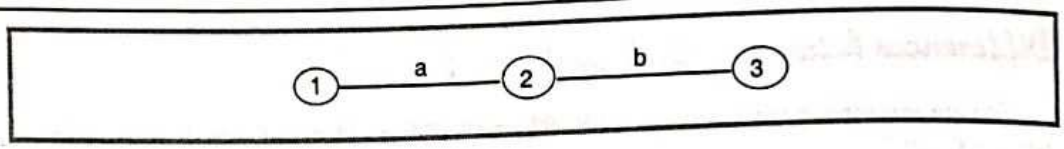
An *activity* is the actual performance of a task and it consumes time and resources. An *event* is the start or completion of a task and does not consume time or resources. For example, machine installation is an activity whereas the start of machine installation is an event. Similarly, completion of machine installation is an event.

The length of the arrow in a network diagram does not bear any relationship to the time which the activity takes or the resources which the activity consumes. The direction of the arrow indicates the direction of the work flow. The usual practice is to go from left to right.

CHART I

PERT	CPM
1. The origin is military (naval).	The origin is industrial.
2. It is an event-oriented approach.	It is an activity-oriented system.
3. There is allowance for uncertainty.	No such allowance.
4. It has three time estimates.	There is only one single estimate of time and the emphasis in on cost.
5. It is probabilistic model with uncertainty in activity duration.	It is a deterministic model with well-known activity (single) time based upon past experience.
6. It does not demarcate between critical and non-critical activities.	It marks critical activities.
7. It is especially suitable when high precision is required in time estimates, e.g., defence projects.	It is suitable when reasonable precision is required, e.g., civil construction projects, industrial expansion schemes, etc.
8. Time is averaged.	No averaging of time is involved.
9. The concept of 'crashing' is not applied.	The concept of crashing is applied.
10. It lays emphasis on reduction of the execution time of the project without too much cost implications. It is time-based.	It lay emphasis on the greatest reduction in completion time with the least increase in project cost. It is cost-based.

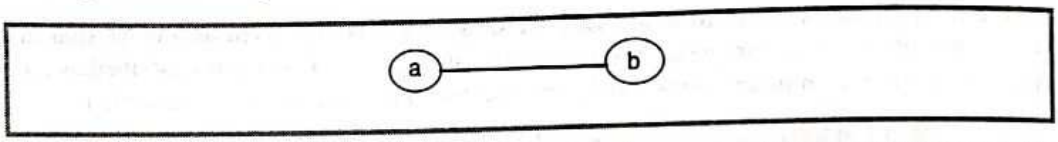
Fig. 20.4: AOA System



All events must be numbered. The same number cannot be used for more than one event.

In the AON system, activities are represented by circles or nodes and arrows are used to show only the dependency relationship between the activity nodes (see Fig. 20.5).

Fig. 20.5: AON



In the AOA diagram, the time required for an activity is indicated alongside the arrow and in the AON diagram, the time is indicated in the circle. For example, if activity *a* requires 10 days and b requires 12 days, they may be indicated as shown in Fig. 20.6 and Fig, 20.7.

Fig. 20.6: AOA Showing Time Required for Activity

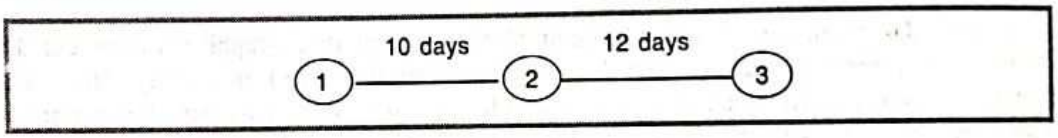
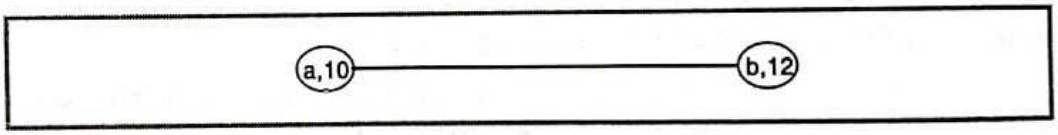


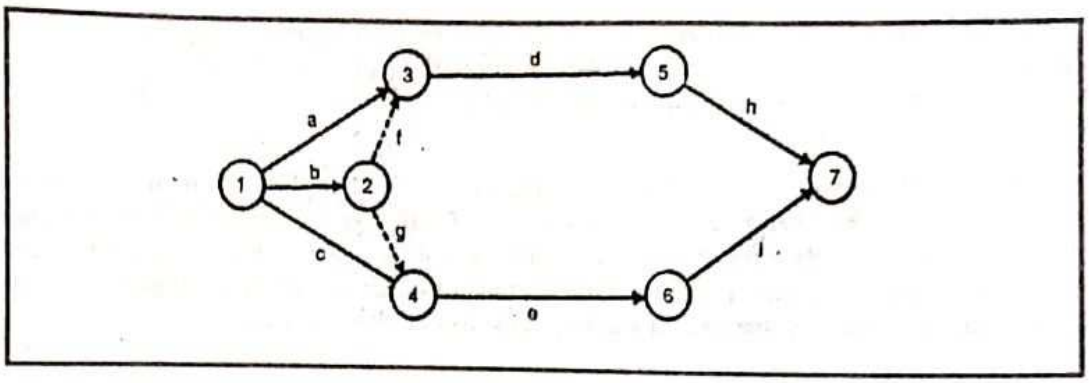
Fig. 20.7: AOA Showing Time Required for Activity



It becomes necessary to introduce *dummy job (s)* in constructing the network diagram if two or more activities in the project have identical immediate predecessors and successors or if two or more jobs have some, but not all, of their immediate predecessors in common. A dummy is an artificial activity introduced in a network to maintain a unique numbering system for the different activities and to keep the logical sequence of activities and their interrelationships correct. A dummy job takes zero to perform and is used solely to illustrate precedence relationship.

Fig. 20.8 illustrates the use of dummy jobs. Activity *b* is a common immediate predecessor of both *d* and *c*, while *a* is an immediate predecessor of *d* alone, and *c* is one of *e*. Hence two dummy jobs *f* and *g* are introduced to indicate the precedence relationship.

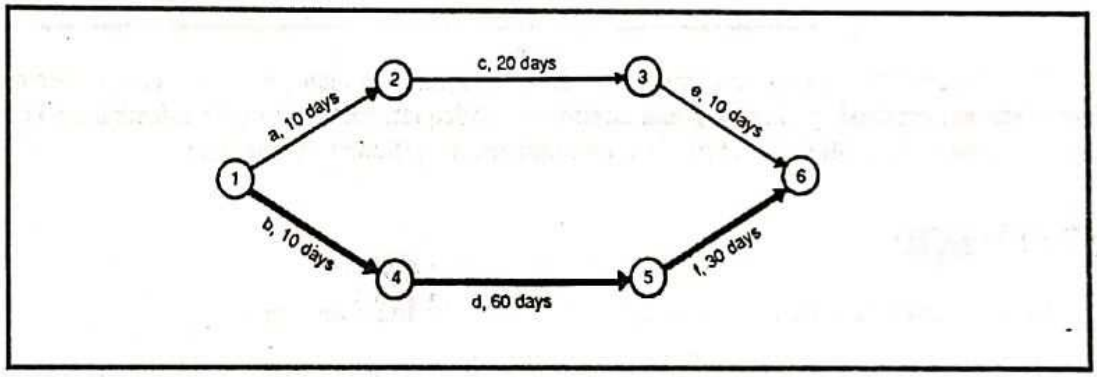
Fig. 20.8:
CPM Showing
Dummy Activities



To illustrate the CPM technique, let us take a very simple example of a small research project. The project is decomposed into the following activities, viz., preparation of the questionnaire for consumer survey, preparation of the questionnaire for dealer survey, and processing and interpretation of the data collected by the dealer survey, processing and interpretation of the data collected by the consumer survey. This is represented on Fig. 20.9.

Job identification	*Job description*	*Immediate predecessor*	*Time required to perform the job*
a	Preparation of dealer questionnaire	—	10 days
b	Preparation of consumer questionnaire	—	10 days
c	Dealer survey	a	20 days
d	Consumer survey	b	60 days
e	Processing and interpretation of dealer survey data	c	10 days
f	Processing and interpretation of data	d	30 days

Fig. 20.9:
Critical Path



Critical Path

The critical path is the longest path in a project network.

A path is a set of nodes connected by arrows beginning at the initial node of a network and ending at the terminal node. In Fig. 20.10, there are two paths: 1-2-3-6 and 1-4-5-6 where the numbers refer to nodes. The length of a path in the network is the total time it takes to travel the path. This time is calculated by adding the individual times between the connected nodes on the path.

The longest path in the network diagram here is the one connecting nodes 1-4-5-6 because it takes 100 days compared to the path connecting nodes 1-2-3-6 which takes only 40 days. The job on the critical path are critical in determining the project's duration and hence they are called critical jobs or critical activities. The critical path is represented by thick lines. Alternatively, it may be represented by double lines.

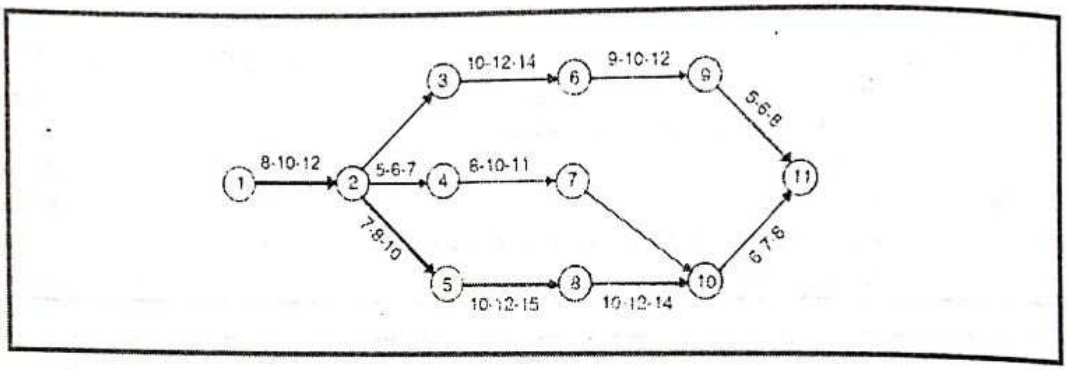
It is clear that even if the preparation of dealer questionnaire, dealer survey and the processing of the dealer survey data are delayed by a total of 60 days, the total duration of the project will not be affected. This extent of delay that can be caused to jobs on the non-critical path without affecting the total duration of the project is known as *slack*. In our example, the *slack* is 60 days.

The concept of critical path makes it clear that if we want to reduce the total duration of a project, we should be able to reduce the time taken by activities on the critical path. For example, if we want to complete the research project of our example earlier, we have to reduce the time taken by any one or more of the activities on the critical path (b, d and f). For example, we may reduce the time for the consumer survey by increasing the number of people employed for this purpose. Similarly, the data processing may also be done quickly.

Management Information System

A Management Information System (MIS) is a collection of data processing equipment, procedures, software, and people that integrates the sub-systems of the organisation and provides the needed information in time for efficient managerial decision-making to discharge the managerial functions promptly and efficiently.

Fig. 20.10



An efficient MIS plays a very important role in enabling the managers to efficiently perform managerial functions like planning, organising, directing and controlling. Adequate and up-to-date information is an essential input for all these functions. The MIS, therefore, is a prerequisite for efficient management.

The Benefits

Network analysis underlines several benefits. The important ones are:

(i) It ensures early and logical planning of the whole project, in terms of both aggregates and disaggregates.

(ii) It puts into perspective the full interrelationship of all activities concerned in the project.

(iii) It monitors the progress of the project to its completion date. Initial planning of projects through network analysis would underline which jobs control the rate of progress and which jobs have time to spare. The controlling jobs are, in fact, the critical jobs or 'key jobs.' Any delay in completing these jobs would hold up the rest of the project while any reduction in time on these jobs can reduce the overall time of the project. The sequence of jobs which require the longest time to complete makes up the critical path.

Determination of the critical path assesses management in focussing attention on the critical jobs, so that they remain on schedule. Naturally, critical jobs would be a relatively small percentage of the total jobs and would call for managerial alacrity so that project completion time does not suffer. Depending on the nature of the project and the criticality of the completion time, management may either slow down or speed up different segments of the project so that activities and events remain in consonance to one another.

Reduction of the overall project time may involve selective increase in direct costs, as a result of crashing. However, such increase would be more than compensated by project completion on date or even ahead of schedule. Network analysis helps management to know and judge alternative ways of optimisation of direct and indirect costs for giving the minimum total cost.

This is particularly important in view of the fact that in many of the Indian public sector projects, expenditure during construction has shot up several times more than the original project estimates due to various factors.

CONCLUSION

The PERT/CPM combined or unified network approach to project planning and control is rated to be the best form of project management system at present.

The method indicates and emphasises likely areas of trouble and delay. It provides a basis for reporting progress, indicates progress lags, requirement of extra effort and its usefulness. It facilitates changes in a programme if the situation warrants.

This planning technique involves analysing minutely the various jobs comprising a project, preparation of the network indicating logical and sequential relationship, scheduling by computing time parameters, and monitoring and control involving updating and time-cost tradeoffs if necessary.

Even though the stage up to scheduling is only the first phase of a network analysis, and is time consuming, it is the most important phase of planning as it makes the planner as well as the man in the field fully aware of the minutest details of the project. The programme of crashing will be required in very few cases. The attempt in most cases has so far been to see how the delay beyond target dates can be reduced.

This technique compels a thorough preplanning of the task which enables engineers and administrators alike to inculcate an awareness and seriousness in each and every activity involved as identification of trouble spots and pinpointing of responsibilities could be easily done. The network can be condensed or expanded to suit the level of application, execution and review.

This technique can be employed for all types of work, small or big. A network plan should be insisted upon when contractors submit tenders for projects. The intensity of delays can be reduced to a great extent and progress stepped up if network planning is adopted and followed up with review of progress and control at regular intervals.

Project design and network analysis are effective tools of management to achieve the objectives of the project. Network analysis could raise timely warning or management of the manufacturing units and efforts could have been made on that basis to persuade buyers to settle dues promptly. It is thus possible for management to pinpoint issues on the basis of network analysis to sort them out. The case study suggests that network analysis can provide radarlike sensitivities, raising signals and indicating directions for managerial action.

The functions of planning, scheduling and controlling are essential to an organisation for execution of a project. Network techniques help the management of the organisation in performing all these functions more efficiently. Indian entrepreneurs have been considered to the extent desirable, similar modern and precise project scheduling techniques like PERT and CPM in drawing up the implementation schedule. The schedule of construction furnished by the promoters of the project in most cases simply indicate the period within which major items of project implementation like acquisition of land and site preparation, commencement and completion of civil construction, placing of orders and delivery of imported and indigenous machinery and commencement of commercial production are expected to be completed. The above schedule neither provides indication of relationship between the various operations nor does it show the extent to which delays in a particular operation would affect the remainder of the project duration time in the comparative appraisal of project ideas. Both the techniques discussed are complementary and beneficial in implementing the project. While PERT is time-based, CPM cost-based. An integrated and co-ordinated technique of PERT and CPM will enable the completion of the project in an optimistic time at a reduced cost. The entrepreneur has to master these techniques in achieving his main objectives. These techniques need to be sharpened and appropriately used in project implementation.

21 CHAPTER

PROJECT REPORT

"A detailed project report (DPR) is drawn up based on the data and results obtained from the varied detailed studies. The DPR is not very much different from a feasibility report; the difference is only in respect of detail and degree of accuracy. DPR is generally prepared from a feasibility report with additional information: (a) deviations, if any, from feasibility report, (b) physical topographical information, (c) rates for various cost estimations, (d) guarantees from concerned authorities for the supply of power, water, etc., (e) estimates covering all aspects of a project in sufficient detail, (f) general — import duty rates, insurance, freight, etc. The preparation of the DPR is the final and most important stage of pre-investment phase of the project."

INTRODUCTION

Soon after the identification of a project and its implementation, the project report is formulated after examining various relevant aspects. Usually, the entrepreneur gets a project report prepared before a project or investment is undertaken. That project report prepared before a project of investment is undertaken. That project report assesses the demand of the proposed product to be produced, works out the costs of investment as well as operational costs and thus estimates the expected profitability of the proposed investment. It is on this basis that not only the entrepreneur takes his decision on whether to proceed on the proposed project, but also financial backers, banks and state departments involved in the project base their decisions on the ways and the extent to which the help should be provided. If the entrepreneur has to go to the money market to raise some risk capital for his venture, the project report may serve as his main instrument in convincing the investors about the profitability of his venture.

In fact, the state financing and nationalised banks in India over the years have been insisting on first getting such a project report from the entrepreneur before taking any action on his application for financial and other support. This strategy has been in operation for several decades. However, the number of the closing down of comparatively new businesses, and the emergence of large number of 'sick' mills give a cause of concern about the strategies adopted at the time of project appraisal. These issues not only adversely affect the involved entrepreneurs, but also the financing institutions. Thus it is not only a serious setback to the budding entrepreneurs of a newly developing country; it wastes the scarce investable funds of the nation, and as the banks have to break-even, this situation hikes up the real interest rate in the economy, making development costly.

A Project Report

A project report incorporating relevant data in respect of a project serves as a guide to management and records merits and demerits in allocating resources to production of specific goods or services. A project report is prepared for analysing the extent of opportunities in the contemplated project.

A project report is prepared by an expert after detailed study and analysis of the various aspects of a project. It gives a complete analysis of the inputs and outputs of the project. It enables the entrepreneur to understand, at the initial stage, whether the project is sound on technical, commercial, financial and economic parameters.

Parties Interested in Project Report

Financial institutions and commercial bankers are the interested parties in the project report which is prepared for direct submission to financial corporations, banks for getting loans. It does not contribute substantially to future operations.

The entrepreneur gets the report prepared by a consultant. As such, these parties providing term loans go for the report because it spells out how production should be organised to yield maximum results.

Scope of a Project Report

Project report includes information on the following aspects:

1. *Economic Aspects:* The project report should be able to present economic justification for investment. It should present analysis of the market for the product to be manufactured. Market analysis basically pertains to the following issues: *(a)* How big is the present market? *(b)* How much is it likely to grow? *(c)* How much of the future market the proposed project can capture after allowing a margin for future entrants? It provides an analysis of the economics of production.

2. *Technical Aspects:* The appropriate report should give details about the technology needed, equipments and machinery required and the sources of availability.

3. *Financial Aspects:* The report should indicate the total investment required including sources of finance and the entrepreneur's contribution. It should present a comparison of cost of capital with the return on capital.

4. *Production Aspects:* It should contain a description of the product selected for manufacture and the reasons for such selection. The report should also bring out the fact whether the product is exportworthy. It should also give details of the design of the product.

5. *Managerial Aspects:* The report should contain qualifications and experience of the persons to be put on the management of the job. If the entrepreneur will look after management, the report must emphasise as to how he is qualified to manage the venture.

Feasibility Reports Setting

A feasibility report or a project report of a new enterprise or of an expansion provides, in general, primary economic information, financial data and technical details which serve a finite number of discrete economic processes or cost structures of the industry concerned. Here, the economic processes are defined as combinations of vectors of material inputs and fuels (distinguished by supplying sectors), labour (by types and skills), capital (by types of function and capacities of categories), permitting different levels of output with varying costs of production but subject to the constraint of industrial capacities of the enterprise. The *"industrial profile"* is a similar document which also presents a brief history and technical descriptions of processes in terms of technical inputs coefficients for small-scale or medium or large-scale manufactures. Given these details, an entrepreneur is concerned with the local market prices and relative prices of substitutes and complements as to guide decision-making for sales and purchases; and to enable to compute and check for profitability (social or private) of the enterprise expansion or of a new plant.

A researcher is, however, concerned with the computation of input, capital and labour vectors, based on the generally available contents of the project report. Further, he examines from the report three aspects: *(i)* Preparation of a number of possible alternative solutions to attain a production target; *(ii)* Comparison of the alternatives and final selection of them; *(iii)* Implementation of the project and scope for economies of scale.

A number of possible alternative solutions of attaining a production target is the result of studying available production techniques, of which choice for the best, singly or in combination can be made. For comparison of alternative solutions among a number of feasible alternatives to the project, a criterion has to be chosen to achieve substantial rate of return with a unique solution, sufficiently profitable to justify the decision to carry on the enterprise. However, the search for such a choice depends on a number of studies of the individual projects or of their combinations.

Tabular data which would appear in the feasibility reports and be of considerable use for estimation and refinement, of input-output coefficients, capital coefficients and labour coefficients vectors of the different processes or sectors are available for reference in Fig. 21.1.

The feasibility report should contain the following details: *(a)* promoter (s) of the project, *(b)* product(s) of the project, *(c)* the level of output, *(d)* the raw materials used and the sources of supply, *(e)* the technical production method selected and the location of the plant, *(f)* the total cost of the project (in local currency and foreign currencies), *(g)* the proposed method of financing (proportions of the various sources of capital) and legal structure of the future enterprise, *(h)* the unit cost of the manufacture compared to those at FOB or CIF prices, *(i)* the size of the market (and the expected trading profits), *(j)* the effects of the projects on the economy, public finances and the labour market, *(k)* the existence of the market: trend of demand, the structure of competing firms and the proposed methods of distribution, trends in imports, exports, income, prices, local producers etc., *(l)* possibility of producing at reasonable cost, alternative methods and brief reasons for selecting, *(m)* initial costs and costs of conversion: *(i)* investment costs and *(ii)* operating costs, *(n)* commercial profitability to ensure repayment of loans and a return on capital investment, *(o)* general information.

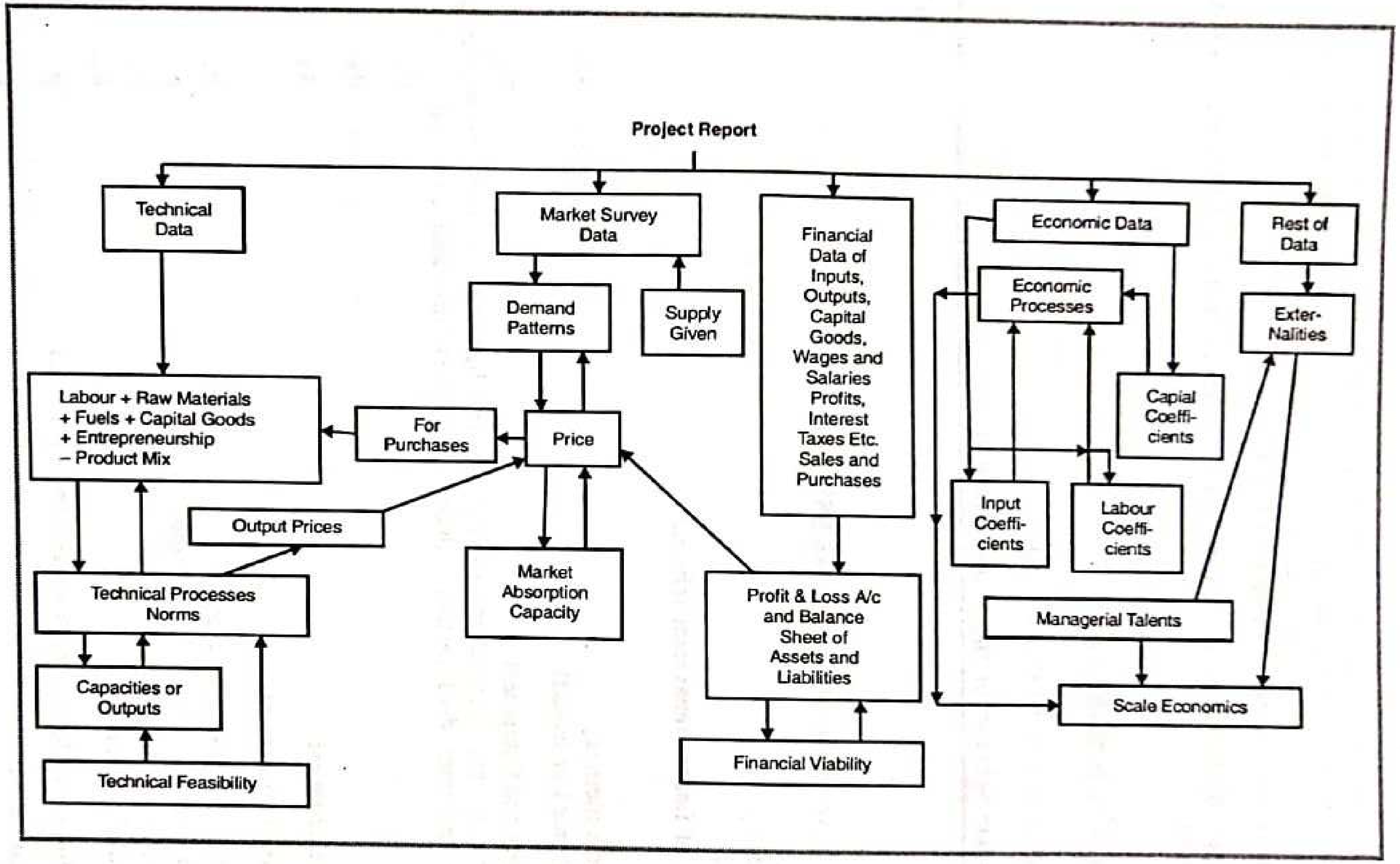
Contents of a Project Report

The following are the contents of a project report:

1. Objective and scope of the report.
2. Product characteristics (specifications, product uses and application, standards and quality).
3. Market position and trends (installed capacity, production and anticipated demand, export prospects and information on import and export, price structure and trends).
4. Raw materials (requirement of raw materials, prices, sources and properties of raw materials).
5. Manufacture (processes of manufacture, selection of process, production schedule and production technique).
6. Plant and Machinery (equipments and machinery, instruments, laboratory equipments, electric load and water supply and the essential infrastructure).
7. Land and building (requirement of land area, building, construction schedule).
8. Financial implications (fixed and working capital investment, project cost and profitability).
9. Marketing channels (trading practices and marketing strategy).
10. Personnel (requirements of staff, labour and expenses on wage payment).

The project report is prepared for submission to the financial institutions for the grant of land and other financial concessions. An entrepreneur can himself prepare the report, otherwise assistance from experts can be sought. There are several organisations which help entrepreneurs in the preparation of reports. The Small Industries Service Institute (SISI) and Small Industries Development Organisation (SIDO) help the entrepreneur in this regard. State Government also help the entrepreneur in matters of financial assistance towards this end.

Fig. 21.1: Industry Profile and Feasibility Study Report



Importance of a Project Report

Project report is of great importance. It highlights the practicability of a project in terms of different factors like economy, finance, technology and social desirability. It is needed by the entrepreneur for carrying out expansion or starting a new production line. These may be carried on by individuals like engineers and scientists, bankers or institutions, consultancy services and development banks.

An important aspect of the report lies in determining the profitability of the project and minimising risks in the execution of the project.

Proforma of a Project Report

We give here a proforma of the Project report.

Proforma for a Project Scheme for the Manufacture of —

Title/Name of the firm

1. Introduction

(a) Scope
(b) Product (give specification, viz., ISS/BSS/ASS)
(c) Process
(d) Marketability
(e) Location
(f) Sources of finance/repayment schedule.

2. Scheme

(a) Land and Buildings: (owned/rented or leased)	Rs.
(b) Machinery and Equipment (give detailed specification/capacity/imported or indigenous). For imported machine allowances (for duty on imported items, dock clearance charges, freight and insurance and local freight)	Rs.
	Rs.
Total:	Rs.
(c) Testing Equipment	Rs.
(d) Other fixed investments:	
(i) Packing and forwarding charges	Rs.
(ii) Electrification and installation charges	Rs.
(iii) Cost of tools/jigs/fixtures	Rs.
(iv) Cost of office equipment	Rs.
(e) Total Non-recurring expenditure (a) + (b) + (c) + (d)	Rs.
(f) Staff and Labour:	Rs.
(i) Indirect labour nos. and wages/p.m.	Rs.
(ii) Direct labour nos. and wages/p.m.	Rs.
Total salaries p.m. [*(i)* + *(ii)*]	Rs.
(g) Raw Materials and Consumables: (Per month on single shift basis with specifications)	Rs.
(i) Indigenous	Rs.

(ii) Imported	Rs.
Total: Rs.	
(h) Other items of expenditure: (Per month on a single shift basis)	Rs.
(i) Power and water charges	Rs.
(ii) Advertising and travelling	Rs.
(iii) Transport	Rs.
(iv) Commission to distributors/agents	Rs.
(i) Total recurring expenditure: *(f)* + *(g)* + *(h)*	Rs.
(j) Working capital for 3 months 3 × recurring expenditure	Rs.
(k) Total Investment required:	
(i) Non-recurring expenditure	Rs.
(ii) Working capital for 3 months	Rs.
Total:	Rs.
(l) Total Cost of Production:	
(i) Total recurring expenditure	Rs.
(ii) Depreciation on machinery and equipment	Rs.
(iii) Depreciation on building	Rs.
(iv) Maintenance charges	Rs.
(v) Interest on total investment	Rs.
(vi) Welfare for staff	Rs.
(vii) Office stationery and postage, etc.	Rs.
Total:	Rs.
(m) Profit and Loss Account:	
(i) By sale of... (qty.) of ... @	Rs.
ex-factory exclusive of applicable taxes	Rs.
(ii) Cost of production (1)	Rs.
(iii) Profit *(i)* – *(ii)* Approx. percentage of the total capital employed	Rs.
Total:	Rs.
3. Profitability and Projections (generally for about 5 to 10 years)	
Phase of activity	
Profitability of phases	
4. Infrastructure	
(i) Locational advantage	
(ii) Availability of material/power/water/labour	Rs.
(iii) Government policy	
Break-Even Point	
(i) Fixed Costs: (Executive salaries/depreciation/rent/interest on investment and administration costs)	Rs.

(ii) Variable costs (direct labour/direct material/income-tax/ commission and administration costs)

Item of Cost	*Fixed* +	*Variable*	Rs. *Total*
Materials	Rs.	Rs.	Rs.
Labour	Rs.	Rs.	Rs.
Other Expenditure	Rs.	Rs.	Rs.

$$Q = \frac{F}{P - V}$$

Where Q = Break-Even Quantity
F = Fixed Cost
V = Variable Cost per unit
P = Sales Price per unit

5. Names and Addresses of Suppliers

(i) Raw Materials

(ii) Machinery and Equipment

6. Remarks

Seal and Date (Signature of the Consultant)

Project profile is a plan which enables a new entrepreneur to choose a suitable line of manufacture.

An entrepreneur usually finds it difficult to prepare this report due to heavy consultancy charges. In such circumstances, a project profile which is in the form of blueprints of different business ventures come to his rescue. It gives full information about the business opportunity of different projects.

Proforma of a Project Profile on a small printing press is given below:

Product Introduction

A printing press can be started as a small business. The demand for job printing is increasing rapidly as the publicity through advertisements in papers, cartons, pamphlets and booklets is needed in marketing of almost every product.

The various educational institutions and other establishments also require printing facilities.

Process of Printing

The following is the process of printing:

(i) The material to be printed is first of all composed by the compositor.

(ii) The composed material is then fed into the printing machine and impression are got on the paper by mechanical operation of the printing press.

Accommodation Required

Floor Space 65 × 16 = 1040 square feet

Machinery and Equipment

The following machinery and equipments are required for a printing press:

(i) Chandeller type printing press (17" × 22") Rs.

(ii) 2 H.P. Motor 3 Phase = 1 Rs.

(iii) Rubber Roller = 1 Rs.

(iv) Paper Cutting machine (42") = 1 Rs.

(v) Proof Press (Roller) = 1 Rs.

(vi) Types, spacing materials, stars, monograms, etc. Rs.

(vii) Wooden type cases, racks, galleys, etc. Rs.

(viii) Type = 100 Kgs. Rs.

Manpower Required

Supervisor 1 Rs.

Compositor 1 Rs.

Machinemen 1 Rs.

Helper 1 Rs.

Raw Materials

(i) Papers Rs.

(ii) Cards Rs.

(iii) Inks Rs.

(iv) Gums, etc. Rs.

Investment

(i) Machinery and Equipment Rs.

(ii) Working Capital for 3 months Rs.

(iii) Total cost of production per year Rs.

Total Production Per Year

(i) Value Rs.

(ii) Profit Rs.

(iii) Rate of return Rs.

A project profile specifies all the requirements such as raw materials, process of production, cost estimates, marketing facilities, expenditures which may be incurred if the industrial unit is to be established for operation. Project profiles can be prepared by different agencies. The Small Industries Development Organisation has been publishing model schemes on certain specific lines of production which provide immediate scope for development as small-scale industries as well as other enterprises.

CONCLUSION

The project report is the blue print of a project. The report strives to accomplish the vital task of providing a bird's-eye-view of project activity. The project report must contain the various detailed information which ultimately helps in the decision making process of whether or not to encourage the project conceived. The financial institutions insist upon such a project report in order to be sure about the feasibility of the project. Since the financial commitments would be huge in many cases, it is necessary that before they advance the money sufficient precaution should be taken or else it would result in a huge loss in case an unprofitable project is financed. Also they ascertain from the report the possibility of generation of funds by the project itself and whether or not it would be substantial enough to repay the amount advanced within the stipulated period also indicates the technical feasibility and on the proper verification of the information supplied, a conclusion can be drawn about the appropriateness of such feasibility. The report also indicates technical feasibility, economic and commercial viability, financial implications of the project and whether or not adequate managerial competence required for successful running of the enterprise is available. In short, the project report is the summary of varied activities of a project — a very vital document.

22 CHAPTER

PROJECT APPRAISAL

"Little-Mirrlees approach to social cost benefit analysis involves determining the accounting or shadow prices, particularly for foreign exchange, savings, and unskilled labour; considering the equity factor; and use of discounted cash flow analysis. It seeks to measure costs and benefits in terms of international prices, rather than domestic prices, and also in terms of uncommitted social income.

The Project Appraisal Division of the Planning Commission uses a modified version of Little-Mirrless approach. All industrial projects are evaluated on three aspects — economic rate of return, effective rate of protection, and domestic resource cost."

INTRODUCTION

Project appraisal an exercise whereby a lending financial institution makes an independent and objective assessment of various aspects of an investment proposition to arrive at the financing decision. Appraisal exercises are basically aimed at determining the viability of a project and sometimes, also in reshaping the project so as to upgrade its viability. This is done by allocating the term finance sought by a promoter.

The factors generally considered by institutions while appraising a project included technical, financial, commercial, economic, ecological, social and managerial aspects. This makes it necessary to recognise the inter-relationship underlying the various aspects of a project. For example, the size of the initial market and the estimates for demand build-up would determine the plant capacity and production phasing; these together would have a bearing on the profitability, which, in turn, would determine the means of financing. Location also has an important bearing on project cost and cost of production. Above all, the management behind the project has a decisive influence on most of these aspects. These considerations imply that project appraisal is viewed as a composite process as against the approach of viewing each aspect individually.

This chapter will focus on the appraiser's thinking process from the viewpoint of the lending financial institutions. This will help ensure necessary preparation on the part of the borrowers-entrepreneurs/businessmen/businesswomen.

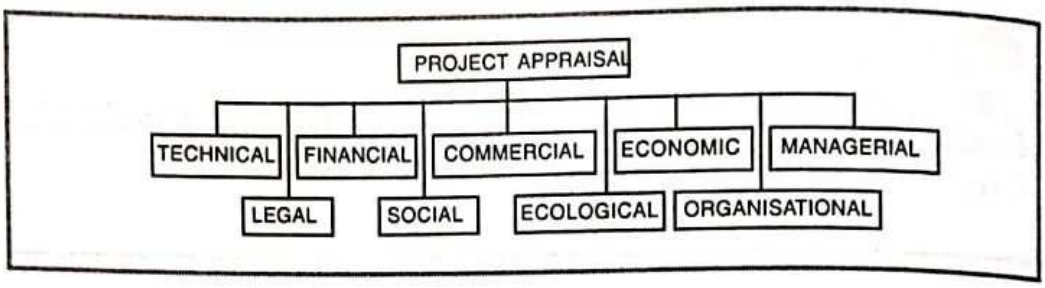
Meaning

The exercise of project appraisal simply means the assessment of a project in terms of its economic, social, and financial viability.

This exercise is critical as it calls for a multi-dimensional analysis of the project that is, a complete scanning of the project.

Financial institutions and banks make a critical appraisal of projects which are submitted to them by the entrepreneurs for getting loans. They have traditionally been accepting the data provided by the entrepreneur as valid while assessing the project. In fact, the emphasis has largely been on the cash-flow and financial viability of a project in assessing their suitability for extending the loans.

Fig. 22.1: Aspects of Project Appraisal



Definition

Project appraisal can be defined as the promoter taking a second look critically and carefully at a project as presented by the promoter person who is in no way involved in or connected with its preparation and who is as such able to take an independent, dispassionate and objective view of the project in its totality as also in respect of its various components. The person who carries out appraisal of a project is usually an official from the financial institutions or a team of institutional officials. Since all ending activities involve risk in a smaller or larger measure, project appraisal aims at sizing up the quality of projects and their long-term profitability aims at minimising the risk of lending by rectifying their weaknesses and improving their quality by incorporating into them features / safeguards missed by the promoters either because of lack of knowledge or information.

Scope of Appraisal

The appraisal of a project is undertaken by the financial institutions with the twin objectives of determining the market potential of a project and selecting an optimal strategy. The methods of analysis vary from project to project. Nevertheless, certain common aspects of study from the angle of technology and engineering are with a mention:

- Choice of technical process and/or appropriate technology;
- Technical collaboration arrangements, if any;
- Size and scale of operations;
- Locational aspects of the project and availability of infrastructural facilities;
- Selection of plant, machinery and equipment together with background, competence and capability of machinery/ equipment suppliers;
- Plant layout and factory buildings;
- Technical engineering services;
- Project design and network analysis for the assessment of project implementation schedule;
- Aspects relating to effluent disposal, management of entry, utilisation of by-products etc.;

— Project cost and its comparison with other similar projects, based on technology, equipment, product mix and time spread;

— Determination of project cost estimates, profitability projections, etc.;

— Sensitivity analysis.

It must be remembered that the different aspects of a project are not independent entities but are highly inter-related; and a meaningful project appraisal depends upon the appreciation of this fundamental fact. For example, the size of the total market for a product as it exists now and the year to year estimates of the future progressive call for expansion of demand would determine planned capacity of the proposed unit and the phasing of production over the years. These in turn would influence the project cost and profitability which would determine the means of financing. The cost of the project and profitability are influenced to a significant extent by its location. Over and above this, the management behind the project, has a decisive role to play in almost all aspects of the project.

Steps Followed in Project Appraisal

Project appraisal is a scientific tool. It follows a specific pattern. First and foremost, an analysis of a region's economy provides a general framework within which the assessment of any project is made. This analysis indicates whether the project is in a potential environment which enjoys priority for economic development of the region/state concerned. This exercise itself usually involves the investigation of six different aspects: economic, technical, organisational, managerial, operational, and financial. The relative importance of these different aspects can vary considerably according to circumstances and type of project. The main stages of the system of project appraisal are:

Step 1	— Economic	Indicates priority use.
Step 2	— Technical	Involves scale of the project and the process adopted.
Step 3	— Organisational	Suitability is examined.
Step 4	— Managerial	Adequacy and competence are critically scrutinised.
Step 5	— Operational	Capability of the project.
Step 6	— Financial	Determines the financial viability for sound implementation and efficient operation.

Fig. 22.2: Steps of Project Appraisal

Project Appraisal Format

Criteria	*Project-I*	*Project-II*	*Project-III*	*Project-IV*
1. Investment size				
2. Location				
3. Technology				
4. Equipment				
5. Marketing				
6. Power & Water				
7. Others' performance				
8. Working capital needs				
9. Labour component				
10. Economic viability				
Total				

Point Scale: A = 5 points; B=4 points; C=3 points; D=2 points; E=1 point.

Economic Aspects

The economic aspects of appraisal are fundamental as they logically precede all other aspects — this is so because the bank will not finance a project unless it stands assured that the project represents a high-priority use of a region's resources. However, a purely financial analysis normally does not provide an adequate basis for judging a project's value to the economy, since the financial analysis looks at the project only from a limited viewpoint of the revenues entering the project's own accounts. So, an economic or social analysis looks at the project from the viewpoint of the whole economy, asking whether the latter will show benefits sufficiently greater than project costs to justify investment in it.

The economic benefits brought about by a successful project normally take the form of an increased output of goods or services, either directly of indirectly (as in a large class of cost-reducing projects). This increased production will also generate many different forms of additional income, such as increased wages or employment of labour, larger government revenues, higher earnings for the owners of capital, or most frequently, a combination of these income benefits.

In a large majority of cases, it is possible to quantify project costs and benefits, and to construct a rate of return or some other appropriate move. Future costs and benefits are calculated, using either market or shadow prices, as found appropriate. Further both costs and benefits are put under subsidence to initiate the projects' estimated rate of return.

The latter is then compared with the minimum earning power of capital judged appropriate for each country. While the rate of return is an important test that all projects with quantifiable cost and benefits must pass, importance and its significance is usually overestimated. The rate of return is a necessary confirming test of projects that have to be justified within a much wider frame of reference, in which basic project objectives and the nature of project benefits (e.g., foreign-exchange savings, increased employment and improved income distribution) play major roles.

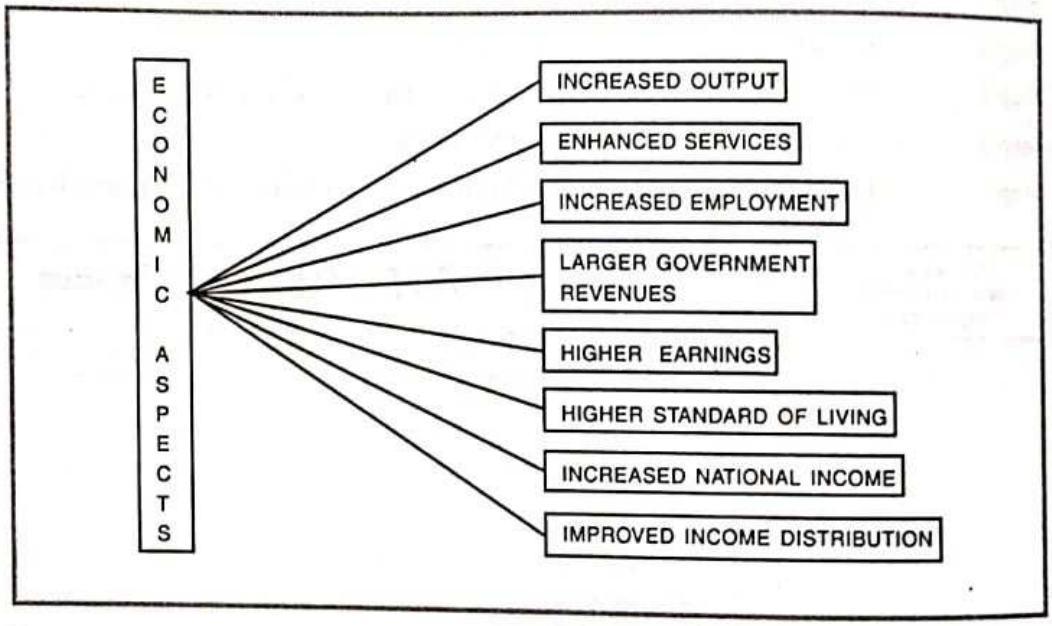


Fig. 22.3: Economic Aspects of a Project

Organisational Aspects

As a lender and a development institution, the bank places particular stress on the need for an efficient organisation and responsible management for the execution of the project. During appraisal, these two essential dimensions of a project are examined. If one or the other is found wanting, short-term remedial steps are recommended to the entrepreneur and the bank may make a clause for assistance — such as the recruitment of individuals or an organisation qualified to assist in running the enterprise, at least during the initial phase; or those for a longer term, such as a management

study, reorganisation or creation of a new autonomous agency to operate the project. In either case, the need for training local staff to fill positions at all levels is examined, and training programmes may well be included as part of the project. The objective of this aspect of appraisal is to make sure that the project is adequately carried out and that a locally-staffed institution, capable of contributing effectively to the development of the sector in question, is created.

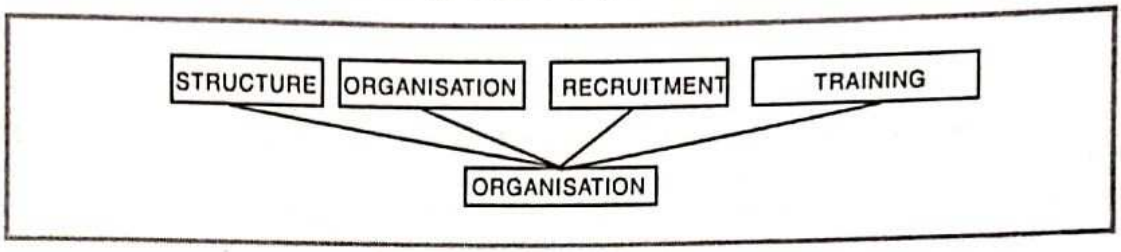


Fig. 22.4: Organisational Aspects

Managerial Aspects

If the management is incompetent, even a good project may fail. It is rightly pointed out that if the project is weak, it can be improved upon, but if the promoters are weak and lack in business acumen, it is difficult to reverse the situation. It is, therefore, natural that financial institutions very carefully appraise the managerial aspects before sanctioning assistance for a project.

It may be relevant to recall here that there are provisions which enable financial institutions to exercise control over the assisted units. For example, they now stipulate the condition of option for conversion of loans into equity in respect of loans aggregating to Rs. 5 crore or more generally, and in respect of sick units, irrespective of the amount of assistance and the level of shareholding in the assisted company.

Further, there is a provision for appointment by the financial institutions of nominee directors on the boards of all MRTP companies assisted by them. As regards non-MRTP companies, nominee directors are appointed on the boards on a selective basis, especially in cases where one or more of the following conditions exist, viz., *(a)* the unit is running into problems and is likely to become sick, *(b)* institutional holding is more than 26 per cent and *(c)* the institutional stake by way of loans/investment exceeds Rs. 5 crores.

The Companies Act, the Industries (Development and Regulation) Act, etc., empower Government to exercise powers of control over the management, including the take-over of management of industrial undertakings.

All these indicate the importance given to proper managerial strategies to prevent mismanagement.

If a proper appraisal of the managerial aspects is made in the beginning itself, future problems in this area can be avoided to a very large extent. It is, therefore, necessary that the overall background of the promoters, their academic qualifications, business and industrial experience, their past performance, etc. are looked into in greater detail to assess their capabilities for implementing the project for which financial assistance has been sought.

Technical Aspects

The importance of technical appraisal in project evaluation needs no emphasis. Technical appraisal of a project broadly involves a critical study of the following:

Location and Site

An industrial feasibility study aspect refers to the appropriate and location selection of a geographical area where the project should be located. Towards this end, the required site characteristics shall be kept in mind when selecting the location.

There are a number of important factors that influence industrial location because the site may significantly influence the cost of production and distribution, distribution efficiency, the operating environment, etc.

The problem of site selection gets complicated by the fact that at a particular location where one or a few factors are favourable, other factors may not be so. Selection of an optimum location, therefore, revolves round the combined consideration and evaluation of all the relevant factors.

The important factors that influence industrial location are the following:

1. *Raw Material Supplies:* Certain industries are located near the source of raw materials. This is particularly true of industries based on gross (weight-losing) localised material — industries with a high *Material Index* (the proportion of the localised material to the final product). For example, iron and steel mills are usually located near the ore deposits and sugar mills in the sugarcane cultivating regions. Similarly, the timber industry tend to be closer to forests or riverways leading from forests. Kallayi (near Calicut, Kerala), one of the largest timber business centres of the world, is on the banks of the Chaliyar river leading from the richly endowed Nilambur forests. In certain cases, even industries based on pure materials prefer to be located near source of raw materials. The jute industry in India, for example, is developed in the jute growing region. Similarly, the early development of the cotton textile industry was in the cotton growing region.

Industries using perishable raw materials also tend to be located in closer proximity to the raw material sources.

2. *Proximity of Markets:* Certain categories of industries tend to be located near the market. This is particularly true of the industries with the manufacturing process that involves an increase in weight and/or bulk. In such cases, the transport and distribution costs can be minimised by being closer to the market. Bottling of drinks is a very good example. Industries with fragile and perishable output also have a tendency to be located closer to the market.

When there are large markets geographically spread, national or internationally, manufacturing units may be established in close proximity to the major markets.

3. *Transportation Facilities:* Transportation facilities including the cost of transport play an important role in industrial location. No wonder, centres connected with sea, air, rail and road transport facilities exert a strong pull on industries. It is not only the transportation of the materials and finished products that it is to be considered but also the transportation facilities for the personnel.

In a vast country like India, there may be significant variations in transportation costs between different locations.

Places with a high transport disadvantage are not likely to attract industries. It is due to this reason that the Government of India is providing transport subsidy to industrial units located in certain hill regions and islands with a view to encouraging the industrial development of these regions.

4. *Power and Fuel Supply:* Power and fuel supply conditions have an important bearing on industrial location. Cheap power or fuel and its uninterrupted supply is an important attraction for industries, especially in the era of energy crisis. In the past, certain industries tended to be located near coal deposits. But the advent of electricity has greatly changed the industrial location patterns. Now, it is not very difficult to take power supply to the location of raw material supply so that the weight-long materials may be processed at their location.

Electrification of various parts of the country, including the villages, is encouraging decentralisation of industries.

5. *Water:* Certain industries like the paper industry by their very nature require large quantities of water. The quality and properties of the available water is as important as the quantity of water available and the stability of its supply. A number of industries also use the water sources for effluent disposal. While selecting the location, the possibility of the pollution of water by other industries making the water unfit for industrial and domestic purposes should also be considered. The requirements of water by the employees and their families housed near the industrial unit for domestic purposes and its availability should also be considered.

6. *Manpower:* The economic, social and political aspects of labour supply have an important influence on industrial location. Not only the quantity but an assessment of skill levels of the available manpower are very important. In certain regions, abundant cheap labour may be available; but if the labour does not possess the required skill, the industry will have to incur expenditure on training the labour.

Cheap labour is particularly important for industries where labour accounts for a significant part of the total value added. On the important factors influencing the location of plants in the less developed countries by the multinationals (MNCs) is said to be the cheap labour supply.

For the assessment to be realistic, it is essential that the wage rates be compared with the level of productivity by the labour.

Certain socio-economic characteristics and political affiliations of labour are also important considerations. In certain localities and communities, labour turnover and absenteeism are high. These factors may not only tend to increase the expenses but also affect the smooth functioning of the enterprise.

Some regions may be characterised by the dominance of militant trade unions, widespread labour unrest, etc., seriously affecting the smooth functioning of industries. Industries prefer to consider other areas for their location.

It may be difficult to get professional, skilled manpower etc., if the location is very remote and deprived of civic amenities.

7. *Labour Laws and Government Policy:* Labour laws and the government's attitude and policy toward strikes and other labour problems and employee-employer relations, etc., may also influence location decision-making.

8. *Natural and Climatic Factor*: Natural and climatic factors also play an important role in the location of certain industries, as the absence of these conditions will necessitate additional expenditure to create favourable conditions artificially. For instance, humid climate is conducive to cotton textile industry. Favourable climatic conditions and other environmental factors played a major role in the location of these industries.

9. *Strategic Considerations:* They also influence the location of industries. It is not likely that major industries will be located in strategically sensitive areas even if all economic factors favour such a location. Especially in the case of strategic industries, special care is taken to assure that the location chosen is not easily accessible to the military forces of other countries. For defence industries, strategic location may be the sole criterion.

10. *Taxes and Fees:* Variations in taxes, fees and charges may also influence industrial location.

11. *Incentives and Disincentives:* There are also certain incentives and disincentives which also may affect industrial location. For instance, in India, the Union and State Governments offer a number of fiscal, monetary and physical incentives for industries in the notified backward regions.

Certain disincentives like higher taxes may discourage industries in certain regions. Government may even ban new industrial units in congested areas, large urban areas or developed regions.

12. *Site and Services:* Some industries require a large area of land which may not be available in a locality where all other factors are favourable. Availability of the required type and quantity of land at reasonable prices is, thus, an important factor.

With a view to developing industries in certain regions, Government has been providing developed sites and necessary facilities and services. Certain such locations like Hosur (Tamil Nadu) have been very successful in luring industries.

Similarly, industrial estates have been established in different parts of the country to encourage the development of industries.

13. *Socio-economic and Political Factors:* Socio-economic and political factors are also sometimes very important, especially in respect of location of public sector units. Some large-scale public sector units are located in backward regions on such considerations. Social and political considerations sometimes favour industrial location in certain sensitive regions.

14. *Miscellaneous Factors:* There are also a number of other factors that may influence industrial location — the attitude of the local community, proximity of complementary industries, prospects of development of the region, service facilities required by the industry, recreational and social facilities, proximity to important centres like metropolitan centres, personal factors, historical factors, etc.

Site

There are a number of important factors to be considered in the selection of the site. These include the load bearing capacity of the site, towards flood and earthquake hazards, access to transport facilities, facilities for water supply and effluent discharge, ecological factors, etc.

The nature of the industry has a bearing on the site selection. For example, some industries like the paper industry need abundant supply of water. For some industries, effluent discharge is a major problem. Environmental pollution is a serious problem that certain industries have to confront with. All these factors influence the selection of site.

As stated earlier, the Government provides 'site and service' in specified locations. However, some of the facilities needed for certain industries may not be available on these sites.

Size of the Plant/Scale of Operation

The size of the plant or scale of operations is an important factor that determines the economic and financial viability of a project.

In many industries, there are certain technological plant capacities which are economical. If the size is sub-optimal, there will be diseconomies of scale.

This is one of the important reasons for poor performance of many industrial units in India. Diseconomies of scale result in high cost and make survival in a competitive market, particularly in the international market, very difficult. The Government of India in this context, has emphasised that the plants or scale of operations should be of economic size.

An important aspect of technological size is that the available process technology and equipment are often standardised at specific capacities in production sectors. Operative capacities in such sectors are, therefore, available only in certain multiples.

There are, however. certain factors that may come in the way of optimal scale. For example, there may be demand constraints, i.e., the market demand may be too low that it cannot absorb the output of the large plant. In some cases there may be resource and input constraints. For example, the available raw material in a region may not be sufficient to feed a large plant. When there is important control, non-availability of economic size plants or equipments domestically makes the adoption of optimal scale impossible. Sometimes, there will also be scarcity of finance.

Another factor that may discourage the establishment of large-scale facilities is the risk of rapid obsolescence of technology or the product.

Technical Feasibility

Appraisal of ethnical aspects of a project involves scrutiny of such aspects of the project as:

- Manufacturing process/technology selected.
- Technical collaboration arrangements made, if any.
- Capacity/size of the project and the scale of operations.
- Location of the project.
- Availability of physical and social infrastructural facilities.
- Availability of various inputs covering raw materials as well as utilities.
- Selection of plant, machinery and equipment together with background, competence and capability of machinery/equipment suppliers.
- Plant layout/and factory building.

— Technical engineering services.

— Project design and network analysis for assessing the project's implementation schedules, etc.

The technical feasibility study should consider the adequacy and suitability of the plant, the equipments and their specifications, plant layout, balancing of different sections of the plant, proposed arrangements for procurement of the plant and equipments, reputation of the machinery suppliers, etc.

The feasibility study should also consider the technology required for a particular project, evaluate technological alternatives and select the most appropriate technology in terms of optimum combination of project components. The various implications of the acquisition of such technology should be assessed, including contractual aspects of technology licensing where applicable, etc.

Government of India's policy in this respect clearly states that while evaluating applications for industrial licensing, the following factors will be specifically considered:

(i) Whether the proposed capacity is of economic size.

(ii) Whether the processes proposed to be adopted are efficient from a techno-economic point of view.

(iii) The extent to which diversification and expansion proposals will result in fuller utilisation of capacity and economies of scale.

Besides, proper evolution of alternative technologies is essential for selection of the appropriate one. This evaluation should be related to plant capacity and should commence with a quantitative assessment of output, production build-up and gestation period and qualitative assessment of product quality and marketability.

The selection of technology has to be related to the nature of the principal inputs that may be available for a project and to an appropriate combination of factor resources for both short and long periods.

Financial Aspects

The purpose of the appraisal of financial aspects of a project is generally to ensure its initiation of financial conditions for the sound implementation and efficient operation. The scope of this aspect of appraisal varies, of course, considerably with the nature of the project and whether it is revenue-producing (e.g., industry, utilities, agriculture) or not (e.g., education, most highway projects).

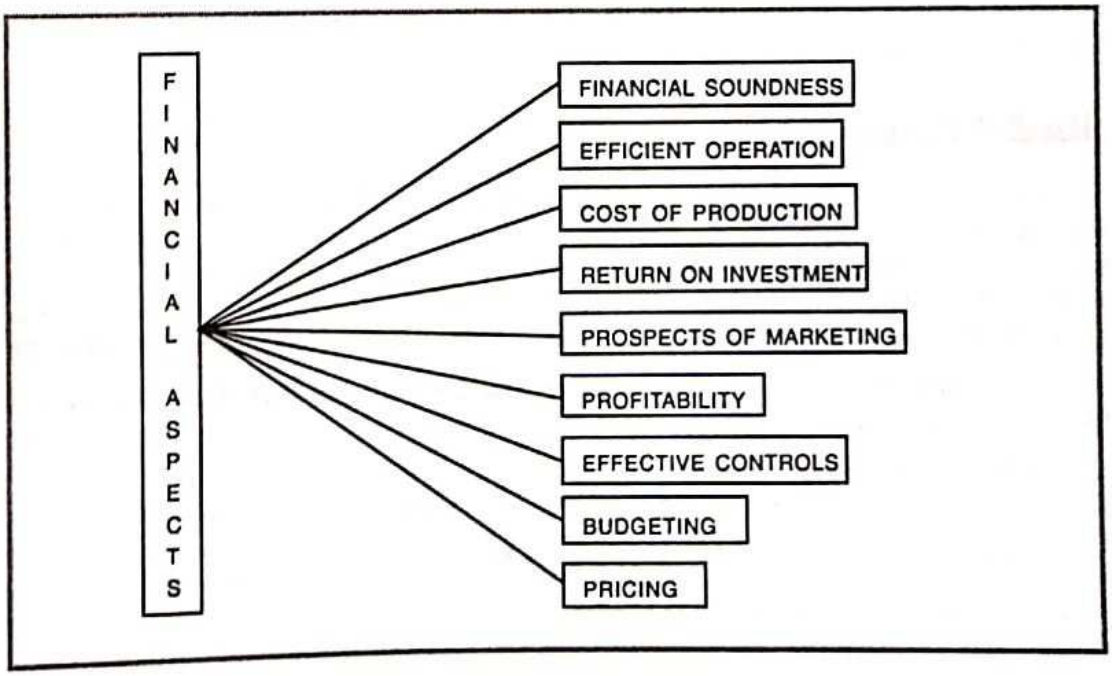


Fig. 22.5: Financial Aspects of Project Appraisal

For projects which involve the marketing of a product or service by an entity, the appraisal includes in investigation of the availability and cost of raw materials power, labour, and services needed for production, and the prospects for marketing the product or service profitably.

In every case, it is necessary to ensure that satisfactory accounts are maintained for effective control over expenditure and revenue, and to disclose the project and entity carrying it out. Also, since the banks finance only a part of the investment cost of a project, it is necessary to ensure that funds from other sources are available on acceptable terms to meet the balance of the cost. This may be relatively simple where the government is able, without difficulty, to provide the rest of the necessary funds from budgetary sources; or it may be complicated, as in a project to expand or modernise a revenue-earning concern, where all the financial requirements of the concern during the construction of the project must be considered.

Financial appraisal also evaluates capacity of revenue-producing investments from the standpoint of the entity, industrial sponsor or other investor who would make them, in order to ascertain whether it is sufficiently attractive to warrant their participation. Establishing that the entity carrying out the project is in a position to manage its business in a cost-effective fashion, is another important aspect.

The financial aspect of project appraisal covers the following areas:

(i) Cost analysis: In the case of cost analysis it is to be decided or to be worked out what would be the cost of production. There are different methods of finding out cost.

(ii) Pricing: This strategy concerns the fixing up of the product's price. Price fixation is a very tedious job. The price must be fixed very judiciously, because the price is the cause of demand. If the price is high, the demand may be low and *vice versa* and a low price may mean a lower rate of profit also.

(iii) Financing: The funds needed to finance the project is an important aspect of project appraisal. It is concerned with raising the funds and making their most efficient use. The funds must be raised from places where the rate of interest is lower.

(iv) Income and Expenditure: The income and expenditure profile is concerned with the estimates regarding the income expected and expenditure involved in the project. This helps in ascertaining the cost involved in production and profit expected therefrom. Detailed proposed accounts should be made for future reference to know whether the plans are working out properly or not.

Financial institutions examine the project to ensure economic justification of investment details. They study the marketing scope of the project and also its worth to the national economy by analysing the consumption pattern and the potential demand for the project.

Market/Commercial Aspects

In setting up an industrial project, estimation of demand for the product/group of products proposed to be manufactured by a promoter is the first important step. Ideally, the market analysis should give a comprehensive account of the market opportunity, as well as of the marketing strategy appropriate for converting the opportunity into a reality. Marketing strategy in this context could be defined as an ever-evolving design or blueprint consisting of a set of inputs like product quality, price, design, dealer/agency discounts, distribution network/channels, packaging, etc.

To be of maximum benefit to a promoter, whether new or already established, market analysis should cover the following major aspects:

(i) Analysis of market opportunity and specifying marketing objectives. This involves a scientific assessment of *(a)* total size of the market for a product; and *(b)* the share that could be secured by a firm, existing or new.

(ii) Planning the process of marketing the product.

(iii) Organisation of the marketing process.

(iv) Control of the implementation of the marketing plan which facilitates taking corrective action when the actual results deviate from the estimates or expectations.

An intensive scanning and analysis of the proposed environment in which the industrial unit has to function should form the basis for analysing market opportunities as well as for specifying the marketing strategy. This is because the ever-changing environment in which the industry sector functions, restricts or expands the opportunities available to and the threats to be faced by an industrial unit.

Market opportunities expressed in terms of demand forecasts and market shares are based on a host of factors outside the control of the promoter, whereas marketing strategy and marketing process are largely under his control. Hence, the formulation of a detailed marketing plan, specification of a proper marketing strategy, and the manner in which the marketing process should be undertaken would enable the promoter to cope with the uncertainties in the market place more effectively than otherwise. It is also a fact that the estimated market share of a promoter and his marketing strategy influence and reinforce each other and should never be viewed in isolation.

Answers to the following questions would indicate the safeguards that may be necessary to take in the likely weak areas in the project:

(i) What is the management culture in which the entrepreneur has been brought up?

(ii) Is the entreprenur's approach to project planning scientific and consistent with the requirements of the proposed project?

(iii) In the initial stages of project planning, is the entrepreneur enlisting the support of mere helpers or of professional managers?

(iv) How has the entrepreneur drawn the organisational structure of the unit? Does it show *ad hocism* or indicate that he has tried to merely fulfil certain legal/other obligations or is it purposeful and does it indicate a good deal of foresight on his part?

The difference between an entrepreneur and manager has been dealt with earlier.

Political and Labour Considerations

Financial institutions also pay attention to political environment and labour conditions of the area where the project is to be located. Strikes, lockouts, industrial peace and communal harmony in the area play a decisive role in examining success or failure of the project.

The lending institutions examine the project to study its soundness on technical, economic, commercial and managerial grounds. If the appraisal report is found satisfactory, the loan application will be favourably considered. The manager then communicates his decision to the borrower and terms and conditions will be negotiated. The most important areas for the borrower and lender to negotiate are: timing in relation to negotiations method of financing based on certificates of work done, repayment schedule, rates of interest, commitment fees, security options, and monitoring and control requirements.

Technical Collaboration Arrangements

The Government of India has issued an illustrative list of industries where no foreign collaboration, financial or technical, is to be allowed in view of indigenous technology base having been well-established. However, looking to the need for constant upgradation of production technology in line with that of developed countries, the Administrative Ministries and Foreign Investment Promotion Board (FIPB) may permit import of technology in those field where:

— indigenous technology developed for items in the list is too closely held and is not available for use by new entrepreneurs on competitive terms;

— technology is required for updating of existing technology in India to meet domestic requirements efficiently or to be competitive in the export market; and

— such import is required for the manufacture of items with substantial exports, backed by buy-back guarantees.

The terms in the collaboration agreement are examined in detail by the appraising institutions with reference to the technical know-how, engineering services, procurement of imported equipment, price comparison with indigenously available equipment, performance guarantee by the collaborators, penalties for non-performance specified in the agreement, deputation of foreign exports during construction, initial and post-operation period, provision for training of Indian technicians etc. The reputation of the collaborators and past experience concerning tie-up arrangements with them, the competitiveness of the terms of collaboration in relation to the requirements of the project, the reasonability of financial collaborations and other costs by way of down-payment and royalties as also restrictive clauses in regard to marketing areas etc., are also looked into and worked upon by the appraiser.

In the case of financial collaborations, the terms relating to the right of participation of foreign collaborator in management and future issues of share capital are also critically examined and considered. The financial standing and reputation of collaborators, where necessary, are checked through the Indian Consulates/Missions abroad as also through the India Investment Centre.

Research and development is also studied in depth and it is ensured that during the validity of the collaboration period, the borrower is allowed free access to the latest developments that may take place at the collaborators' end. The collaborators are also required to agree for providing facilities to the borrower in establishing his own uptodate R & D organisation, both in terms of equipment and manpower.

CONCLUSION

To sum up, project appraisal is a science as well as an art. While the basic principles of appraisal could be mastered in a short time span, the successful practice of the art of carrying out appraisal requires keen observation, a knack for details, objectivity, decision-making. It is also necessary to look ahead of the project. Project appraisal is a key to broad-based, balanced industrial growth of the country. In a way, it calls for a judicious judgement and perspective outlook. It is, therefore, amply viewed as a composite process of development.

23 CHAPTER

FACTORY DESIGN AND LAYOUT

"A factory houses the manufacturing processes, physical facilities, materials, and personnel. Factory design is a plan for a particular type of building, arrangement of machinery and equipment, and provision of service facilities, lighting, heating, ventilation, etc. in the building. The arrangement of machinery and equipment for the manufacturing process is known as factory layout."

INTRODUCTION

In creating a factory, an entrepreneur creates something which is attractive, useful and ingenious from material resources which lack the dimension of targeted benefits. For this, the entrepreneur uses his skills, abilities and strategies to combine a variety of material and human resources. These potential resources manifest themselves in the selection of the factory location, in planning and constructing the factory building, in procuring and installing machinery and equipment, in putting up other production facilities and auxiliary services, and in recruiting and selecting men of competence to use the physical resources for the purpose of producing goods.

In this Chapter, emphasis is being laid on the aspects of factory design, planning and layout.

This makes it imperative for ensuring smooth working of the small industrial activity be it in its administrative work or shop floor activity or even stores management.

Dr. Nau Nihal Singh has aptly observed: "The planning and control of the supply and movement of materials and components and the utilisation of plant and labour ensures that the necessary resources are available at every stage of manufacture to ensure the economic completion of a predetermined delivery programme, and constitute the management techniques of production planning and control."

Concept of Factory Design

The term factory design refers to the plan for a particular type of building, arrangement of machinery and equipment, and provision of service facilities, lighting, heating, ventilation, etc. in the building.

Importance of Factory Design

Factory design and layout of the factory are significant aspects of the factory organisations. They have direct relationship with the process of manufacturing, productively and value of the product. It also influences the operational costs of the enterprise. It also boosts the morale of workers and ensures maximum supervision.

The design and layout of a factory directly influences the operational costs of the plant. It also improves the productivity and profits. The factory design and layout should be scientific and systematic. The principle benefits of a well designed factory are as follows:

- Provides adequate storage facilities for raw material and finished goods
- Direct bearing on the costs of heating, power, light and other services
- Provides a pleasant work environment and enhances employees' morale
- Increases productivity and minimises strain and fatigue
- Reduces excessive movement of workers
- Ensures maximum visibility of operations to the supervisors
- Improves efficiency and steady growth.

Factors Affecting Factory Design

The following factors influence the design of a factory:

1. Location
2. Nature of the manufacturing process
3. Plant Layout
4. Functional Smoothness
5. Material Handling and movement
6. Cost of Building
7. Lighting, Ventilation and Service Facilities
8. Nature of Product
9. Future expansion, modernisation etc.
10. Projecting the image of a factory
11. Appearance.

The factory design and layout should be flexible so that it may be adapted easily to technological change, modernisation, diversification and expansion with minimum cost and time.

Determinants of Factory Planning

In preparing a factory plan, the small entrepreneur has —

(i) To determine the optimal size of the factory in accordance with the manufacturing plan, which includes a consideration of its envisaged future growth;

(ii) To select a proper location for the plant on the basis of the availability of infrastructure and market centres;

(iii) To prepare equipment layout on the basis of the class of work;

(iv) To prepare production methods when materials move continuously through a series of machine operations;

(v) To determine the type of structure required on the basis of the type of product with full safety measures;

(vi) To provide service facilities for workers and machines;

(vii) To schedule the construction and installation of machinery.

Any planning exercise requires of the planner a good knowledge of what is involved in the activity concerned, such as the nature of the materials to be handled, their quality and the quantity, the processes they have to be subjected to, inspection and quality control at various stages, assembly procedures, packing, etc. He should also know the sequence of operations. He should look ahead beyond the immediate future and anticipate changes, modifications, additions, deletions, etc., which may be forced upon his organisation as a result of expansion, obsolescence, diversification or any other reasons. Having anticipated these, provision should be made to accommodate such changes.

While working on a factory layout plan, a very important aspect to be kept in mind is the fact that the movement of materials from one stage of manufacture to the next should be minimal. For this, this movement has to be streamlined. If this is not initiated, it will result in the wastage of human effort and time, both of which have a telling effect on the efficiency of an organisation and the cost of production. In industrial life, the economic and efficient usage of all the factors of production is the key to profitability and the ability to compete in the market.

Selection of Plant and Equipment

The adequacy and suitability of the plant and machinery is examined in the context of the selected process, basis of selection, reasonability of cost, reputation and ability of machinery suppliers, reliability of performance and proper balancing in various sections so that no section has under or over capacity. The arrangements/agreements with the machinery suppliers are examined with special reference to the price quoted, guarantees of workmanship and performance, provisions for spare parts and efficient after-sales service.

The plant and machinery might have been selected by the applicant on the advice of its collaborates, turn-key contractors or technical advisers. Similarly, the suppliers of the plant and machinery might have been suggested by the collaborators or consultants or selected through competitive bids. Full details, including the degree of sophistication in the selection of machinery and equipment as also the criteria in the selection of suppliers are obtained by the appraisers and examined. In the case of machinery and equipment proposed to be imported, unless the same is against a "tied-credit", it is ensured that the practice of calling competitive tenders is followed. Further, the institutions also ensure that the promoters are not in any way interested directly or indirectly with the parties supplying machinery to the project.

Project based on secondhand plant and machinery are generally not encouraged by the financial institutions. The borrower should not make any commitments or incur capital expenditure without specific section of financial assistance. Proposals involving acquisition of secondhand machinery for setting up new units where cost capacity exceeds 25 per cent of the total cost/capacity of machinery/proposed scheme are not normally entertained. In respect of schemes for expansion and diversification, this limit would, however, depend upon the actual need and other relevant factors. Likewise, the use of secondhand plant and equipment is specifically not encouraged for the production of sophisticated items or where the dimensional accuracy of the product is of paramount importance. However, the use of second-hand machinery and equipment is considered as an exception in those cases where the delivery period of new machinery is unduly long and the cost of new machinery is likely to be far in excess of secondhand machinery, thereby affecting the profitability and economics of the project.

In respect of machinery supply agreement for secondhand plant and equipment, it ensured that the agreement provides for the following:

- Responsibility should be undertaken by the suppliers for doing or getting done the required reconditioning/ renovation and processing and a warranty/guarantee thereof.
- Undertaking that each and every equipment to be supplied with or without reconditioning will be covered by a guarantee/warranty for free replacement of parts, components, materials, or spares, if proved defective in design, materials workmanship, reconditioning, fatigue, etc. after erection at the factory site during such of the initial years of operation as may be mutually agreed upon.
- Provisions for performance guarantee to the rated capacity.
- Provision for providing adequate technical personnel for control and supervision during erection of the equipment with a view to ensuring proper performance and commissioning as visualised.
- Provision for penalty, damages, indemnity, etc., if equipment is not found satisfactory.

Factory Planning

Every normal person would enjoy living an orderly life. Such a way provides him with not only peace, confidence, assurance, but also develops big efficiency in whatever he is involved in. Similarly, every small industrial activity is planned with a view to ensuring its orderly working be it in its administrative work or shop floor activity or even stores management.

Dr. Nau Nihal Singh aptly observes: "The planning and control of the supply and movement of materials and components and the utilisation of plant and labour ensures that the necessary resources are available at every stage of manufacture to ensure the economic completion of a predetermined delivery programme, and constitutes the management techniques of production planning and control."

Determinants of Factory Planning

(i) To determine the optimal size of the factory in accordance with the manufacturing plan, which includes a consideration of the envisaged future growth of the operation.

(ii) To select a proper location for the plant on the basis of the availability of infrastructure and market centres.

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While working on a factory layout plan, a very important aspect to be kept in mind is the fact that the movement of materials from one stage of manufacture to the next should be minimal. Materials must move in streamline. Their movement, back and forth, right and left, involves wastage of human effort and time, both of which have a telling effect on the efficiency of an organisation and the cost of a product. In industrial life, an economic and efficient usage of all the factors of production is the key to profitability and the ability to compete in the market.

Industrial activities are of various kinds. Some involve very simple processes, while others are quite complex ones. Yet a simple process need necessarily mean that it does not demand any thought or planning. Competitions in

activities which involve simple processes is inevitably greater; and therefore the utmost economy is called for. As for activities involving complex processes, it is obvious that a great deal of thought is given to planning.

Shop Floor Planning

Shop floor planning should be taken up unit-wise. The entire activity should be broken up into units. Each unit comprises allied activities. In large industry, the units are large and are further sub-divided for better control. For example, a large mechanical engineering workshop would be broken down into several units — machine shop, forging shop, welding shed, electroplating section, assembly shop, testing house, and so on. The machine shop may be subdivided into a lathe section, an automat section, a milling section, planning, gear cutting, and so on. All these sections should be properly planned for and laid out. The layout of the units in the entire factory, and of the individual machines and facilities within each unit demands adequate macro-planning and micro-planning.

Small industrialists do not generally attach adequate Importance to planning their projects, because they believe that planning is unimportant because it involves very little expenditure. Soon, however, they discover to their cost that. because of inadequate planning, there is an obstruction to the smooth flow of production, that production is hampered and there are delays which step up the cost of production, and wipe out the profitability of a job.

At this stage, the entrepreneur realises that if a particular modification is carried out, the bottleneck in production may be cleared. If the modification is minor, he is lucky. Without much loss of production, it may be effected at a reasonably low expense. However, if it is a major one, he would curse himself for not having planned for it in the beginning, when the expense would have been much less.

Let us take a concerte case. Fig. 23.1 and 23.2 show two layouts of a mechanical engineering workshop respectively. In Fig. 23.5 layout No.1 was the initial idea of the planner. The workshop is small and in these days of the high cost of the working space, machines are laid out with the minimum space between them. Very often this space may be barely adequate for the movement of men and materials.

It will be seen from the layouts that the workshop is divided into two units, viz., a sheet metal unit and a machining unit. There is a third unit, viz., assembly unit. After the assembly, the finished goods are subjected to final inspection before being packed and sent to the finished good stores.

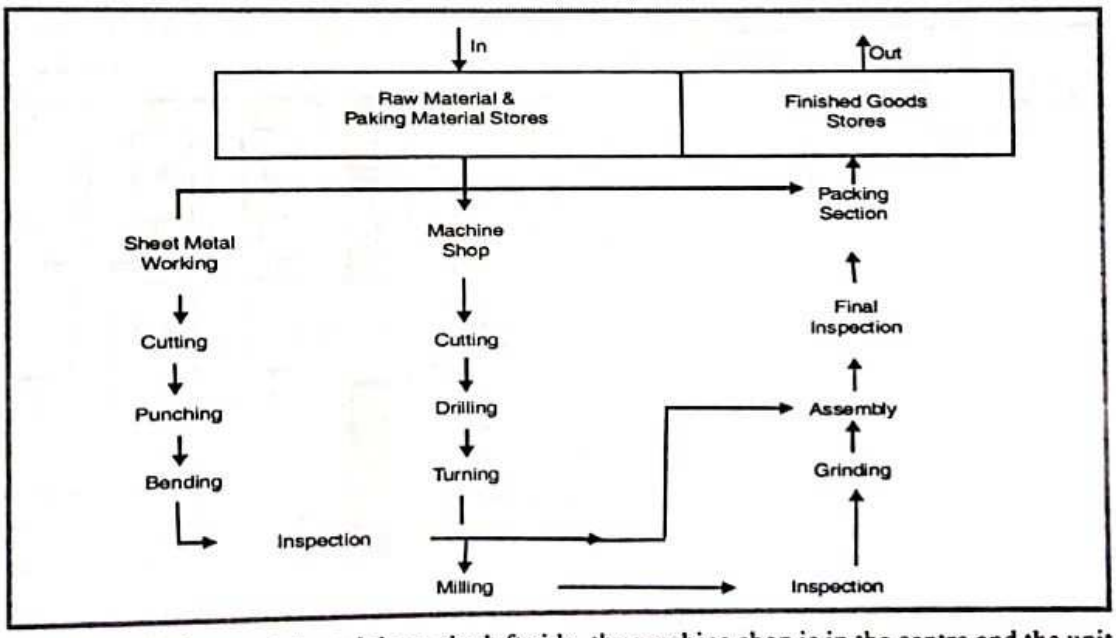
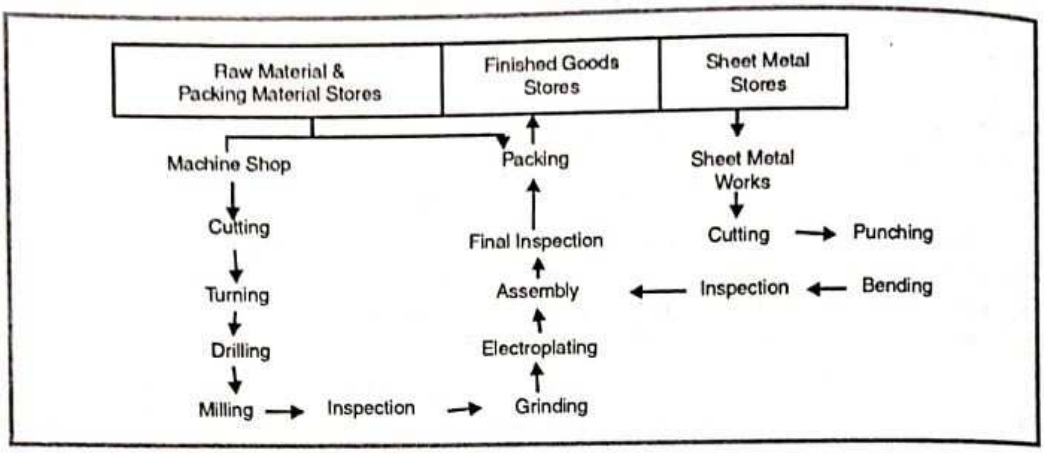


Fig. 23.1: Simple Layout of a Small-Scale Industry

It will be noticed that in Fig. 23.1 sheet metal work is on the left side, the machine shop is in the centre and the unit assembly is on the right side. The finished product of the sheet metal shop has to pass through the machine shop in order to reach the assembly area. This passage of sheet metal jobs through the machine shop is bound to cause inconvenience. Generally, sheet metal jobs are bulky and require a considerable amount of space, both in the

manufacturing area and for their movement. As mentioned earlier the space between machines is usually limited; and therefore such space may be either inadequate for the movement in which case there will be a serious problem, or during such movement, production work on the machines on either side would be hampered. In either case, the efficiency of the factory would be adversely affected.

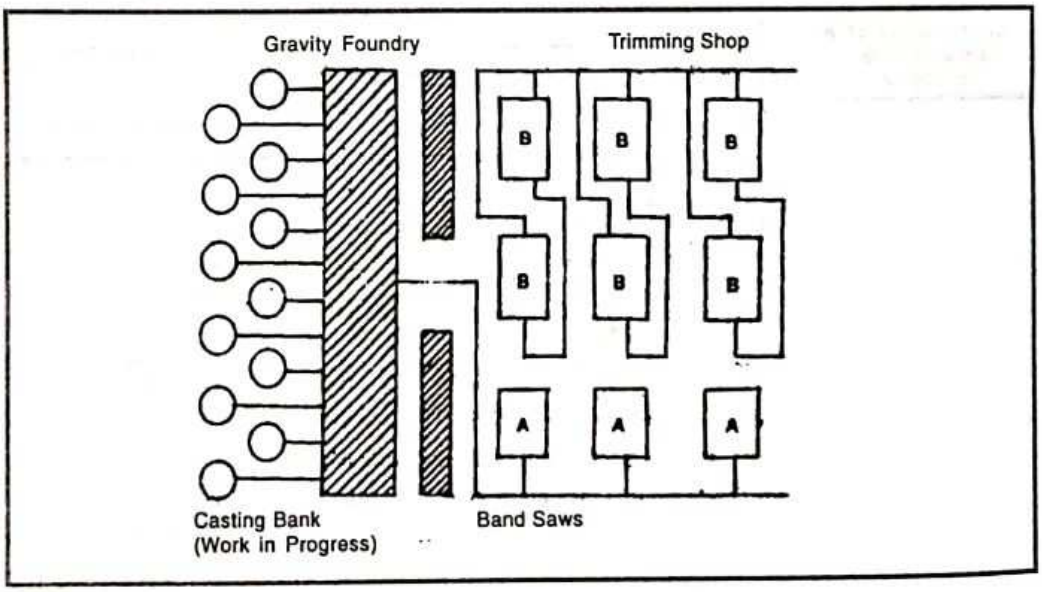
Fig. 23.2: Simplified Layout of a Small-Scale Industry



From Fig.23.3 it is obvious that this problem has been eliminated by bringing the assembly area in between the two operations of machining and sheet metal working. Cross movements have been completely eliminated.

Another feature that will be noticed in the two layouts is the relative positions of the drilling and turning (lathe) machines. Initially, the job was sent to the drilling machine after the raw material was cut to size; and thereafter it was sent to the lathe for turning operations. Subsequently, it was realised that, after a hole was drilled in job materials, the turning operation had become somewhat difficult, and uneconomical. To avoid this, the job had to be first turned, then a hole drilled in it. This modification in the flow of the job resulted in its movement becoming repetitious, i.e., it had to pass the same point three times instead of only once as it should have been. Here, again production efficiency suffered.

Fig. 23.3: Gravity Foundry Trimming Shop: Old Layout



It is obvious that, in Fig. 23.3 this repetitive problem has been overcome by interchanging the positions of the drilling and turning machines. In this layout, the raw materials store section has been broken up into two parts, one for the machine shop and packing materials and another for the sheet metal section. Each of them is on the side of the related unit, and in between is the finished. goods stores section. Often, sheet metals in raw condition are stored in the open because they are bulky. Hence, keeping them separately from other stores is apt and convenient. Again, in layout No.2, the packing section is placed very near the raw material stores section, where packing materials are stored, and also near the finished good stores, thus ensuring a minimal movement of materials.

The example giver above is a simple one. In actual practice, many constraints may be noticed. The planning exercise, therefore, will be quite interesting and taxing.

Case Study

A small die-casting foundry, employing 85 persons, was in arrears and short of capital. Production was affected by the layout of the foundry. The diagrams show the improvement in the layout which resulted in increase in production and productivity.

Fig. 23.3 shows the old layout under which the sides of casting, blocked up due to arrears of work of trimming. Trimming work was affected by the wrong layout.

The unit was reset as per the new layout (Fig. 23.4) under which the work was quite smooth. Thereafter, trimming output improved from pace-making effect of the day-shift casting directly on the trimming benches from the bandsaws and eventually the point was reached where most castings were dispatched within two or three days of being cast.

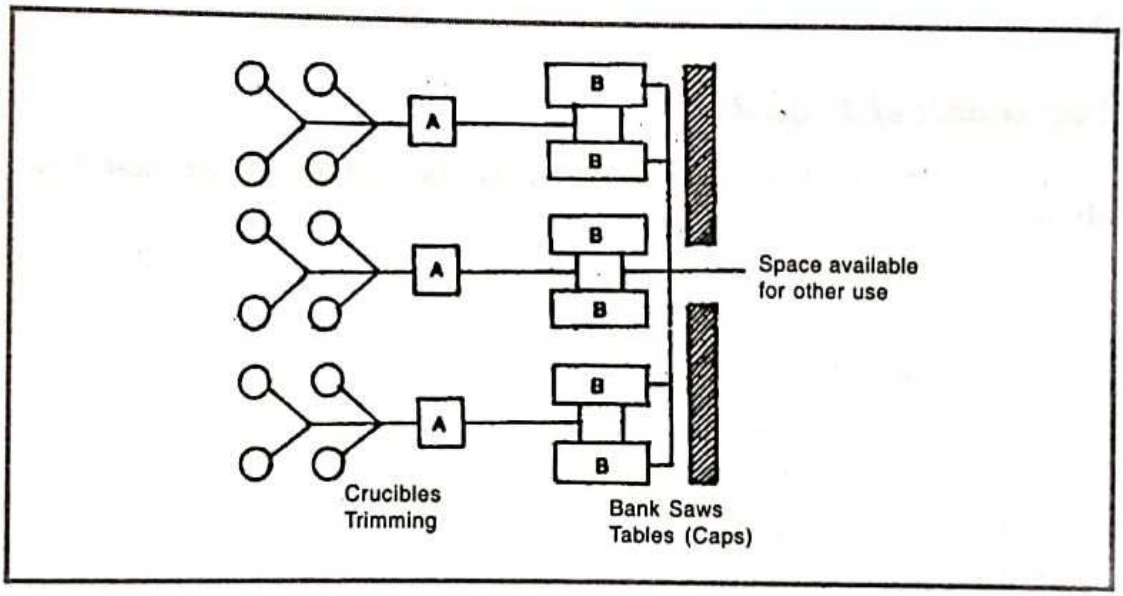


Fig. 23.4: New Layout Combined Foundry and Trimming Shop

Plant Layout and Factory Building

The subject of plant layout not only covers the initial layout of machines and other facilities but encompasses improvement in, or revisions of, the existing layout in the light of subsequent developments in the methods of production. In other words, a plant layout is "a floor plan for determining and arranging the desired machinery and equipment of a plant, whether established or contemplated, in the one best place to permit the quickest flow of material at the lowest cost and with the least amount of handling in processing the product from the receipt of the raw materials to the shipment of the finished products."

A more simple, clear and comprehensive definition is given by Knowels and Thomson. They say that a plant layout involves:

"(*i*) Planning and arranging manufacturing machinery, equipment and services for the first time in completely new plants;

"(*ii*) The improvements in layouts already in use in order to introduce new methods and improvements in manufacturing procedures.

During the course of appraisal, considerable emphasis is laid on a proper and scientific plant layout as once the plant and equipment are erected, it becomes difficult and costly to change at a later stage. The following aspects are kept in view while evaluating the plant layout:

- Production technology and product-mix;
- Efficient, economic and uninterrupted flow of human and materials resources;
- Proper space for maintenance;
- Future expansion/diversification of the project;
- Safety precautions particularly when explosive or bulky material is required to be handled;
- Proper lighting and ventilation;
- Proper layout of utilities and services and provisions for effluent disposal, where necessary;
- Effective supervision of work; and
- Proper storage and stacking space, where required.

The building designs are to be kept in conformity with the plant layout and construction of the building is to be carried out by experienced architects and contractors unconnected with the promoters/management group. In case where process requirement envisages special conditions like air-conditioning, aircooling, dust control, humidity control, etc., it is ensured that due care be taken in the design of the buildings.

Importance of Layout

The importance of a layout lies in enhancing manufacturing function and supervision and control. Some of the advantages are:

1. Economies in handling,
2. Effective use of available area,
3. Minimisation of production delays,
4. Improved quality control,
5. Minimum Equipment investment,
6. Avoidance of bottlenecks,
7. Better production control,
8. Better supervision,
9. Improved utilisation of labour,
10. Improved employee morale,
11. Maximisation of production,
12. Avoidance of unnecessary and costly changes,
13. Increased revenues and profits, and
14. Success of the enterprise.

Considerations in Factory Layout

While choosing the layout for a factory, the following factors should be taken into consideration:

1. Nature of Product: The type of product to be manufactured affects plant layout in several ways. Small and light products can be moved easily to the machines whereas for heavy and bulky products the machines may have to be moved. Large and heavy equipment requires assembly bays. One or a few standardised products can better be produced through product layout while process layout is more useful for producing a large variety of non-standardised products. Quality and fragility of the product also influence the layout.

2. Volume of Production: Normally high volume manufacturing requires product layout and low volume job production needs process layout.

3. Materials Handling: The pattern of layout depends to a great extent on the nature of materials and materials handling plan. It is necessary to provide adequate space for storage and adequate aisles for free movement of materials.

4. Type of Equipment: Specifications of machinery and equipment are a prime consideration in factory layout. General purpose machines need a different layout than specialised machines. Adequate space must be provided for the location and movement of all machines and equipment.

5. Factory Building: Ideally, a building should be built to suit the best factory layout. But in practice the layout might have to be modified to fit a given building. The covered area, the number of storeys, elevators and stairs, parking and storage area all affect the layout. The plant site should also be considered in choosing the layout for a factory.

6. System of Manufacture: The type of manufacturing process is single most important determinant of factory layout. Continuous manufacturing system requires a different sequence of machines than intermittent manufacturing.

7. Lighting and Ventilation: In laying out a factory adequate provision must be made for lighting, ventilation and heating. These are essential for the health, comfort and productivity of workers.

8. Service Facilities: The layout of a factory must include proper service facilities required for the comfort and welfare of workers. These include canteen, lockers, drinking water, toilets, first aid, fire escapes, etc.

Technical and Engineering Services

One of the important aspects in the appraisal of projects is the institutional evaluation of the technical and engineering services. This becomes all the more important in large-size projects. Technical and engineering services comprise preparation of detailed drawings/designs of the plant layout, detailed specifications of plant and equipment, arrangements for process know-how, engineering know-how and consultancy, design and layout of utilities and services like power, water, steam, air supply, off-site facilities, etc. These also include the services for preparing tender documents for complete civil works, selection and procurement of equipment and their erection.

All the above services are sometimes entrusted to process and engineering consultants and in some cases, part of the work including coordination at various levels is taken care of by the project management team of the concern. The process consultants generally supply the essential know-how and basic engineering requirements. The engineering consultants provide detailed information of the various facilities involved in the project, including design parameters, preparation of specifications, inviting quotations, and their analysis, recommendation for purchases and award of contracts, inspection of the equipment purchased, arrangements for shipping and handling of equipment, supervision during construction/installation/erection of the equipment, assistance/supervision during commissioning etc. Consultants are often involved in the preparation of detailed project reports and in the furnishing of the information/clarification required by the institutions during appraisal. The background of the consultants, their scale of operations, experience on other projects and plants based on similar technology is looked into in depth. The possibility of infringement of existing patents is also examined and an endeavour is made to obtain necessary indemnity from the consultants. Another important aspect examined while evaluating the adequacy of consultant is the provision for technical training of the personnel in the plant of the collaborators. It is also necessary to make arrangements for in-plant training by the

representatives of the consultants, deputation of consultant's personnel for supervision during erection and commissioning, administration of the performance guarantees, trial-runs and initial operation of the plant.

Materials Handling

It is the responsibility of production managers and industrial engineers to plan a good layout which places "the right equipment at the right position to be worked in the right manner for completing the manufacturing process in the shortest possible time." This *inter alia* means that the layout should be such that the new materials, stores, intermediate stores and work places should be interlinked so that the production may flow uninterruptedly.

The Report on Materials Handling in Industry say that handling adds nothing to the value of the product but only to the cost. The advantages of materials handling are: *(i)* Reduced labour cost; *(ii)* Increased capacity of existing building, especially stores; *(iii)* Better machine utilisation; *(iv)* Larger turn-over; *(v)* Less capital tied up in work-in-progress; *(vi)* Easier stock control; *(vii)* Less fatigue for operations; *(viii)* More efficient production control; *(ix)* Better inspection and control of quality; *(ix)* improved safety.

In Fig. 23.5 two layouts are shown to indicate how unnecessary material handling can be avoided. The new layout ensures a smooth functioning of the production channels at reduced cost. At the same time, more space is made available. A proper layout not only improves material handling operations but also increases the production and productivity per employee.

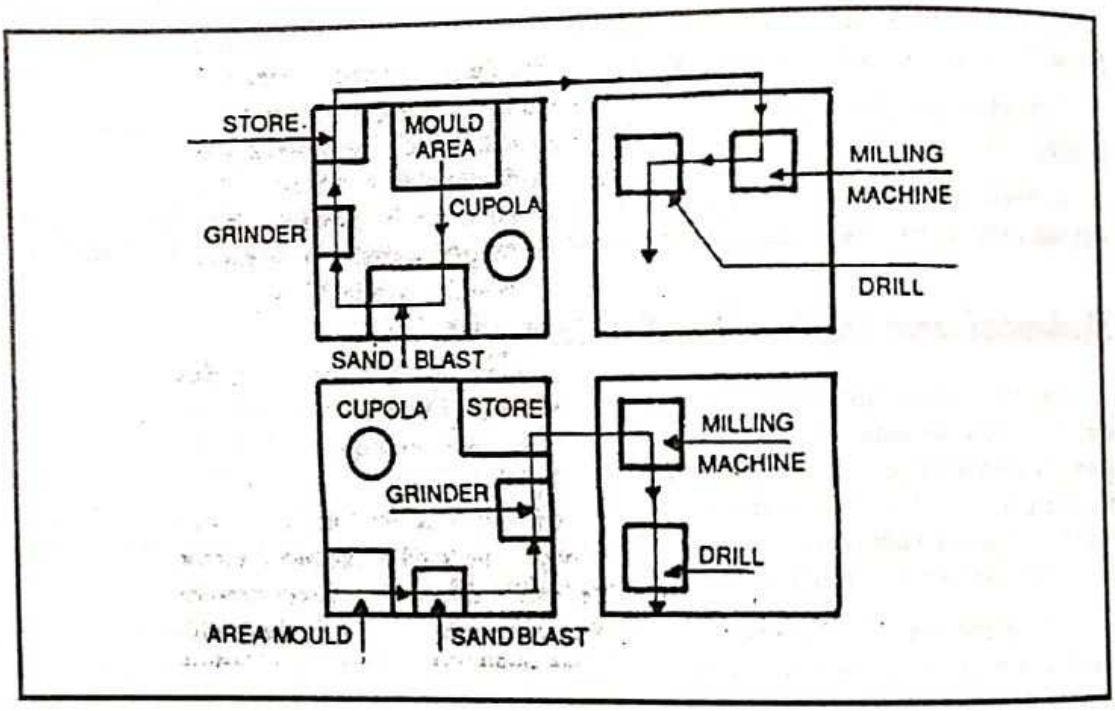


Fig. 23.5: Layout of a Small-Scale Unit and Scope for Modernisation is Shown in these two Diagrams

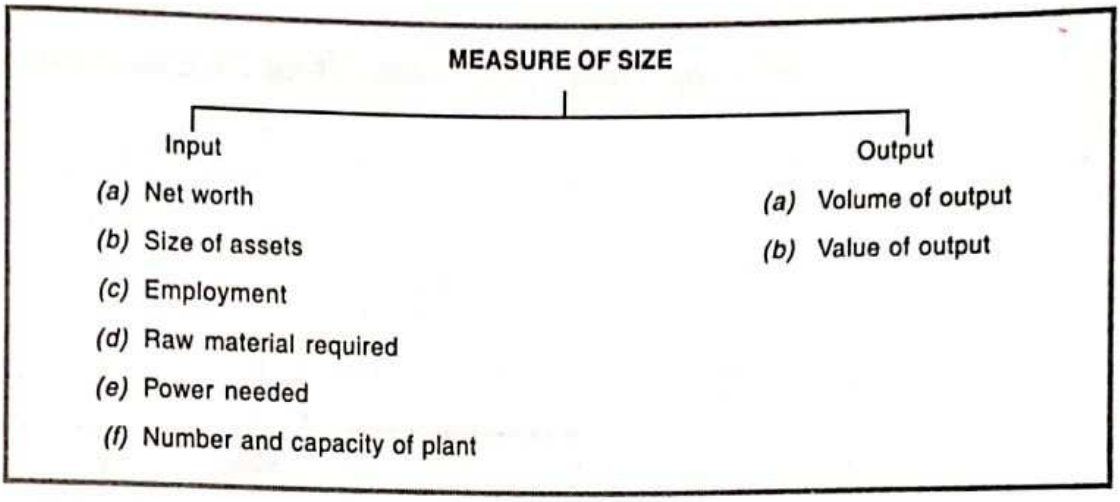
Optimum Size of the Plant

The scale and size of operations of the unit determine its efficiency and profitability. This is determined by the laws of returns. Accordingly, an industrial unit, with a capital investment of Rs. 10 lakh in plant and machinery, is a small unit. Earlier, even the number of workers employed was considered to be a factor determining the size of the plant.

In general, the following standards are employed to measure the size of a unit:

The flexibility of small-scale units create large-scale employment opportunities, bring about a balanced and diversified economic development, ensure a somewhat equitable distribution of wealth, and a proper growth of these units. They survive for the following reasons: *(i)* individual tastes, *(ii)* changing fashions, *(iii)* widely fluctuating demand, *(iv)*

Fig. 23.6:



new power sources, *(v)* standardisation of components, *(vi)* short gestation period, *(vii)* greater motivation, *(viii)* nature and process of production.

In other words, a small-scale unit can be easily formed. It has flexibility and ownership control. Such units are most suitable because of limited demand and changing tastes, local market, limited capital needs, limited managerial ability, limited risk of loss, shorter gestation period, reduced production lag, etc. Steinwall, in his book, *Small and Big Business*, has pointed out that small firms are protected by their good- will, customer loyalty, the individual markets they possess, which the large firms conquer only at considerable expense. They also enjoy special Government support and patronage and ensure diversification of industries.

A firm may start and steadily move towards expansion in order to secure internal economies of scale to a certain extent, reduce costs and increase profits. After reaching a particular level, the law of diminishing returns or increasing cost begins to operate and acts as a brake on further expansion. Under the existing conditions of techniques and organisational know-how, a point is reached beyond which further growth becomes uneconomical and leads to waste of efficiency. This level is probably known as the *optimum level*, indicating the most profitable combination of resources providing equi-marginal utility or return. Prof. E.A.B. Robinson has observed: "By the optimum firm we must mean a firm operating at that scale at which the conditions of technique and organising ability exist, and it has the lowest average cost of production per unit, when all these costs, which must be covered in the long run, are included."

The optimum size of the plant achieves equi-marginal returns from all resources or factors of production. It indicates a rational allocation of resources and a combination of inputs to secure maximum output under existing economic conditions and maximum profit due to the lowest average cost.

The optimum level of small industry organisations is influenced by *(a)* technical production economies, *(b)* managerial economies, *(c)* marketing economies and *(d)* nature, size and stability of demand.

CONCLUSION

The success of an enterprise to a greater extent depends upon the factory design and layout. The location, layout, amenities will influence productivity and facilitate better management. More importantly, the efficiency of the production flow depends largely on how well the various machines, production facilities and employee amenities are located in a plant. In a properly laid-out plant, the movement of materials, from the raw material stage to the end product stage, is smooth and rapid; the movement is generally in a forward direction; the materials do not criss-cross, or go backward and forward for further operations. Moreover, production bottlenecks and delays are few, materials handling costs are reduced.

Operating Model for a Consulting Organisation