Project ManageMent

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Dedicated to

The book Project Management is dedicated to my beloved parents

Sri. R. Bennaiah and Smt. D. Soubhagyam

Preface

Project Management is one of the emerging subject, the details available on it are limited and scattered. The details of project planning, feasibility study and project appraisal study help and provide insight and guidelines to the young and promising entrepreneurs to start their projects.

This book is organized into various chapters and these chapters' deals with An Over View of Project Management Technical And Financial Analysis, Project Formulation And Life Cycle, Project Information System etc.

The contents in this text book are planned in a systematic and a logical sequence to understand the subject with ease. It is presented in simple and self learning style, and no previous knowledge of project management is required to understand the subject. This book is meant for all graduates and post graduates who are interested in the area of project management.

The author will be very grateful for any suggestions and corrections for the improvement of this book.

Dr. R. Emmaniel

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Dr. R. Emmaniel

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Introduction to Project Management

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To Understand The Concept Of Project And Project Management
- To Understand What Is Classification Of Project
- To Know What Is Project Identification And Selection
- To Familiar With Factors Contributed To Project Success
- To Understand the different stages of Project Life cycle
- To know the Roles and Responsibilities of Project Manager

1.1. INTRODUCTION

Projects have a major role to play in the economic development of a country. Since the introduction of planning in our economy, we have been investing large amount of money in projects related to industry, minerals, power, transportation, irrigation, education etc. with a view to improve the socio-economic conditions of the people. These projects are designed with the aim of efficient management, earning adequate return to provide for future development with their own resources. But experience shows that there are several short comings in the ultimate success of achieving the objectives of the proposed project.

Project Definition

Project in general refers to a new endeavor with specific objective and varies so widely that it is very difficult to precisely define it. Some of the commonly quoted definitions are as follows. Project is a temporary endeavor undertaken to create a unique product or service or result. (AMERICAN National Standard ANSI/PMI99-001-2004)

1.2. CONCEPT OF PROJECT AND PROJECT MANAGEMENT

The term project has a wider meaning. A project is accomplished by performing a set of activities. For example, construction of a house is a project. The construction of a house consists of many activities like digging of foundation pits, construction of foundation, construction of walls, construction of roof, fixing of doors and windows, fixing of sanitary fitting, wiring etc. Another aspect of project is the non-routine nature of activities. Each project is unique in the sense that the activities of a project are unique and non routine. A project consumes resources. The resources required for completing a project are men, material, money and time. Thus, we can define a project as an organized programme of pre determined group of activities that are non-routine in nature and that must be completed using the available resources within the given time limit.

Let us now consider some definitions of 'project'. Newman et. al define that "a project typically has a distinct mission that it is designed to achieve and a clear termination point the achievement of the mission".

Gillinger defines "project" as the whole complex of activities involved in using resources to gain benefits. Project management institute, USA defined project as "a system involving the co-ordination of a number of separate department entities throughout organization, in a way it must be completed with prescribed schedules and time constraints".

According to the encyclopedia of management, "project is an organized unit dedicated to the attainment of goal, the successful completion of a development project on time, within budget, in conformance with predetermined programme specification." Though project management is in the process of getting evolved as a separate branch of study, projects are not new to the earth. One of the Seven Wonders of the World, the pyramids date back to 2650 B.C. which stand as the hall mark of Egyptian civilization. The period of construction of the Taj Mahal, another wonder of the world is reported to be during 1626-1648 A.D. It is reported that about 20,000 persons worked for nearly 22 years to complete this spectacular structure, which stands today as mankind's proudest creation. One can imagine the extent of resources and expertise that would have been put forth for the completion of such magnificent projects. Project management is an organised venture for managing projects, involves scientific application of modern tools and techniques in planning, financing, implementing, monitoring, controlling and coordinating unique activities or task produce desirable outputs in accordance with the determined objectives with in the constraints of time and cost.

1.3. CHARACTERISTICS OF PROJECT

a) Objectives: A project has a set of objectives or a mission. Once the objectives are achieved the project is treated as completed.

b) Life cycle: A project has a life cycle. The life cycle consists of five stages i.e. conception stage, definition stage, planning & organising stage, implementation stage and commissioning stage.

c) Uniqueness: Every project is unique and no two projects are similar. Setting up a cement plant and construction of a highway are two different projects having unique features.

d) Team Work: Project is a team work and it normally consists of diverse areas. There will be personnel specialized in their respective areas and co-ordination among the diverse areas calls for team work.

e) Complexity: A project is a complex set of activities relating to diverse areas.

f) Risk and uncertainty: Risk and uncertainty go hand in hand with project. A risk-free, it only means that the element is not apparently visible on the surface and it will be hidden underneath.

g) Customer specific nature: A project is always customer specific. It is the customer who decides upon the product to be produced or services to be offered and hence it is the responsibility of any organization to go for projects/services that are suited to customer needs.

h) Change: Changes occur through out the life span of a project as a natural outcome of many environmental factors. The changes may very from minor changes, which may have very little impact on the project, to major changes which may have a big impact or even may change the very nature of the project.

i) Optimality: A project is always aimed at optimum utilization of resources for the overall development of the economy.

j) Sub-contracting: A high level of work in a project is done through contractors. The more the complexity of the project, the more will be the extent of contracting.

k) Unity in diversity: A project is a complex set of thousands of varieties. The varieties are in terms of technology, equipment and materials, machinery and people, work, culture and others.

1.4. CLASSIFICATION OF PROJECTS

The location, type, technology, size, scope and speed are normally the factors which determine the effort needed in executing a project. Project can be classified under different heads, some of which are shown in figure 1.1.

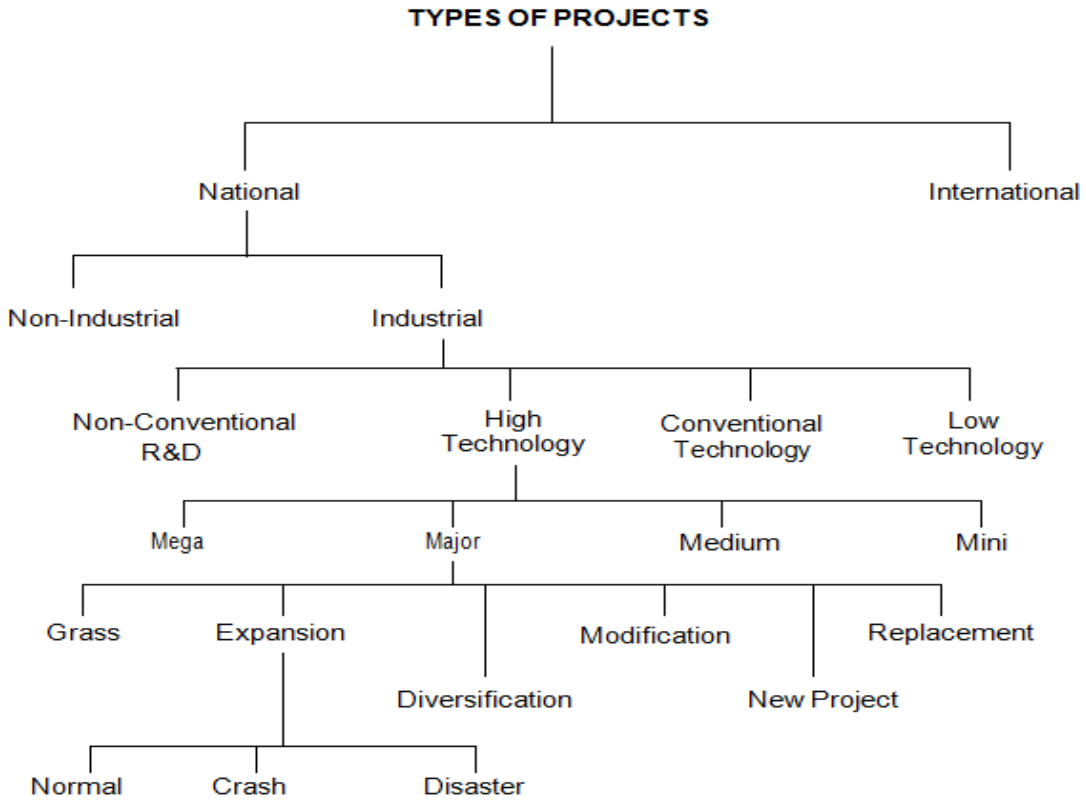

Fig-1.1: Classification of Project

Industrial Vs Development projects

There is no standard classification of the projects. However considering project goals, these can be classified into two broad groups, industrial and developmental. Each of these groups can be further classified considering nature of work (repetitive, non-repetitive), completion time (long term, shot term etc), cost (large, small, etc.), level of risk (high, low, no-risk), mode of operation (build, build-operate-transfer etc).

Industrial projects also referred as commercial projects, which are undertaken to provide goods or services for meeting the growing needs of the customers and providing attractive returns to the investors/stake holders. Following the background, these projects are further grouped into two categories i.e., demand based and resource / supply based. The demand based projects are designed to satisfy the customers' felt as well the latent needs such as complex fertilizers, agro-processing infrastructure etc. The resource/ supply based projects are those which take advantage of the available resources like land, water, agricultural produce, raw material, minerals and even human resource. Projects triggered by successful R&D are also considered as supply based. Examples of resource based projects include food product units, metallurgical industries, oil refineries etc. Examples of projects based on human resource (skilled) availability include projects in IT sector, Clinical Research projects in bio services and others.

Development projects are undertaken to facilitate the promotion and acceleration of overall economic development. These projects act as catalysts for economic development providing a cascading effect. Development projects cover sectors like irrigation, agriculture, infrastructure health and education.

1.5 PROJECT IDENTIFICATION & SELECTION

The first and one of the critical steps in the project cycle management is the identification and selection process. This is an important stage such that it can affect the whole process including that of sustainability of the project after completion and transferring to operational phase. However, this stage is overlooked in some cases particularly in the process of capturing the actual needs of the beneficiaries. Identification of a new project is a complex problem. Project selection process starts with the generation of project ideas. In order to select the most promising project, the entrepreneur needs to generate a few ideas about the possible project one can undertake. The project ideas as a process of identification of a project begin with an analytical survey of the economy (also known as pre-investment surveys). The surveys and studies will give us ideas

According to Westland, Jason (2006) the project identification and selection of the project cycle is slotted in the Project Initiation Phase. Within the initiation phase, the business problem or opportunity is identified, a solution is defined, a project is formed and a project team is appointed to build and deliver the solution to the customer. Figure

1.2: shows the activities undertaken during the initiation phase

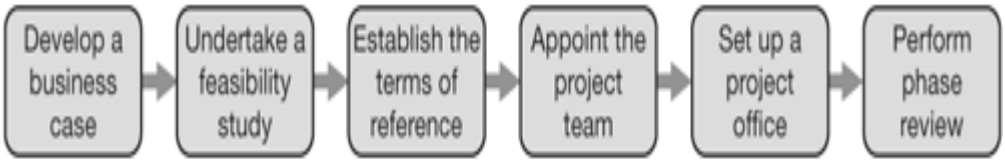

Fig-1.2: Project initiation activities.

Develop a business case: The trigger to initiating a project is identifying a business problem or opportunity to be addressed.

A business case is created to define the problem or opportunity in detail and identify a preferred solution for implementation. The business case includes:

- A detailed description of the problem or opportunity.
- A list of the alternative solutions available.
- An analysis of the business benefits, costs, risks and issues.
- A description of the preferred solution.
- A summarized plan for implementation.

The business case is then approved by an identified project sponsor, and the required funding is allocated to proceed with a feasibility study. Undertake a feasibility study: At any stage during or after the creation of a business case, a formal feasibility study may be commissioned. The purpose of a feasibility study is to assess the likelihood of each alternative solution option achieving the benefits outlined in the business case. The feasibility study will also investigate whether the forecast costs are reasonable, the solution is achievable, the risks are acceptable and the identified issues are avoidable.

a) Establish the terms of reference: After the business case and feasibility study have been approved, a new project is formed. At this point, terms of reference are created. The terms of reference define the vision, objectives, scope and deliverables for the new project. They also describe the organization structure, activities, resources and funding required undertaking the project. Any risks, issues, planning assumptions and constraints are also identified.

b) Appoint the project team: The project team is now ready to be appointed. Although a project manager may be appointed at any stage during the life of the project, the manager will ideally be appointed prior to recruiting the project team. The project manager creates a detailed job description for each role in the project team, and recruits people into each role based on their relevant skills and experience.

c) Set up a project office: The project office is the physical environment within which the team is based. Although it is usual to have one central project office, it is possible to have a virtual project office with project team members located around the world. A project office environment should include:

Equipment, such as office furniture, computer equipment, stationery and materials. Communications infrastructure, such as telephones, computer network, e-mail, Internet access, files storage, database storage and backup facilities:

- Documentation, such as a project methodology, standards, processes, forms and registers.
- Tools, such as accounting, project planning and risk modeling software.
- Perform a phase review: At the end of the initiation phase, a phase review is performed. This is basically a checkpoint to ensure that the project has achieved its objectives as planned.
- To determine 'demand' projects from communities or stakeholders, 2 key elements are involved; (i) needs analysis and (ii) situation analysis.

a) Needs Analysis: Analyzing the present actual situation can be 'problem based' or 'opportunity based'. It concerns identifying the priority problems/ opportunities and their main causes, and identifying the causes that can be addressed by the project intervention. It is essential to understand the resources within the community or from others that are relevant to tackling the problems. It is important therefore that all many citizens and stakeholder groups get the chance to express the problems they experience and recommend solutions. Discussions, opinions and clarifications by the problem 'owners' should be respected. The Manual on Community Participation has elaborate guidelines on how to conduct participatory needs assessment & situation analysis. This ensures that 'ownership' which is part of the project pre-feasibility is established from people's needs and requirements.

b) Situation Analysis: Situation analysis concerns identifying the priority problems/ opportunities and their main causes. This is an important factor because people's desires and assessment of their needs, may be based on 'symptoms' of an underlying or situational factor; addressing the symptoms will not solve the problems because the cause and effect have not been properly analyzed. A properly planned intervention should therefore combine both needs analysis and situational analysis, based upon a correct and complete analysis of the existing situation. This involves analyzing the present actual situation through various methods (transect walk, social mapping, gender analysis etc). The method chosen, can be 'problem based' e.g. what are the prevalent problem situations or 'opportunity based', e.g. is there an opportunity to serve people with disability?

1.6. FACTORS CONTRIBUTED TO PROJECT SUCCESS

Developing or identification of success factors has dominated the field of project management from 1980s to 2000. Many researchers have tried to a certain extent to identify success factor for project management. These includes Kerzner (1987), Pinto and Slevin (1987), Pinto, Slevin and Dennis (1989), Clarke (1999), Cooke Davis (2002) and Muller (2003). The following paragraphs are dedicated in reviewing the main contributors in setting the success factors.

Pinto's Model of Ten Critical Success Factors of the Project Management Profile

Pinto and others have published a number of articles between 1987-1990 on critical success factors and has established a widely known accepted 10 critical success factors are listed as follows

- Project mission – Initial clarity of goals and general direction.
- Top management support – Willingness of top management to provide the necessary resources and authority of power for project success.
- Project schedule/plans – Detailed specification of the individual action steps required for project management.
- Client consultation – Communication and consultation with, and active listening to all affected parties.
- Personnel – Recruitment, selection and training of the necessary personnel for the project team.
- Technical tasks – Availability of the required technology and expertise to accomplish the specific technical action steps.
- Client acceptance – The act of "selling" the final project to its intended users.
- Monitoring and feedback – Timely provision of comprehensive control information at each stage in the implementation process.
- Communication – Provision of an appropriate network and necessary data to all key actors in the project management.
- Trouble shooting – Ability to handle unexpected crises and deviations from plan.

The first seven factors can be laid out on a sequential critical path while the balance three factors which are monitoring and feedback, communication and trouble shooting must be necessarily present at each point in the implementation process. As the project move along its life cycle, different factors are emphasized. The first three factors (mission, top management support and schedule) are related to the early "planning phase" of project management whereas the other seven are concerned with the actual execution stage of the project life cycle. As both strategic and tactics are essential for successful project management, their importance shifts as the projects moves through its life cycle. Strategic issues are most important at the beginning and tactical issues gain in importance toward the end. It is vital that a successful project manager/leader must be able to make transition between strategic and tactical considerations as the project moves forward.

In addition Pinto also stress the importance for both project team and clients to perform regular assessments to determine the "health" of the project and to involve team members in early planning and conceptual meetings. By doing so it can reinforces the goals of clients in the mind of the project team as well to obtain client's perceptions on the ability of the project to satisfy their expectation besides influencing team members to achieve a common project goal. Regular and continuous communication is essential to ensure the team is moving in one common direction and members are aware of transition and also to emphasize the importance of joint effort in making the project a successful one.

Kerzner's Critical Success Factors

Kerzner (1987) in his study define critical success factors are elements which must exist within the organization in order to create an environment where projects may be managed with excellence on a consistent basis. They are the few key areas where "things must go right" for a particular business to flourish.

- **1st** critical factor: Corporate understanding of project management in order for a successful project management and management, corporate understanding of the project management at the employee/functional level, project management level and executive level. A good corporate understanding will create a corporate culture where project management is no longer viewed as either a threat to established authority or a cause for unwanted change.
- **2nd** critical factor: Executive commitment project management is unlikely to succeed unless there is any visible support and commitment by executive management. This support and commitment can be described in two subtopics; project sponsorship and life-cycle management. The role of the sponsor is to manage interference that exist for the project manager besides continuously remind project team that only performance at the highest standards of excellence are acceptable. It is important that company goals,

objectives and values be well understood by all members of the project team throughout the life-cycle of the project. Ongoing and positive executive involvement, in a leadership capacity will reflect executive management's commitment to project management.

- **3rd** critical factor: Organizational adaptability refers to the organization's ability to respond quickly and effectively to changes in the marketplace. Two critical factors involving organizational adaptability were found in organizations committed to excellence; informal project management and a simple but lean structure. The decision to go for either formal or informal project management and implementation depends on the scope and size of the project, the cost of the project, the availability of experienced personnel for the project and also the maturity of the concept of utilizing project in an organization. Staffing for projects was done in a manner to achieve a blend of experience, technical expertise and training. Proper selection of resources will insure that technical skills are optimally utilized with a minimum of overhead. A project team where its structure is simple and lean enable better control, communication and in budget. With this lean approach, the project manager must be experienced and have a qualified team. There must be a clear definition of responsibility and authority for individual members of the team and the project manager must be able fill the roles of facilitator, coordinator, leader, organizer, planner, delegator and administrator in order for the project to be implemented successfully.
- **4th** critical factor: Project Manager Selection Criteria that are normally used to select project managers are whether they were results-oriented, possessed strong interpersonal skills, their depth of understanding of the organization and lastly their commitment to corporate values.
- **5th** critical factors: Leadership style by the project manager is necessary for the successful implementation of projects. Normally the project manager has a great deal of responsibility but does not have the commensurate authority as a line manager whereas the line manager has a great deal of authority but only limited project responsibility. Considering this fact, it is therefore important for a project manager to maintain a leadership style that adapts to each employee assigned to the project. This is further complicated by the fact that the project's life cycle may be so short that the project manager does not have sufficient time to get to know the people.
- **6th** critical factors: Commitment to planning and control well-managed projects are committed to planning. For example if the output of a project is to contain quality, then this quality must be properly planned for in the early states of a project. When detailed planning is being done, it must be tracked or follow-up and re-planning must be done if the initial plan does not work before it is too late to do so. It is shown that personnel factor especially the project manager competence and leadership style is one of the crucial factor in project success implementation. This is true as project in itself has no essence unless it is managed by a group of people with the necessary skills, experience and qualification.

1.7 PROJECT LIFE CYCLE

Every project, from conception to completion, passes through various phases of a life cycle synonym to life cycle of living beings. There is no universal consensus on the number of phases in a project cycle. An understanding of the life cycle is important to successful completion of the project as it facilitates to understand the logical sequence of events in the continuum of progress from start to finish. Typical project consists of four phases- Conceptualization, Planning, Execution and Termination. Each phase is marked by one or more deliverables such as Concept note, Feasibility report, Implementation Plan, HRD plan, Resource allocation plan, Evaluation report etc.

Conceptualization Phase

Conception phase, starting with the seed of an idea, it covers identification of the product / service, Pre-feasibility, Feasibility studies and Appraisal and Approval. The project idea is conceptualized with initial considerations of all possible alternatives for achieving the project objectives. As the idea becomes established a proposal is developed setting out rationale, method, estimated costs, benefits and other details for appraisal of the stakeholders. After reaching a broad consensus on the proposal the feasibility dimensions are analyzed in detail.

Planning Phase

In this phase the project structure is planned based on project appraisal and approvals. Detailed plans for activity, finance, and resources are developed and integrated to the quality parameters. In the process major tasks need to be performed in this phase are

- Identification of activities and their sequencing
- Time frame for execution
- Estimation and budgeting
- Staffing

A Detailed Project Report (DPR) specifying various aspects of the project is finalized to facilitate execution in this phase.

Execution Phase

This phase of the project witnesses the concentrated activity where the plans are put into operation. Each activity is monitored, controlled and coordinated to achieve project objectives. Important activities in this phase are

- Communicating with stakeholders
- Reviewing progress
- Monitoring cost and time
- Controlling quality
- Managing changes

Termination Phase

This phase marks the completion of the project wherein the agreed deliverables are installed and project is put in to operation with arrangements for follow-up and evaluation.

Life Cycle path

The life cycle of a project from start to completion follows either a "S" shaped path or a "J " shaped path (Figure 1.3 and 1.4). In "S" shape path the progress is slow at the starting and terminal phase and is fast in the implementation phase. For example, implementation of watershed project. At the beginning detailed sectoral planning and coordination among various implementing agencies etc. makes progress slow and similarly towards termination, creating institutional arrangement for transfer and maintenance of assets to the stakeholders progresses slowly.

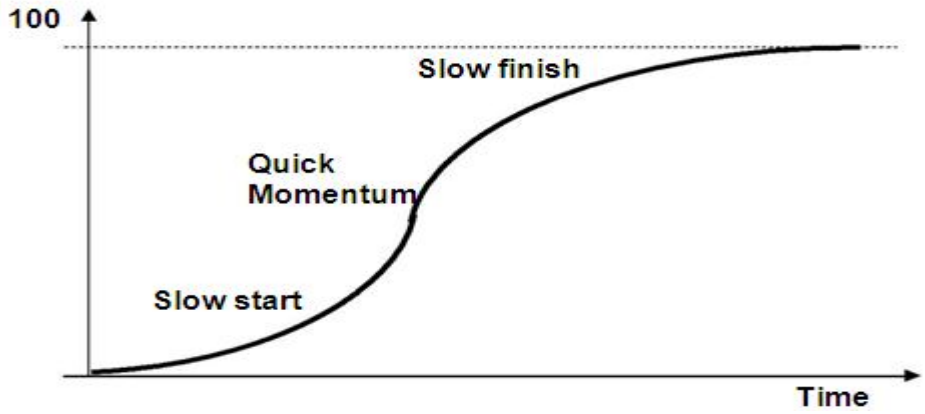

Fig-1.3: Project life path – "S' shape

In "J" type cycle path the progress in beginning is slow and as the time moves on the progress of the project improves at fast rate. Example, in a developing an energy plantation. In this the land preparation progresses slowly and as soon as the land and seedling are transplantation is under taken. This is shown in figure 1.4

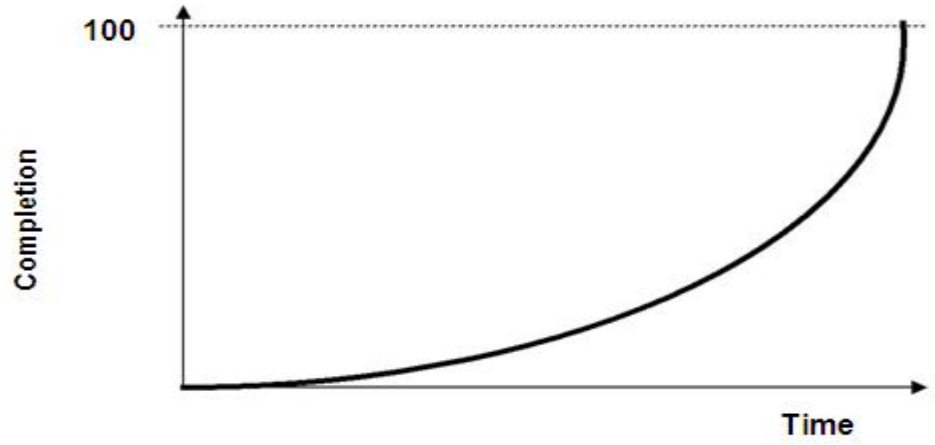

Fig-1.4: Project life cycle path - "J" Shape

1.8 PROJECT PERFORMANCE DIMENSIONS

Three major dimensions that define the project performance are scope, time, and resource. These parameters are interrelated and interactive. The relationship generally represented as an equilateral triangle. The relationship is shown in figure 1.5

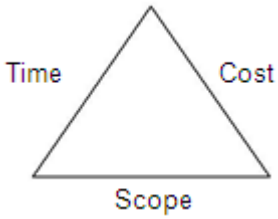

Figure-1.5: Project performance dimensions

It is evident that any change in any one of dimensions would affect the other. For example, if the scope is enlarged, project would require more time for completion and the cost would also go up. If time is reduced the scope and cost would also be required to be reduced. Similarly any change in cost would be reflected in scope and time. Successful completion of the project would require accomplishment of specified goals within scheduled time and budget. In recent years a forth dimension, stakeholder satisfaction, is added to the project. However, the other school of management argues that this dimension is an inherent part of the scope of the project that defines the specifications to which the project is required to be implemented. Thus the performance of a project is measured by the degree to which these three parameters (scope, time and cost) are achieved.

Mathematically

Performance = f(Scope, Cost, Time)

In management literature, this equilateral triangle is also referred as the "Quality triangle" of the project.

1.9 ROLES AND RESPONSIBILITIES OF PROJECT MANAGER

A project manager is a professional in the field of Project management. Project managers can have the responsibility of the planning, execution and closing of any project, typically relating to construction industry, architecture, computer networking, telecommunications or software development.

A project manager is a facilitator. The ideal project manager does whatever it takes to ensure that the members of the software project team can do their work. This means working with management to ensure that they provide the resources and support required as well as dealing with team issues that are negatively impacting a team's productivity. The project manager must possess a combination of skills including the ability to ask penetrating questions, identify unstated assumptions and resolve personnel conflicts along with more systematic management skills.

The actions of a project manager should be almost unnoticeable and when a project is moving along smoothly people are sometimes tempted to question the need for a project manager. The project manager is the one who is responsible for making decisions in such a way that risk is controlled and uncertainty minimized. Every decision made by the project manager should ideally be direct benefit to the project.

(a) Qualities of the Project Manager

The project manager is key ingredient in the success of a project. In addition to providing leadership in planning, organizing and controlling the manager should possess a set of skills that will both inspire the project tam to succeed and win the confidence of thecustomer.

1) Leadership Ability: Leadership is getting things done through others; the project manager achieves results through the project team. Project leadership involves inspiring the people assigned to the project to work as a team to implement the plan and achieve the project objective successfully. The project manager needs to create for the team a vision of the result and benefits of the project. For example, the project manager may describe a new layout for a plant that will be the result of a project and articulate the benefits of this project, such as the elimination of bottlenecks, increased throughput and reduced inventory. When project team members can envision the result, they will be more motivated to work as a team to complete the project successfully.

Project leadership requires involvement and empowerment of the project team. Individuals want to have ownership and control of their own work. They want to show that they can accomplish goals and meet challenges. The project manager should involve individuals in decisions affecting them and should empower them to make decisions within their assigned areas of responsibility.

2) Ability to Develop People: The effective project manager has a commitment to the training and development of people working on the project. He or uses the project as an opportunity to add value to each person's experience base so that all members of the project team are more knowledgeable and competent at the end of the project than when they started it. The project manager should establish an environment where people can learn from the tasks they perform and the situations they experience or observe and he or she must communicate to the team the importance of continuous self- development activities. One way of encouraging such activities is to talk about the importance of self-development at project team meetings. Another way is to meet with project team members individually at the start of their project assignments and encourage them to take advantage of their assignments to expand their knowledge and skills.

3) Communication skills: Project managers must be good communicators. They need to communicate regularly with the project team, as well as with any sub-contractors, the customer and their own company's upper management. Effective and frequent communication is crucial for keeping the project moving, identifying potential problems and soliciting suggestions to improve project performance, keeping abreast of customer satisfaction and avoiding surprises. A high level of communication is especially important early in the project to build a good working relationship with the project team and to establish clear expectations with the customer.

Effective project managers communicate and share information in a variety of ways, they have meetings and informal conversations with the project team, the customer and the company's upper management. They also provide written reports to the customer and upper management. All these tasks require that the project manager have good oral and written communication skills.

4) Interpersonal Skills: The project manager needs to establish clear expectations of members or the project team so that everyone knows the importance of his or her role in achieving the project objective. The project manager can do so by involving the team in developing a project plan that shows which people are assigned to which tasks and how those tasks fit together. Much like the coach of an athletic team, the project manager should emphasize that everyone's contribution is valuable to executing the plan successfully.

It is important that the project manager develop a relationship with each person on the project team. This may sound like a time consuming activity, but it isn't necessarily so. It requires making the time to have an informal conversation with each person on the project team and with each key individual in the customer's organization. These conversations, initiated by thee project manager, can take place during work or outside

the office. They can occur over lunch, while traveling with thee person on a business trip or while sitting next to the individual at a Little League game. Such situations provide an opportunity for the project manager to get to know the various people on the project team.

5) Ability to handle Stress: Project managers need to be able to handle the stress that can arise from work situations. Stress is likely to b high when a project is in jeopardy of not meeting its objective because of a cost overrun, a schedule delay or technical problems with the equipment or system; when changes in scope are requested by the customer; or when conflict arises within the project team regarding the most appropriate solution to a problem. Project activity can get both tense and intense at times. The project manager cannot panic; she or he has to remain unruffled. The effective project manager is able to cope with constantly changing conditions.

The project manager needs to have a good sense of humor. Used appropriately, humor can help a project manager handle thee stress and break the tension. Since the project manager sets an example for the project team and demonstrates what acceptable behavior on the projects, any humor must be in good taste. A manager should not till inappropriate jokes or have improper items hanging on the office wall and he or she must make it known to the project team right from the beginning that such behavior is unacceptable and will not be tolerated.

6) Problem-solving Skills: A project manager needs to be a good problem solver problem solver. Although it's easier to identify problems than to solve them, good problem-solving starts with the early identification of a problem or potential problem. Early identification of a problem will allow more time to develop a well – though-out solution. In addition, if a problem is identified early, it may be less costly to solve and may have less impact on other parts of the project. Good problem identification requires a timely and accurate data – driven information system; open and timely communication among the project team, the sub-contractors and the customer and some "get feelings" based on experience.

The project manager should encourage project team members to identify problems early and solve them on their own. The project team needs to be self-directed in solving problems and not wait for or depend on the project manager to get them started.

7) Time management Skills: Good project managers manage their time well. Projects require a lot of energy because they involve many concurrent activities and unexpected events. To make optimal use of the time available, project managers have to have self-discipline, be able prioritize and show a willingness to delegate.

(b) Roles of the Project Manager

The project management role is arguably the most challenging of roles within the project team. As the project progresses through its various life cycle stages, project manager's must be able to adapt themselves to the changing demands of the project and the team. Much can be found on management theory and practice, when applied to projects; consequently everyone will have their own opinion, and will be right in their own contexts. That doesn't help you find you formulate a practical view based on experience. We have distilled our experiences, beliefs, thoughts and opinions to what we believe the project management role is and the part the project manager plays in this. First and foremost, project management is a team sport, and in today's modern society it relies on the principal players of the team taking responsibility and accountability for those aspects of the project.

They have been charged with. Indeed, this ethos should be passed down to all team members irrespective of their level of involvement in the project. All Teams need a leader, our view is that this is the principal role of the one commonly referred to as the 'Project Manager'. We shall however, continue to refer to the principal project management role as the Project Manager.

Many organizations and project sponsors set their projects up to fail because they do not fully recognise how important the project management role is, to successfully manage a project through its life cycle. It is still common that project managers are appointed on a part-time basis, the assumption being they can manage the project on a part-time basis as a stretch to their other day to day duties and responsibilities. To successfully manage the project management process, requires full-time commitment. Though in practice 'time' may be

shared with other duties and responsibilities, when it comes to the crunch, the project must get the first call when a conflict of interest arises. This leads nicely to the statement "The Mission is the No.1 Priority, no-one is bigger than the Mission!", including the Project Manager!

Provided the project sponsors are serious about their commitment to the project. The project deserves the respect of having all the stops pulled out for it, including a full-time project manager.We think of the project management role consisting of 3 dimensions:

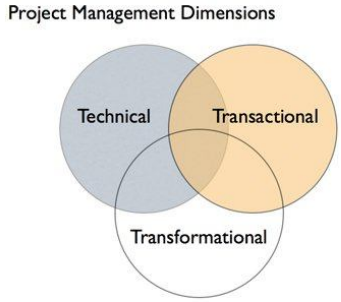

Fig-1.6: Project Management Role.

1.) Technical

The Technical dimension covers the more 'hands-on' role of the Project Manager. The Project Manager must be able to, and be prepared to get their sleeves rolled up and get stuck into technical issues at a detailed level. Generally, this is more so during the earlier project definition stages of the project life cycle. The project Team is usually at its leanest, and all members have to get involved in progressing the detail of technical issues, or the project will stall.

"The Devil is in the Detail" most have heard that expression and it's 100% true when it comes to projects. Take your eye off an understanding of the detail at your peril. That is to say the project manager absolutely does not need to know how to do everyone's tasks within the project, but needs to appreciate all the processes being carried out and be able to confidently challenge others at a level of informed understanding. The Technical aspects of the project management role would include those activities needed to develop and complete the project definition, and then to implement the project in accordance with its implementation plan, controlling the project assuring the required quality of delivery.

Being a team sport, the project management role is not necessarily the same thing as the Project Manager's role. For the Project Manager, depending on the size of the project, the role could include managing a team of project managers to deliver these technical aspects, or more commonly, initially carrying out a significant portion of the technical project management aspects.

2.) Transactional

The Transaction Dimension refers to the traditional project management activities associated with managing the project's work flows and performance. Such activities would initially include establishing the project baseline metrics and parameters required to control the project during the implementation stage. During the project implementation stage Transactional activities would include all those project management control and reporting activities carried out regularly, needed to demonstrate control of the project. Here the Project Manager is performing foremost as a 'Manager'.

3.) Transformational

The Transformation Dimension refers to activities associated with leadership. Here the Project Manager is acting as the Project Leader. Softer people, relationship and communication skills need to be put to work, seeking to get the best performance from the Project Team.

This is where we believe Project Managers should be at their most effective. The project is delivered by the Team, and therefore regular ongoing Team maintenance, development and motivation are essential activities if the project is to be successful. This is where the best Project Managers spend the majority of their time; they realise that the performance return from their effort invested in the Team and individuals vastly increases the chances of success.

Project Managers who grasp a project with passion, and who create a sustainable buzz about the project create an environment where people feel they must be part of the Project Team, and who end up talking about being part of the project many years after its completion.

During the Feasibility Study, the Project Manager spends proportionately more time in the Technical and Transformational dimensions. 'Technical', when developing and challenging the scope of the project and evaluating options. Transformational when communicating the objectives and benefits expected of the project as well as the vision of what success will look like. During the Implementation stage, the Project Manager is increasingly concerned with successfully delivering the project as defined, and operates more proportionately in the Transactional dimension, ensuring project performance is maintained at the levels required to achieve success. Transformational management skills will be employed as the team gets larger, to keep communicating the vision, to motivate, encourage and guide team members to perform whilst outside of their comfort zones.

During the close out stage time gets more proportionately spent back in the Technical dimension, as well as the Transactional dimension. Technical details need closing out in order to complete the project, the 'Devil is in the Detail' again. Transactional control is needed to ensure the last project activities are being completed properly and to schedule and cost. In addition to the above roles the project manager regularly performed the following duties.

a) Project Planning: It is usually the project manager's responsibility to prepare the project plan. The role of the functional managers in assisting the project manager must be clearly defined. They should also usually bear the burden of the detailed discipline planning to confirm to the overall project plan.

b) Project Organization: The project manager usually adapts the standard project chart to the specific requirements of the project at hand. The role that functional management plays in concurring or modifying the project chart must be determined by senior management.

c) Project Staffing: For each position shown on the chart, the functional manager will supply candidates. The project manager's role in selection/approval of the project team requires clarification by senior management.

d) Personnel Administration: Normally, this is the responsibility of the functional manager. The project manager is responsible for maintaining discipline within the taskforce area.

e) Contact Administration: Thee involvement of the project manager vis a vis the legal department in interpreting and administering the contract should be clearly defined so that each a aware of the split of responsibilities.

f) Technical Management: The exact expectations as to the responsibility for management of engineering and other technical personnel are needed to be defined. Management responsibilities are frequently split and the interfaces need to be clarified.

g) Project Administration: A function of project management. Any exceptions should be identified and made clear.

h) Final Administration: A function of the project manager with each of the specific exceptions and limitations noted.

i) Communication: Communication requires dedication from both project and functional management. Senior management expectations should be noted.

j) Materials Management: In organization with strong procurement involvement, it will be necessary to specifically define those responsibilities which are assigned to project management.

k) Construction: The project manager's involvement during the construction phase and at the jobsite requires careful definition to distinguish his responsibilities from those of the construction manager.

l) Turnover of Facilities to Owner: The split of responsibilities among the owner, initial operations department and the project should be carefully identified, preferably by means of a checklist assigning each anticipated activity to one specific party.

m) Performance assurance: Responsibility of each individual for his own work, of functional management for the work done by each discipline and the project manager for the overall project work.

n) Client relations: The basic responsibility must remain with the project manager. He must have help from senior management and from discipline specialists.

o) Job Close-Out: A complete listing of project responsibilities and departmental responsibilities is required. Instructions for charging of time are needed. The clear-cut assignment of responsibility to functional and project management in each of these areas will reduce unnecessary conflict and confusion during the execution of the project.

1.10. SELF ASSESSMENT QUESTIONS

1. Define Project Management And Outline Its Features Clearly?
2. Discuss The Process Of Generating And Screening The Project Ideas?
3. Define The Term 'Project'. How Will You Classify The Projects?
4. What Do You Understand By Project Identification? Discuss, With Examples, The Process Involved In Project Identification.?
5. Discuss The Roles And Responsibilitie of Project Manager?

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Chapter - 2
Project Planning and Feasibility Study

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of Project planning and process
- To know the concept of Feasibility study.
- To know the Process of Feasibility Study.

2.1. INTRODUCTION

A major decision at the outset of any project is to decide upon the organization and composition of the project team. In so doing, it is worth remembering that many members will have dual responsibilities of involvement in the project in addition to a commitment to other projects or management of a functional area on a day-to-day basis. It is at this stage that a project manager should be appointed and responsibilities made explicit for all members of the team. The selection of the team will be dependent upon the skill requirements of the project, and upon the matching of those skills to those possessed by individual members of the team. There may be a conflict here with hierarchical status. The project management team will, therefore, begin its task in advance of project proper so that a plan can be developed. An important first step is to set the objectives and then define the project, breaking it down into a set of activities and related costs. It is probably too early to determine exact resource implications at this stage, but expected requirements for people, supplies and equipment should at least be estimated during the planning stage.

2.2. WHAT IS A PROJECT PLAN

A project plan is a model of the process that the project team intends to follow to realize the project objectives. It brings together a number of important aspects of this process including its scope, timing, cost, and associated risks. The project plan can be viewed as a type of "contract" between the project team members and other stakeholders. It defines" the process by which the objectives will be achieved, and the responsibilities in carrying out this process.

Project plans also underpin a number of other key project management functions including estimating and forecasting, options analysis and decision- making, and performance monitoring and control. Everyone in the project team should be involved in developing the plan. It should be a collaborative effort. The project manager should provide leadership in this area but may delegate some of the administrative aspects and detailed analysis to a project support role. On larger projects there may be one or more dedicated planners.

2.3. FEATURES OF PROJECT PLAN

After the initiation stage, the project is planned to an appropriate level of detail The main purpose is to plan time, cost and resources adequately to estimate the work needed and to effectively manage risk during project execution. As with the Initiation process group, a failure to adequately plan greatly reduces the project's chances of successfully accomplishing its goals.

Project planning generally consists of

- Determining how to plan.
- Developing the scope statement.
- Selecting the planning team.
- Identifying deliverables and creating the work breakdown structure.
- Identifying the activities needed to complete those deliverables and networking the activities in their logical sequence.
- Estimating the resource requirements for the activities.
- Estimating time and cost for activities.
- Developing the schedule.
- Developing the budget.
- Risk planning.
- Gaining formal approval to begin work.

Additional processes, such as planning for communications and for scope management, identifying roles and responsibilities, determining what to purchase for the project and holding a kick-off meeting are also generally advisable.For new product development projects, conceptual design of the operation of the final product may be performed concurrent with the project planning activities, and may help to inform the planning team when identifying deliverables and planning activities.

2.4. KEY ELEMENTS OF A PLAN

- **Products –** What products must the project deliver what is the quality requirements associated with the products.
- **Activities –** What activities are needed to deliver the products?
- **Resources –** What resources are needed to carry out the activities?
- **Schedule –** In what sequence should we carry out the activities? How long will the activities take to complete. Are the required resources available and how long will the project take overall.
- **Budget –** What are the time-phased resource requirements and financial costs and how much the project will cost overall.
- **Risks –** Are we taking unnecessary risks is the level of risk – exposure commensurate with the risk appetite and are there any opportunities that could be exploited.
- **Assumptions –** What are the underlying assumptions associated with the plan.

2.5. WHAT ARE THE BENEFITS OF PLANNING

- It is more likely to lead to success and is more cost-effective than a "just do it" approach.
- It develops greater mutual understanding and more commitment to achieving the objectives within the project team.
- It provides an "early warning system" so that problems" are identified while there is still time to do something about them.

2.6. THE PLANNING PROCESS

The planning process consisting of four important stages which includes

Stage1: Identify structure and define the products needed to achieve the project objectives. Break down the work needed to deliver the products into discrete work packages. Define the responsibilities of the individuals or teams who will deliver the work packages.

Stage2: Identify the activities and resources needed to deliver the work packages. Construct a schedule that takes account of the logical dependencies between activities, and the availability of resources.

Stage3: Estimate the quantity of resources and financial costs associated with each work package, and use this information in conjunction with the schedule to develop time-phased budgets.

Stage 4: Identify and analyze the risks associated with each work package and evaluate a range of options for handling them. Select the most cost-effective combination of risk management actions and incorporate them into the plan.

2.7. PROJECT FEASIBILITY STUDY

A project feasibility study either refines a business case by examining the range of possible options and potential issues, or forms a basis for its development. It is usually an activity carried out in the project initiation phase. A feasibility study should address issues that could influence the success of a potential project and assess the advantages and disadvantages of each option so they can be ranked. It includes a cost/benefit analysis and results in the development of a feasibility report, sometimes referred to as an options paper.

Feasibility Studies In order to make wise investments in a marketplace experiencing increasing levels of risk, companies are turning to feasibility studies to determine if they should offer new products, services or undertake a new business endeavor. The purpose of a feasibility study is to determine if a business opportunity is possible, practical and viable. When faced with a business opportunity, many optimistic people tend to focus on just the positive aspects. A feasibility study enables a realistic view at both the positive and negative aspects of the opportunity. A feasibility study is an important tool for making the right decisions. A wrong decision often leads to business failure. For example, only 50% of start-ups are still in business after 18 months and only 20% are in business after 5 years. Feasibility studies are useful when

starting a new business or identifying a new opportunity for an existing business. Ideally, the feasibility study process involves making rational decisions about a number of enduring characteristics of a project, including: . Definition of the project; . Current market segmentation; . Projected growth in each market segment; . Current market offerings; . Customer profile(s); . Estimation of customers/revenues; . Determination of competitive differentiation and advantage(s); . Vision/mission statement; . Definition of proposed operations/management structure and management methods; and . Financing and projected cash flows refer to link below for more information.

2.8. PURPOSE AND OBJECTIES OF THE FEASIBILITY STUDY

The feasibility study should provide a good foundation to allow early project analysis and design activities to commence in a focused manner. The end product of the study should be a clear, concise Feasibility Report to senior management, which presents the proposed project's original specifications and objectives, with conclusions and recommendations for the next phase. This report should highlight the advantages and disadvantages associated with each option and cover issues such as cost, revenue, strategic considerations and other issues. It should provide senior management with a firm basis to determine whether the project has sufficient merit to continue into more detailed phases. It should especially highlight changes that may need to be made to any existing business case due to the study.

What is the general objectives of the feasibility study

Feasibility is the study of whether or not a project is worth doing. The process followed in making this determination is called a feasibility study. The main objective of the feasibility study is to prepare 1) Project Specification 2) Cost Benefit Analysis 3) Prepare Feasibility Report. The project specification has all the information about the project which is more like a guideline for the project. It gives a great insight to the management about the kind of investment involved for undertaking a project along with the manpower, hardware, software and other factors. Cost Benefit analysis is a method to identify the gross benefit involved in the development and implementation of a new system. Basically, it tells the organization whether they are economically prepared for the project. Feasibility Report contains various feasibility studies like:- Technical Feasibility Economic Feasibility Operational Feasibility Social Feasibility Time Feasibility Management Feasibility And Legal Feasibility.

2.9 COMPONENTS OF PROJECT FEASIBILITY STUDY

The conversion of the project idea into a commercial reality could possibly be achieved through a variety of choices in terms of plant size, location, technology, product mix, marketing approaches, etc. Before the ultimate feasibility study is taken up, there should be clarity about the choices from among these possibilities or alternatives. Alternatives will have to be considered in respect of the following:

a) **Market size and plant capacity:** The market scope and size have to be assessed, taking note of the prevailing and prospective demand. The sales organization, the marketing network and distribution channels that will be appropriate, the plant capacity to be installed and the production processes to be adopted are all aspects on which a reasonable degree of clarity is needed before the feasibility study can be taken up.

b) **Material inputs:** the raw materials and other critical stores items that are needed and the alternatives or substitutes in respect thereof, the different sources for their procurement and the related economics of purchase should be examined and suitable options chosen.

c) **Location and site:** Alternative locations available with adequate infrastructure facilities, or with proximity to supplies of materials or to the markets for outputs have to be considered and a proper choice made.

d) **Project engineering:** Technology and equipment sources have to be identified and compared before a decision is taken. Their suitability to the local or domestic conditions have to be examined carefully and the availability of requisite skills for their proper maintenance to be ensured.

e) **Overheads:** The organization structure will determine the nature and amount of overheads to be incurred in respect of manufacturing, selling and administrative functions. Building and equipment layout, the choice of having a sales network or distributing through wholesale outlets, etc. are aspects on which, at least. Tentative decisions should be taken to guide the feasibility study.

f) **Manpower:** Ready availability of semi-skilled and skilled labour as also casual or unskilled labour, competent and qualified supervisory and general staff, the training facilities that are needed and related matters need to be considered and appropriate choices made.Project implementation: Whether the implementation will be departmentally carried out or whether it will be entrusted entirely to specialist contractors are questions that have to be resolved at the pre-feasibility stage.

g) **Financial analysis:** Fairly reliable, though aggregate, estimates have to be made on the capital costs of equipment, buildings, etc, and on the choices from among alternative sources or modes of financing the project. Reliable assessment of costs and revenues during operating phase will have to be made at this stage and the profitability examined.

Where the investment possibilities and prospects are widely known to be good, because of the nature of the product or very favourable market factors, there may be no need for a pre-feasibility study. Even in such instances, in order to decide on the location, size, etc., there may be a need for pre-feasibility studies on related aspects, by way of functional or support studies, before the eventual decision on investment is taken

2.10. WHAT ARE THE MAJOR PARTS OF A FEASIBILITY STUDY PROCESS

If a feasibility study is completed as the project is being initiated, one of its outputs could be a preliminary business case. if it is completed after the business case has already been developed, it can help refine the scope. in either case, it should narrow the range of options, assess each of the remaining options and propose solutions to issues raised. in many ways, a feasibility study can be treated like a mini-project in its own right; its outcome being a decision on how the larger project should be managed.

Sometimes a project proposal or project business plan is developed to scope the feasibility activities if it is a major undertaking.

There are basically six parts to any effective Feasibility Study

1. The Project Scope which is used to define the business problem and/or opportunity to be addressed. The old adage, "The problem well stated is half solved," is very apropos. The scope should be definitive and to the point; rambling narrative serves no purpose and can actually confuse project participants. It is also necessary to define the parts of the business affected either directly or indirectly, including project participants and end-user areas affected by the project. The project sponsor should be identified, particularly if he/she is footing the bill. I have seen too many projects in the corporate world started without a well defined project scope. Consequently, projects have wandered in and out of their boundaries causing them to produce either far too much or far too little than what is truly needed.

2. The Current Analysis is used to define and understand the current method of implementation, such as a system, a product, etc. From this analysis, it is not uncommon to discover there is actually nothing wrong with the current system or product other than some misunderstandings regarding it or perhaps it needs some simple modifications as opposed to a major overhaul. Also, the strengths and weaknesses of the current approach are identified (pros and cons). In addition, there may very well be elements of the current system or product that may be used in its successor thus saving time and money later on. Without such analysis, this may never be discovered. Analysts are cautioned to avoid the temptation to stop and correct any problems encountered in the current system at this time. Simply document your findings instead, otherwise you will spend more time unnecessarily in this stage (aka "Analysis Paralysis").

3. Requirements - how requirements are defined depends on the object of the project's attention. For example, how requirements are specified for a product are substantially different than requirements for an edifice, a bridge, or an information system. Each exhibits totally different properties and, as such, are defined differently. How you define requirements for software is also substantially different than how you define them for systems.

4. The Approach represents the recommended solution or course of action to satisfy the requirements. Here, various alternatives are considered along with an explanation as to why the preferred solution was selected. In terms of design related projects, it is here where whole rough designs (e.g., "renderings") are developed in order to determine viability. It is also at this point where the use of existing structures and commercial alternatives are considered (e.g., "build versus buy" decisions). The overriding considerations

though are: . Does the recommended approach satisfy the requirements? . Is it also a practical and viable solution? (Will it "Play in Poughkeepsie?") A thorough analysis here is needed in order to perform the next step...

5. Evaluation - examines the cost effectiveness of the approach selected. This begins with an analysis of the estimated total cost of the project. In addition to the recommended solution, other alternatives are estimated in order to offer an economic comparison. For development projects, an estimate of labour and out-of-pocket expenses is assembled along with a project schedule showing the project path and start-and-end dates. After the total cost of the project has been calculated, a cost and evaluation summary is prepared which includes such things as a cost/benefit analysis, return on investment, etc.
6. Review - all of the preceding elements are then assembled into a Feasibility Study and a formal review is conducted with all parties involved. The review serves two purposes: to substantiate the thoroughness and accuracy of the Feasibility Study, and to make a project decision; either approve it, reject it, or ask that it be revised before making a final decision. If approved, it is very important that all parties sign the document which expresses their acceptance and commitment to it; it may be a seemingly small gesture, but signatures carry a lot of weight later on as the project progresses. If the Feasibility Study is rejected, the reasons for its rejection should be explained and attached to the document.

Conclusion It should be remembered that a Feasibility Study is more of a way of thinking as opposed to a bureaucratic process. For example, what I have just described is essentially the same process we all follow when purchasing an car or a home. As the scope of the project grows, it becomes more important to document the Feasibility Study particularly if large amounts of money are involved and/or the criticality of delivery. Not only should the Feasibility Study contain sufficient detail to carry on to the next succeeding phase in the project, but it should also be used for comparative analysis when preparing the final Project Audit which analyses what was delivered versus what was proposed in the Feasibility Study. Feasibility Studies represent a common sense approach to planning. Frankly, it is just plain good business to conduct them. However, I have read where some people in the IT field, such as the "Agile" methodology proponents, consider Feasibility Studies to be a colossal waste of time. If this is true, I've got a good used car I want to sell them. parts of the feasibility study Things that are generally feasible are definitely a main part of any government study

2.11. HOW TO MANAGED FEASIBILITY STUDY

The following three main elements should be managed in relation to the Feasibility Study

1. **Organisation -** There should be a clearly focused, but flexible structure built around the milestone plan. Roles and responsibilities should be clearly defined and a responsibility chart or governance structure model is one way of doing this definition.
2. **Communication -** The Manager should maintain good contact with the Project Sponsor to ensure the study remains on target and any required changes are made. Internal team communication is also important to ensure delays are tracked, duplication is avoided and information is shared, especially between different areas of specialty.
3. **Control -** The Manager should ensure milestones adopted are appropriate for achieving the aims of the study and are reached on time. Costs should also be monitored, and timing and budget changes made so that the study still meets its aims.

2.12. SELF – ASSESSMENT QUESTIONS

1. Define Project Planning. Discuss the Important Steps in Project Planning?
2. What is Feasibility Study? Explain the importance of Feasibility Study?
3. Discuss the process of Feasibility Study?
4. Explain the components of Feasibility study?
5. Discuss the Following.
   a) Objectives of Feasibility Study
   b) How to Manage the Feasibility Study

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Chapter- 3

Technical and Financial Analysis

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To study the various aspects to be considered for technical analysis of the project.
- To understand the considerations involved in financial analysis of the project
- To study the Environmental analysis of Project study.

3.1. INTRODUCTION

The success of an enterprise depends upon the entrepreneur doing the right thing at the right time. Starting a new venture is a very challenging and rewarding task. A businessman has to take numerous decisions, right from the conception of a business idea, upon the start of production. Hence, the identification of the project to be undertaken, requires an analysis of the project in depth. Therefore, a technical and financial analysis of the project has to be undertaken.

3.2. TECHNICAL ANALYSIS

Analysis of technical and engineering aspects is done continually when a project is being examined and formulated. Other types of analyses are dependent and closely intertwined with technical analysis. Technical analysis is concerned primarily with:

3.2.1. Materials and inputs

An important aspect of technical appraisal is concerned with defining the materials and inputs required, specifying their properties in some detail, and setting up their supply programme. There is an intimate relationship between the study of materials and inputs and other aspects of project formulation, particularly those concerned with location, technology, and equipment. Materials and inputs may be classified into four broad categories: (i) raw materials, (ii) processed industrial materials and components, (iii) auxiliary materials and factory supplies, and (iv) utilities.

a) **Raw materials —** Raw materials (processed and /or semi-processed) may be classified into four types: (i) agricultural products, (ii) mineral products, (iii) livestock and forest products, and (iv) marine products.

b) **Processed industrial materials and components —** Processed industrial materials and components (base metals, semi-processed materials, manufactured parts, components, and sub-assembly represent an important input for a number of industries. In studying them the following questions need to be answered: In the case of industrial materials, what are their properties? What is the total requirement of the project? What quantity would be available from domestic source? What quantity would be available from foreign sources? How dependable are the supplies? What has been the past trend in prices? What is the likely future behaviour of prices?

c) **Auxiliary materials and factory supplies —** In addition to the basic raw materials and processed industrial materials and components, a manufacturing project requires various auxiliary materials and factory supplies, like chemicals, additives, packaging materials, paints, varnishes, oils, grease, cleaning materials, etc. The requirements of such auxiliary materials and supplies should be taken into account in the feasibility study.

d) **Utilities —** A broad assessment of utilizes (power, water, steam, fuel, etc.) may be made at the time of input study though a detailed assessment can be made only after formulating the project with respect to location, technology, and plant selection. Since the successful operation of a project critically depends on adequate availability of utilities the following points should be raised whiled conducting the input study: What quantities are required? What are the sources of supply? What would be the potential availability? What are the likely shortages/bottlenecks? What measures may be taken to augment supplies.

3.2.2. Production technology

For manufacturing a product/service often two or more alternative technologies are available. For example

- Steel can be made either by the Bessemer process or the open hearth process.
- Cement can be made either by the dry process or the wet process.
- Soda can be made by the electrolysis method or the chemical method.
- Paper, using bagasse as the raw material, can be manufactured by the kraft process or the soda process or the simoncusi process.
- Vinyl chloride can be manufactured by using one of the following reactions: acetylene on hydrochloric acid or ethylene or chlorine.

3.2.3. Choice of technology

The choice of technology is influenced by a variety of considerations

- **Principal inputs —** The choice of technology depends on the principal inputs available for the project. In some cases, the raw materials available influence the technology chosen. For example, the quality of limestones determines whether the wet or dry process should be used for a cement plant. It may be emphasized that a technology based on indigenous inputs may be preferable to one based on imported inputs because of uncertainties characterizing imports, particularly in a country like India.
- **Investment outlay and production cost —** The effect of alternative technologies of investment outlay and production cost over a period of time should be carefully assessed.
- **Use by other units —** The technology adopted must be proven by successful use by other units, preferably in India.
- **Product mix —** The technology chosen must be judged in terms of the total product-mix generated by it, including saleable by-products.
- **Latest developments —** The technology adopted must be based on latest development in order to ensure that the likelihood of technological obsolescence in the near future, at least, is minimized.
- **Ease of absorption —** The ease with which a particular technology can be absorbed can influence the choice of technology. Sometimes a high-level technology may be beyond the absorptive capacity of a developing country which may lack trained personnel to handle that technology.

3.2.4. Product Mix

The choice of product mix is guided primarily by market requirements. In the production of most of the items variations in size and quality are aimed the production of most of the items, variations in size and quality are aimed at satisfying a broad range of customers. For example, production of shoes to different customers. It may be noted that sometimes slight variations in quality can enable a company to expand its market and enjoy higher profitability.

For example, a toilet soap manufacturing unit may by minor variation in raw material, packaging, and sales promotion offer a high profit margin soap to consumers in upper-income brackets.

While planning the production facilities of the firm, some flexibility with respect to the product mix must be sought. Such flexibility enables the firm to alter its product mix in response to changing market conditions and enhances the power of the firm to survive and grow under different situations. The degree of flexibility chosen may be based on a careful analysis of the additional investment requirements for different degrees of flexibility.

3.2.5. Plant capacity

Plant capacity (also referred to as production as capacity) refers to the volume or number of units that can be manufactured during a given period. Several factors have a bearing on the capacity decision.

- **Technological requirement —** For many industrial projects, particularly in process type industries, there is a certain minimum economic size determined by the technological factor. For example, a cement plant should have a capacity of at least 300 tonnes per day in order to use the rotary kiln method; otherwise, it has to employ the vertical shaft method which is suitable for lower capacity.
- **Input constraints —** In a developing country like India, there may be constraints on the availability of certain inputs. Power supply may be limited; basic raw materials may be scarce; foreign exchange available for imports may be inadequate. Constraints of these kinds should be borne in mind while choosing the plant capacity.
- **Investment cost —** When serious input constraints do not obtain, the relationship between capacity and investment cost is an important consideration. Typically, the investment cost per unit of capacity decreases as the plant capacity increases. This relationship may be expressed as follows:

- **Market conditions —** The anticipated market for the product/service has an important bearing on plant capacity. If the market for the product is likely to be very strong, a plant of higher capacity is preferable. If the market is likely to be uncertain, it might be advantageous to start with a smaller capacity. If the market, starting from a small base, is expected to grow rapidly, the initial capacity may be higher than the initial level of demand-further additions to capacity may be affected with the growth of market.
- **Resources of the firm —** The resources, managerial and financial, available to a firm define a limit on its capacity decision. Obviously, a firm cannot choose a scale of operations beyond its financial resources and managerial capability.
- **Governmental policy —** The capacity level may be constrained by governmental policy. Given the level of additional capacity to be created in an industry, within the licensing framework of the government the government may decide to distribute the additional capacity among several firms.

3.2.6. Location and site

The choice of location and site follows an assessment of demand, size, and input requirement. Though often used synonymously, the terms 'location' and 'site' should be distinguished. Location refers to a fairly broad area like a city, an industrial zone, or a coastal area; site refers to a specific piece of land where the project would be set up.

The choice of location is influenced by a variety of considerations: proximity to raw materials and markets, availability of infrastructure, governmental policies, and other factors.

a) **Proximity to raw materials and markets —** An important consideration for location is the proximity to sources of raw materials and nearness to the market for final products. In terms of a basic locational model, the optimal location is one where the total cost (raw material transportation cost plus production cost plus distribution cost for final product) is minimized. This generally implies that: (i) a resource-based project like a cement plant or a steel mill should be located close the source of basic material (for example, limestone in the case of a cement plant and iron-ore in the case of a steel plant); (ii) a project based on imported material may be located near a port; and (iii) a project manufacturing a perishable product should be close to the center of consumption. However, for many industrial products proximity to the source of raw material or the center of consumption may not be very important. Petro-chemical units or refineries, for example, may be located close to the source of raw material, or close to the center of consumption, or at some intermediate point.

b) **Availability of infrastructure —** Availability of power, transportation, water, and communications should be carefully assessed before a location decision is made. Adequate supply of power is a very important condition for location— insufficient power can be a major constraint, particularly in the case of an electricity-intensive project like an aluminum plant. In evaluating power supply the following should be looked into: the quantum of power available, the stability of power supply, the structure of power tariff, and the investment required by the project for a tie-up in the network of the power supplying agency. For transporting the inputs of the project and distributing the outputs of the project, adequate transport connections—whether by rail, road, sea, inland water, or air— are required. The availability, reliability and cost of transportation for various alternative locations should be assessed. Given the plant capacity and the type of technology, the water requirement for the project can be assessed. Once the required quantity is estimated, the amount to be drawn from the public utility system and the amount to be provided by the project from surface or sub-surface sources may be determined. For doing this the following factors may be examined: relative costs, relative depend abilities, and relative qualities. In addition to power, transport, and water, the project should have adequate communication facilities like telephone and fax etc.

c) **Governmental policies —** Governmental policies have a bearing on location. In the case of public sector projects, location is directly decided by the government. It may be based on a wider policy for regional dispersion of industries. In the case of private sector projects, location is influenced by certain governmental restrictions and inducements. The government may prohibit the setting up of industrial projects in certain areas which suffer from urban congestion. More positively, the government offers inducements for establishing industries in backward areas. These inducements consist of outright subsidies, concessional finance, tax relief, and other benefits.

d) Other factors — Several other factors have to be assessed before reaching a location decision: ease in coping with environmental pollution, labour situation, climatic conditions, and general living conditions. A project may cause environmental pollution in various ways: it may throw gaseous emission; it may produce liquid and solid discharges; it may cause noise, heat, and vibrations. The location study should analyze the costs of mitigating environmental pollution to tolerable levels at alternative locations. The labour situation at alternative locations may be assessed in terms of: (i) the availability of labour, skilled, semi-skilled, and unskilled; (ii) the past trends in labour rates, the prevailing labour rates, and the projected labour rates; and (iii) the state of industrial relations judged in terms of the frequency and severity of strikes and lockouts and the attitudes of labour and management. The climatic conditions (like temperature, humidity, wind, sunshine, rainfall, snowfall, dust and fumes, flooding, and earthquakes) have an important influence on location. They have a bearing on cost as they determine the extent of air-conditioning, de-humidification, refrigeration, special drainage, etc., required for the project.General living conditions, judged in terms of cost of living, housing situation, and facilities for education, recreation, transport, and medical care, need to be assessed at alternative locations.

3.2.7. Machinery and Equipment

The requirement of machinery and equipment is dependent on production technology and plant capacity. It is also influenced by the type of project. For a process-oriented industry, like a petrochemical unit, machinery and equipment required should be such that the various stages have to be matched well. The choice of machinery and equipment for a manufacturing industry is somewhat wider as various machines can perform the same function with varying degrees of accuracy. For example, the configuration of machines required for the manufacture of refrigerators could take various forms. To determine the kinds of machinery and equipment requirement for a manufacturing industry, the following procedure may be followed: (i) Estimate the likely levels of production over time. (ii) Define the various machining and other operations. (iii) Calculate the machine hours required for each type of operation. (iv) Select machinery and equipment required for each function.

The equipment required for the project may be classified into the following types: (i) plant (process) equipment, (ii) mechanical equipment, (iii) electrical equipment, (iv) instruments, (v) controls, (vi) internal transportation system, and (vii) other machinery and equipment. In addition to the machinery and equipment, a list should be prepared of spare parts and tools required. This may be divided into: (i) spare parts and tools to be purchased with original equipment, and (ii) spare parts and tools required for operational wear and tear.

Constraints in selecting machinery and equipment— In selecting the machinery and equipment, certain constraints should be borne in mind:

(i) there may be a limited availability of power to set up an electricity intensive plant like, for example, a large electric furnace; (ii) there may be difficulty in transporting a heavy equipment to a remote location; (iii) workers may not be able to operate, at least in the initial periods, certain sophisticated equipment such as numerically controlled machines; (iv) the import policy of the government may preclude the import of certain types of machinery and equipment.

3.2.8. Structures and civil works

Structures and civil works may be divided into three categories: (i) site preparation and development, (ii) buildings and structures, and (iii) outdoor works.

- Site preparation and development— This covers the following:
- grading and leveling of the site, (ii) demolition and removal of existing structures, (iii) relocation of existing pipelines cables, roads, powerlines, etc., (iv) reclamation of swamps, draining and removal of standing water, (v) connections for the following utilities from the site to the public network: electric power (high tension and low tension), water (use water and drinking water), communications (telephone, fax, etc.), roads, railway sidings, and other site preparation and developmental work.
- Buildings— Buildings and structures may be divided into: (i) factory or process buildings; (ii) ancillary buildings required for stores, warehouses, laboratories, utility supply centers, maintenance services, and others; (iii) administrative buildings; (iv) staff welfare buildings, cafeteria, and medical service buildings; and (v) residential buildings.

- Outdoor works— Outdoor works cover (i) supply and distribution of utilities (water, electric power, communication, steam and gas); (ii) handling and treatment of emissions, wastages, and effluents; (iii) transportation and traffic arrangements (roads, railway tracks, paths, parking areas, sheds, garages, traffic signals, etc.): (iv) outdoor lighting; (v) landscaping; and (vi) enclosure and supervision (boundary wall, fencing, barriers, gates, doors, security posts, etc.).

3.2.9. Project charts and layouts

Once data is available on the principal dimension of the project— market size, plant capacity, required technology, equipment and civil works, conditions obtaining at plant site, and supply of inputs to the project— project charts and layouts may be prepared. These define the scope of the project and provide the basis for detailed project engineering and estimation of investment and production costs.

3.2.10. Work Schedule

The work schedule, as its name suggests, reflects the plan of work concerning installation as well as initial operation. Often, it is found that the required inputs like raw material and power are not available in adequate quantity when the plant is ready for commissioning, or the plant is not ready when the raw material arrives.

3.3. FINANCIAL ANALYSIS

Financial analysis is defined as the process of discovering economic facts about an enterprise and/or a project on the basis of an interpretation of financial data. Financial analysis also seeks to look at the capital cost, operations cost and operating revenue. The analysis decisively establishes a relationship between the various factors of a project and helps in maneuvering the project's activities. It also serves as a common measure of value for obtaining a clear-cut understanding about the project from the financial point of view. An analysis of several valuing securities and analysis is vital in the financial tools provide an important basis for appraising managerial programmes. Financial interpretation of financial statements. It can provide an insight into two important areas of management— return on investment and soundness of the company's financial position.

Internal management accounts provide information which is valuable for the purpose of control. The information is made available in the form of accounting data, which may be manifested as financial and accounting statements. A financial analysis reveals where the company stands with respect to profitability, liquidity, leverage and an efficient use of its assets. Financial reports provide the framework within which business planning takes place. They are the key through which an effective control of a business enterprise is exercised. It is the process of determining the significant financial characteristics of a firm. It may be external or internal. The external analysis is performed by creditors, stockholders and investment analysis. The internal analysis is performed by various departments of a firm.

3.3.1. Significance of financial analysis

Financial analysis primarily deals with the interpretation of the data incorporated in the proforma financial statements of a project and the presentation of the data in a form in which it can be utilized for a comparative appraisal of the projects. It is, in effect, concerned with the development of the financial profile of the project. Its purpose is to find out whether the project is attractive enough to secure funds needed for its various constituent activities and once having secured the funds, whether the project will be able to generate enough economic values to achieve the objectives for which it is sought to be implemented. It deals not only with the financial aspects of a project but also with its operational aspects.

Analysis of financial statements has become very significant due to the widespread interest of various parties in the financial results of a company. In recent years, the ownership of capital of most public companies has become broad-based. A number of parties and bodies, including creditors, potential suppliers, and debenture-holders, credit institutions like banks, industrial finance corporations, potential investors, employees, trade unions, important customers, economists, investment analysts, taxation authorities and government have a stake in the financial results of a company. Various people look at the financial statements from various angles. A number of techniques have been developed to undertake analysis of financial statements in order to reach conclusions about the financial health, profitability and efficiency of an enterprise and also to compare an enterprise with other similar undertakings.

3.3.2 Financial AnalysisTechniques

The Financial Analysis, examines the viability of the project from financial or commercial considerations and indicates the return on the investments. Some of the commonly used techniques for financial analysis are as follows.

- Pay-back period.
- Return on Investment (ROI)
- Net Present Value (NPV)
- Profitability Index(PI)/Benefit Cost Ratio
- Internal Rate of Return (IRR)

a) Pay-back Period

This is the simplest of all methods and calculates the time required to recover the initial project investment out of the subsequent cash flow. It is computed by dividing the investment amount by the sum of the annual returns (income – expenditure) until it is equal to the capital cost.

Example-1: (Uniform annual return)

A farmer has invested about Rs. 20000/- in constructing a fish pond and gets annual net return of Rs.5000/- (difference between annual income and expenditure). The pay back period for the project is 4 years (20000/ 5000).

Example-2: (Varying annual return)

In a project Rs.1,00,000/- an initial investment of establishing a horticultural orchard. The annual cash flow is as under.

Table-3.1

Time	Annual Income	Annual Expenditure	Annual Return	Cumulative Return
1st Year	60,000	30,000	30,000	30,000
2nd Year	70,000	30,000	40,000	70,000
3rd Year	85,000	25,000	60,000	1,30,000

Pay-back period = Two and half years

The drawback in this method is that it ignores any return received after the payback period and assumes equal value for the income and expenditure irrespective of the time.

It is also possible that projects with high return on investments beyond the pay-back period may not get the deserved importance i.e., two projects having same pay-back period – one giving no return and the other providing large return after pay-back period will be treated equally, which is logically not correct.

b) Return on Investment (ROI)

The ROI is the annual return as percentage of the initial investment and is computed by dividing the annual return with investment. It is calculation is simple when the return is uniform. For example the ROI of the fish ponds is (5000/ 10000) X 100 = 50%. When the return is not uniform the average of annual returns over a period is used. For horticultural orchard average return is (1,30,000/3) = 43333. ROI = (43333/100000) X 100 = 43.3 %.

Computation of ROI also suffers from similar limitation as of pay-back period. It does not differentiate between two projects one yielding immediate return (lift irrigation project) and another project where return is received after some gestation period say about 2-3 years (developing new variety of crop).

Both the pay-back period and ROI are simple ones and more suited for quick analysis of the projects and sometimes provide inadequate measures of project viability. It is desirable to use these methods in conjunction with other discounted cash flow methods such as Net Present Value (NPV), Internal Rate of Return (IRR) and Benefit-Cost ratio.

Discounted Cash Flow Analysis

The principle of discounting is the reverse of compounding and takes the value of money over time. To understand his let us take an example of compounding first. Assuming return of 10 %, Rs 100 would grow to Rs110/- in the first year and Rs 121 in the second year. In a reverse statement, at a discount rate of 10% the return of Rs.110 in the next year is equivalent to Rs100 at present. In other words the present worth of next years return at a discount rate 10 % is only Rs.90.91 i.e., (100/110) Similarly Rs121 in the second year worth Rs 100/- at present or the present value of a return after two years is Rs. 82.64 (100/121). These values Rs.90.91 and rs.82.64 are known as present value of of future annual return of Rs.100 in first and second year respectively. Mathematically, the formula for computing present value (PV) of a cash flow "C_n" in "nth" year at a discount rate of "d" is as follows;

$PV = C_n / (1+d)^n$

The computed discount factor tables are also available for ready reference. In the financial analysis the present value is computed for both investment and returns. The results are presented in three different measures ie. NPV, B-C Ratio, and IRR.

c) Net Present Value (NPV)

Net Present Value is considered as one of the important measure for deciding the financial viability of a project. The sum of discounted values of the stream of investments in different years of project implementation gives present value of the cost (say C). Similarly sum of discounted returns yields the present value of benefits (say B). The net present value (NPV) of the project is the difference between these two values (B- C). Higher the value of NPV is always desirable for a project.

d) Benefit-Cost Ratio (B-C Ratio) or Profitability Index (PI)

The B-C Ratio also referred as Profitability Index (PI), reflect the profitability of a project and computed as the ratio of total present value of the returns to the total present value of the investments (B/C). Higher the ratio better is the return.

e) Internal Rate of Return (IRR)

Internal Rate of Return (IRR) indicates the limit or the rate of discount at which the project total present value of return (B) equals to total present value of investments (C) i.e. B-C = Zero. In other words it is the discount rate at which the NPV of the project is zero. The IRR is computed by iteration i.e. Computing NPV at different discount rate till the value is nearly zero. It is desirable to have projects with higher IRR.

3.3.3. Utility of financial and accounting statements

Financial statements play a vital role in the internal financial control of an enterprise. These should, therefore, the properly constructed, analyzed and interpreted by executives, bankers, creditors and investors.

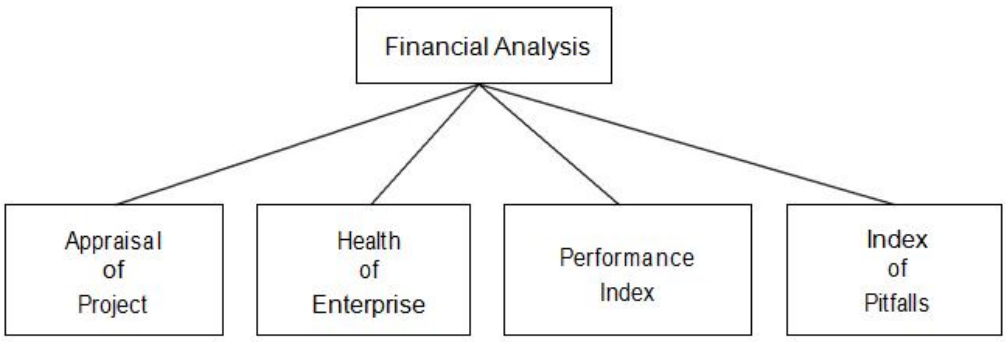

Fig-3.2: Utility of Financial Analysis

The entire future of a company hinges on the manager's ability to decide relevant financial data with a view to planning profit ability moves. Learning to read financial statements is the first essential element in any businessman's attempt to acquire financial management skills. The change in the elitism of stock ownership to broad public ownership has necessitated a concomitant change in the entire process of reporting corporate financial results. The role of management in the matter of preparation of financial statements is to add understanding to these statements, the fairness of which is to be viewed through the eye of the user, while

that of the accountant is to close the communication gap and of the auditor to add credibility to them. For evolving a good economic information system, accounting innovations are of great economic information system. Without these, communication with the financial community would be difficult, the interest of present and future potential investors would not be served, the ability of the company to raise additional capital would be impaired and the government's regulatory measures and policies would not serve the best interest of society. Though a financial statement reveals less than it conceals, it provides the indicators of the enterprise's performance during the year.

3.4 ENVIRONMENTAL ANALYSIS

The performance of a project may not only be influenced by thetechnical and financial factors stated earlier. Other external environmental factors, which may be economical, social or cultural. May have a positive as well. The larger projects may be critically evaluated by lending institutions by taking into consideration the following factors:

1. Employment potential.
2. Utilization of domestically available raw material and other facilities.
3. Development of an industrially backward area as per government policy.
4. Effect of the project on the environment, with particular emphasis on the pollution of water and air that will be caused by it.
5. The arrangements for effective disposal of effluent, as per government policy. Energy conservation devices, etc., employed for the project.

Environmental Impact Assessment (EIA) and the Environmental Impact Statement (EIS) are said to be the instrument through which the environmental management tries to accomplish its objective. The basic premise behind the EIS/ EIA is that no one has any right to use the precious environmental resources resulting in greater loss than gain to society. From this, it follows that the aim of EIS is to seek ways by which the project can proceed without any irreparable losses to environment and minimum losses if any, so that the net effect will be a desirable gain.Environmental Impact Assessment (EIA is defined as, “An activity designed to identify, predict, interpret and communicate information about the impact of an action on man’s health and well-being (including the well-being of ecosystems on which man’s survival depends). In turn, the action is defined to include any engineering project, legislative proposal, policy program, or operational procedure with environmental implications.”

An EIA, therefore, is a study of the probable changes in the various socio-economic and bio-physical attributes of the environment, which result from a proposed action. On the other hand, Environmental Impact statement (EIS) is defined as: A report, based on studies, disclosing the likely or certain environmental consequences of a proposed action, this altering the decision-maker, the public and the government to environmental risks involved; the finding enable better informed decisions to be made, perhaps to reject or defer the proposed action or permit it subject to compliance with specific conditions.

The EIS is a document prepared by an expert agency on the environmental impact of a proposed action/project that significantly affects the quality of environment. The EIS is used mainly as a tool for decision- making. At times, the EIA and EIS are used interchangeably as synonyms. But both are difference between the two is that the EIA is carried-out by the expert agency while the EIS as a tool is given to the decision-makers in different formats. As a matter of fact, the EIS is the outcome of EIA.

3.4.1 Objectives of EIA

1. To identify and describe (in as quantified manner as possible) the Environmental Resources/ values (ER/Vs) or the environmental Attributes (EA) which will be affected by the proposed project, under existing or “with or without project” conditions.
2. To describe, measure and assess the environmental effect that the proposed project will have on the ER/Vs (again, in as quantified manner as possible), including positive effects which enhance ER/Vs as well as the negative effects which impair them. Direct or indirect and short-term or long-term effects are

to be considered. This would also include the description of the specific ways by which the project plan or design will minimize the adverse effects and maximize positive effects.

3. To describe the alternatives to the proposed project which could accomplish the same result but with a different set of environmental effects. Energy generation by thermal, hydel and nuclear would explain the case in point. Further, alternative locations are also considered.

3.4.2 Guidelines on the Scope and Contents of EIA

The following are the accepted points to be covered in an EIA study / report:

1. A description of the project proposed action; a statement of its purpose and a description of all relevant technical details to give a complete understanding of the proposed action, including the kinds of materials, manpower/resources, etc., involved.
2. The relationship of the proposed action to the land-use plans, policies and controls in the affected area or the project- vicinity. It is necessary to gain a complete understanding of the affected environment.
3. The probable impacts of the proposed project on environment are a very important aspect to be considered in details. It is necessary to project the proposed action into the future and to determine the possible impacts on the environmental attributes. The changes are to be quantified wherever possible.
4. Alternatives to the proposed action, including those not within the existing authority/ agency.
5. Any probable adverse environmental effect that cannot be avoided and stating how each avoidable impact will be mitigated.
6. The relationship between local short-term uses of man's environment and thee maintenance of and enhancement of long-term productivity.
7. Any irreversible and irretrievable commitments of resources (including natural, cultural, labor and materials).
8. An indication of what other interests and considerations of government policy or program are through to off-set the adverse effect identified.

3.4.3 Process of EIA

The EIA process makes sure that environmental issues are raised when a project or plan is first discussed and that all concerns are addressed as a project gains momentum through to implementation. Recommendations made by the EIA may necessitate thee re-design of some project components, require further studies, and suggest changes which alter the economic viability of the project or cause a delay in project implementation. To be of most benefit it is essential that an environmental assessment is carried out to determine significant impacts early in the project cycle so that recommendations can be built into the design and cost- benefit analysis without causing major delays or increased design costs. To be effective once implementation has commenced, the EIA should lead to a mechanism whereby adequate monitoring is undertaken to realize environmental management. An important output from the EIA process should be thee delineation of enabling mechanism for such effective management.

The way in which an EIA is carried-out is not rigid: it is a process comprising a series of steps. These steps are outlined below:

a) Screening

b) Scoping

c) Prediction and mitigation

d) Management and monitoring

e) Audit

1) Screening: Screening is the process of deciding on whether an EIA is required. This may be determined by size (e.g., greater than a predetermined surface area of irrigated land that would be affected, more than a

certain percentage or flow to be diverted or more than a certain capital expenditure).Alternatively it may be based on site-specific information. The output from the screening process is often a document called an Initial Environmental Examination or evaluation (IEE). The main conclusion will be a classification of the project according to its likely environmental sensitivity. This will determine whether an EIA is needed and if so to what detail.

2) Scoping: Scoping occurs early in the project cycle at the same time as outline planning and pre-feasibility studies. Scoping is the process of identifying the key environmental issues and is perhaps the most important step in an EIA. Scoping is important for two reasons:

a) So that problems can be pinpointed early allowing mitigating design changes to be made before expensive detailed work is carried out.

b) To ensure that detailed prediction work is only carried-out for important issues. It is not the purpose of an EIA to carry-out exhaustive studies on all environmental impacts for all projects. If key issues are identified and a full EIA considered necessary then the scoping should include terms of reference for these further studies.

3) Predictions and Mitigation: Once the scoping exercise is complete and the major impacts to be studied have been identified, prediction work can start. This stage forms the central part of an EIA. Several major options are likely to have been proposed either at the scoping stage or before and each option may require separate prediction studies. Realistic and affordable mitigating measures cannot be proposed without first estimating the scope of the impacts, which should be in monetary terms wherever possible. It then becomes important to quantify the impact of thee suggested improvements by further prediction work. Clearly, options need to be discarded as soon as their unsuitability can be proved or alternatives shown to be superior in environmental or economic terms, or both. It is also important to test the "without project" scenario.

An important outcome of this stage will be recommendations for mitigating measures. This would be contained in the Environmental Impact Statement. Clearly, the aim will be to introduce measures which minimize any identified adverse impacts and enhance positive impacts. Formal and informal communication links are needed to be established with tams carrying-out feasibility studies so that their work can take proposals into account.

4) Management and Monitoring: The part of the EIS covering monitoring and management is often referred to as the Environmental Action Plan or Environmental management plan. It not only sets-out the mitigation measures needed for environmental management, both in the short and long-term, but also the institutional requirements for implementation. The term 'institutional' is used here in its broadest context to encompass relationships:

a) Established by law between individuals and government,

b) Between individuals and groups involved in economic transactions,

c) Developed to articulate legal, financial and administrative links among public agencies

d) Motivated by socio-psychological stimuli among groups and individuals.

The purpose of monitoring is to compare predicted and actual impacts, particularly if the impacts are either very important or the scale of the impact cannot be very accurately predicted. The results of monitoring can be used to manage the environment, particularly to highlight problems early so that action can be taken. The range of parameters requiring monitoring may be broad or narrow and will be dictated by the 'prediction and mitigation' stag of the EIA. Typical areas of concern where monitoring is weak are: water quality, both inflow and outflow; stress in sensitive ecosystems; soil fertility; water related health hazards; equity of water distributions; groundwater levels.

5) Auditing: In order to capitalize on the experience and knowledge gained, the last stage of an EIA is to carry-out an Environmental Audit sometime after completion of the project or implementation of a program. It will therefore usually be done by a separate team of specialists to that working on the bulk of the EIA. The audit should include an analysis of the technical, procedural and decision- making aspects of the EIA.

Technical aspects include

a) The adequacy of the base-line studies,

b) The accuracy of predictions and the suitability of mitigation measures.

Procedural aspects include:

a) The efficiency of the procedure,

b) The fairness of the public involvement measures, and

c) The degree of coordination of roles and responsibilities.

Decision-making aspects include:

a) The utility of the process for decision–making, and

b) The implications for developments.

3.4.4 Some Major Issue in the Preparation of EIA

The following are the major issues reported to be encountered commonly while conducting and preparing the EIS/EIA. Some of the issues cannot be resolved. In the absence of better alternatives, the analyst has to accept the issues as they are:

1) Determining the Environmental Impact: this is the central theme in any EIS/EIA. It is a very complex process. At the out-set, a distinction has to be made between the environmental impact and the changes in environmental attributes. Our interest is on the "impacts" and not on the 'changes', which normally take place even without the project. The determination of environmental impacts involves:

a) Identification of impacts on environmental attributes or the ER/Vs

b) Measurement of impacts on attributes, and

c) Aggregation of impacts on attributes to reflect the total impact on environment.

2) With and without the Project: The environmental impacts are measurement of attributes with and without the project or activity at a given point in time. But thee changes in the attributes take place over time without thee activity.

Therefore, the impact must be measured in terms of "net" change in the attribute at a given point in time.

3) Identifying the Impacts: The number of attributes to be practically infinite because any characteristic of the environment is considered to be attribute. Therefore, they have to be reduced to manageable numbers. Thus, duplicative, redundant, difficult to measure and obscure attributes may be eliminated in favor of those that are more tractable. This implies that some attributes, which are difficult to measure or conceptualize, may still remain to be examined. In this case, bias and subjectivity are likely to be crept in.

4) Characteristics of the Base: Conditions to the Activity: The nature of the impact is determined by the conditions of the environment existing before the project. The assessment of the characteristics of the bas is a critical factor.

5) Role of Attributes: Though thee impacts are considered to be the effects on the definite discrete attributes of the environment, the actual impacts are not correspondingly well categorized. Nature does not necessary respect man's discrete categories. Rather, the actual impact may be the effect of varying severity on a variety of interrelated attributes. The issue is one of identifying and assessing the cause condition effect in order to work-out the remedial measures.

6) Measurement of Impact: Ideally, all impacts must be translatable into common units. However, this is not possible because of the difficulty in defining impacts in common units (e.g., on income and on water quality). In addition, the quantification of some impacts may be beyond the state of the art.

7) Aggregation Problem: After measuring the project impacts on various individual attributes or ER/Vs, one encounters the problem of how to aggregate all impacts (quantitative), thus assessed to arrive at a single composite measure to represent the "total activity impact'. This would involve expressing the various impact measures in common units, which is very difficult. Some use a weighting procedure to accomplish this,

which is again subjective. There is another associated problem of summing-up and comparing with the impact of an alternative activity.

8) Secondary Impacts; Secondary or indirect impacts on environment should also be considered particularly in relation to the infrastructure investments that stimulate or induce secondary effects in the form of associated investments and changed patterns of social and economic activity. Such induced growth brings significant changes in the natural conditions. Similarly, there can be significant secondary impacts in the bio-physical environment.

9) Cumulative Impact: Here, accumulation refers to thee similar activities spread over in an environmental setting hotels, beach, resorts, surface or underground mines, industrial estates, etc. A single individual activity may produce a negligible effect on environment. However, a series of similar activities may produce significant cumulative effects. Therefore, it is suggested to prepare an Environmental Impact Assessment (EIA) on broad programs rather than on a series of component actions (e.g., industrial estates, mining sector, tourism industry, etc.). Or, alternatively, one can prepare an EIA for a particular geographical area where a series of similar activities are located (e.g., mining areas, coastal line for beach resorts, etc.).

10) Reporting Finding: The result should be displayed in such a way that it makes easy and clear to comprehend the total impacts of an activity from a brief review. It is suggested to display the impacts on a summary sheet in a matrix from.

3.4.5 Limitations of EIA

Despite the success of EIA as a policy approach, in practice there have been two important shortcomings in its use as a planning tool in the Asia-Pacific region:

1) Severe problems have often arisen with the objectivity of EIA reports,

2) Preparatory work by regulatory authorities, primarily prior agreements on the scope or terms of reference for EIAs, has often missed opportunities for directing sound analysis towards the major environmental problems or opportunities associated with a given project.

Though RIAs are meant to improve project design and decision-making, this is often overlooked in practice. They too frequently are seen only as a stumbling block to investment. Furthermore, it has become common for oversight of the EIA process to be vested in the same line department responsible for promoting development of that sector. This often places environmental staff at odds with others in the department whose principal objective is to encourage investment in, e.g., mining, agriculture, or transportation. Project proponents-conduct EIAs, and it is easy to see that such groups may be reluctant to severely criticize project design if thee proponent is paying their bills and government oversight is weak.

The second major shortcoming in the application of EIA policies in the Asia-pacific region relates to their scope of analysis. The most common methods employed are based on a checklist approach wherein a pre-set range of potentially negative environmental impacts-sometimes refined according to the sector involved-is reviewed and the likelihood of adverse outcomes assessed .EIAs rarely attempt to fully quantify the environmental effects of project-induced change (e.g., the numbers of people with specific types of adverse health conditions resulting from air pollution or the reductions in crop yields due to erosion).They almost never describe these impacts in monetary terms.

3.5. SELF ASSESSMENT QUESTIONS

1. What aspects are considered in Technical Analysis.Explain?
2. Discuss the different aspects to be studied for making Financial Analysis of the Project?
3. What Factors have a bearing on choice of Technology?
4. What Considerations Influence the Choice of Location of the Project?
5. Discuss the Role of Environmental Analysis in Project Study?

Chapter-4
Market and Demand Analysis

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- Discuss the type of information required for market and demand analysis.
- Explain the various sources of secondary information.
- Describe the procedure of conducting market survey.
- Explain the different methods of demand forecasting.
- Deal with uncertainties in demand forecasting.

4.1. INTRODUCTION

The exercise of project appraisal often begins with an estimation of the size of the market. Before a detailed study of a project is undertaken, it is necessary to know, at least roughly, the size of the market because the viability of the project depends critically on whether the anticipated level of sales exceeds a certain volume. Many a project has been abandoned because preliminary appraisal revealed a market of inadequate size. This chapter is divided into the following five sections dealing with various aspects of market and demand analysis.

- Information required for market and demand analysis
- Secondary sources of information
- Market survey
- Demand forecasting
- Uncertainties in demand forecasting

4.2. INFORMATION REQUIRED FOR MARKET AND DEMAND ANALYSIS

The principal types of information required for market and demand analysis relate to-

(i) Effective demand in the past and present:

To guage the effective demand in the past and present, the starting point typically is apparent consumption which is defined as:

Production + Imports – exports – changes in stock level

In a competitive market, effective demand and apparent consumption are equal. However, in most of the developing countries, where competitive markets do not exist for a variety of products due to exchange restrictions and controls on production and distribution, the figure of apparent consumption may have to be adjusted for market imperfections. Admittedly, this is often a difficult task.

(ii) Breakdown of demand

To get a deeper insight into the nature of demand, the aggregate (total) market demand may be broken down into demand for different segments of the market. Market segments may be defined by (i) nature of product, (ii) consumer group, and (iii) geographical division.

- **Nature of product —** One generic name often subsumes many different products: steel covers sections, rolled products, and various semi-finished products; commercial vehicles cover trucks and buses of various capacities etc.
- **Consumer groups —** Consumers of a product may be divided into industrial consumers and domestic consumers. Industrial consumers may be sub-divided industry-wise. Domestic consumers may be further divided into different income groups.
- **Geographical division —** A geographical breakdown of consumers, particularly for products which have a small value-to-weight relationship and products which require regular, efficient after-sales service is helpful.

(iii) Price

Price statistics must be gathered along with statistics pertaining to physical quantities. It may be helpful to distinguish the following types of prices: (i) manufacturer's price quoted as FOB (free on board) price or CIF (cost, insurance, and freight) price, (ii) landed price for imported goods, (iii) average wholesale price, and (iv) average retail price.

(iv) Methods of distribution and sales promotion

The method of distribution may vary with the nature of product. Capital goods, industrial raw materials or intermediates, and consumer products tend to have differing distribution channels. Further, for a given product, distribution methods may vary. Likewise, methods used for sales promotion (advertising, discounts, gift schemes, etc.) may vary from product to product. The methods of distribution and sales promotion employed presently and their rationale must be studied carefully.

(v) Consumers

Two categories of information about the consumers may be required: demographic and sociological information, and attitudinal information. Under the first category, information on the following is required: age, sex, income, avocation, residence, religion, customs, beliefs, and social background. Under the second category, information on the following is required- preferences, intentions, attitudes, habits, and responses.

(vi) Governmental policy

The role of government in influencing the demand and market for a product may be significant. Governmental plans, policies, legislations, and fiats which have a bearing on the market and demand of the product under examination should be studied. These are reflected in: production targets in national plans, import and export trade controls, import duties, export incentives, excise duties, sales tax, industrial licensing, preferential purchases, credit controls, financial regulations, and subsidies/penalties of various kinds.

(vii) Supply and competition

It is necessary to know the existing sources of supply and whether they are foreign or domestic. For domestic sources of supply information along the following lines may be gathered: location, present production capacity, planned expansion, capacity utilization level, bottlenecks in production, and cost structure. Competition from substitutes and near-substitutes should be examined because almost any good may be replaced by some other good as a result of changes in relative prices, quality, availability, promotional strategies, consumer taste, and other factors.

4.3. SECONDARY SOURCES OF INFORMATION

The information required for demand and market analysis is usually obtained partly from secondary sources and partly through a market survey. In marketing research, a distinction is usually made between primary information and secondary information. Primary information refers to information which is collected for the first time to meet the specific purpose on hand; secondary information, in contrast, is information which is in existence and which has been gathered in some other context. Secondary information provides the base and the starting point for market and demand analysis. It indicates what is known and often provides leads and cues for further investigation.

General secondary sources of information

The important sources of secondary information useful for market and demand analysis in India are mentioned below-

- **Census of India —** A decennial publication of the Government of India, it provides information on population, demographic characteristics, household size and composition, and maps.
- **National sample survey reports —** Issued from time to time by the Cabinet Secretariat, Government of India, these reports present information on various economic and social aspects like patterns of consumption, distribution of households by the size of consumer expenditure, distribution of industries, and characteristics of the economically active population. The information presented in these reports is obtained from a nationally representative sample by the interview method.
- **Plan reports —** Issued by the Planning Commission usually at the beginning, middle, and end of the five-year plans, these reports and documents provide a wealth of information on plan proposals, physical and financial targets, actual outlays, accomplishments, etc.
- **Statistical abstract of the Indian Union —** An annual publication of the Central Statistical Organisation, it provides, inter alia, demographic information, estimates of national income, and agricultural and industrial statistics.
- **India Year Book —** An annual publication of the Ministry of Information and Broadcasting, it provides wide ranging information on economic and other aspects.
- **Other publications —** Among other publications mention may be made of the following: (i) Weekly Bulletin of Industrial Licenses, Import Licenses and Export Licenses (published by the Government of India); (ii) studies of the economic division of the State Trading Corporation; (iii) commodity reports and

other studies of the Indian institute of Foreign Trade; (iv) studies and reports of export promotion councils and commodity boards; and (v) Annual report on Currency and Finance (issued by Reserve Bank of India).

Evaluation of secondary information

While secondary information is available economically and readily (provided the market analyst is able to locate it) its reliability, accuracy, and relevance for the purpose under consideration must be carefully examined. The market analyst should seek to know (i) Who gathered the information? What was the objective? (ii) When was information gathered? When was it published? (iii) How representative was the period for which information was gathered? (iv) Have the terms in the study been carefully and unambiguously gathered? (v) What was the target population? (vi) How was the sample chosen? (vii) How representative was the sample? (viii) How satisfactory was the process of information gathering? (ix) What was the degree of sampling bias and non-response bias in the information gathered? (x) What was the degree of misrepresentation by respondents? (xi) How properly was the information by respondents? (xii) Was statistical analysis properly applied?

4.4. MARKET SURVEY

Secondary information, though useful, often does not provide a comprehensive basis for demand and market analysis. It needs to be supplemented with primary information gathered through a market survey, specific for the project being appraised.

The market survey may be a census survey or a sample survey. In a census survey the entire population is covered. (The word 'population' is used here in a particular sense. It refers to the totality of all units under consideration in a specific study. Examples are- all industries using milling machines, all readers of the Economic Times). Census surveys are employed principally for intermediate goods and investment goods when such goods are used by a small number of firms. In other cases, a census survey is prohibitively costly and may also be infeasible. For example, it would be inordinately expensive to cover every user of Lifebuoy or every person in the income bracket Rs. 10,000-Rs. 15,000.

Due to the above mentioned limitations of the census survey, the market survey, in practice, is typically a sample survey. In such a survey a sample of the population is contacted/observed and relevant information is gathered. On the basis of such information, inferences about the population may be drawn. The information sought in a market survey may relate to one or more of the following (i) Total demand and rate of growth of demand; (ii) Demand in different segments of the market; (iii) Income and price elasticity of demand; (iv) Motives for buying; (v) Purchasing plans and intentions; (vi) Satisfaction with existing products; (vii) Unsatisfied needs; (viii) Attitudes toward various products (ix) Distributive trade practices and preferences; (x) Socio-economic characteristics of buyers.

Steps in a sample survey

Typically, a sample survey consists of the following steps

- **Definition of the target population —** In defining the target population the important terms should be carefully and unambiguously defined. The target population may be divided into various segments which may have differing characteristics. For example, all television owners may be divided into three to four income brackets.
- **Selection of sampling scheme and sample size —** There are several sampling schemes- simple random sampling, cluster sampling, sequential sampling, stratified sampling, systematic sampling, and non-probability sampling. Each scheme has its advantages and limitations. The sample size, other things being equal, has a bearing on the reliability of the estimates — the larger the sample size, the greater the reliability.
- **Preparation of the questionnaire —** The questionnaire is the principal instrument for eliciting information from the sample of the respondents. The effectiveness of the questionnaire as a device for eliciting the desired information depends on its length, the types of questions, and the wording of questions. Developing the questionnaire requires thorough understanding of the product/service and its usage, imagination, insights into human behaviour, appreciation of subtle linguistic nuances, and

familiarity with the tools of descriptive and inferential statistics to be used later for analysis. It also requires knowledge of psychological scaling techniques if the same are employed for obtaining information relating to attitudes, motivations, and psychological traits. Industry and trade market surveys, in comparison to consumer surveys, generally involve more technical and specialized questions. Since the quality of the questionnaire has an important bearing on the results of market survey, the questionnaire should be tried out in a pilot survey and modified in the light of problems/difficulties noted. Recruiting and training of field investigators must be planned well since it can be time-consuming. Great care must be taken for recruiting the right kinds of investigators and imparting the proper kind of training to them. Investigators involved in industry and trade market survey need intimate knowledge of the product and technical background particularly for products based on sophisticated technologies.

- **Obtaining information as per the questionnaire from the sample of respondents —** Respondents may be interviewed personally, telephonically or by mail for obtaining information. Personal interviews ensure a high rate of response. They are, however, expensive and likely to result in biased responses because of the presence of the interviewer. Mail surveys are economical and evoke fairly candid responses. The response rate, however, is often low. Telephonic interviews, common in western countries, have very limited applicability in India because telephone tariffs are high and telephone connections few.
- **Scrutiny of information gathered —** Information gathered should be thoroughly scrutinized to eliminate data which is internally inconsistent and which is of dubious validity. For example, a respondent with a high income and large family may say that he lives in a one-room tenement. Such information, probably inaccurate, should be deleted. Sometimes data inconsistencies may be revealed only after some analysis.
- **Analysis and interpretation of data —** Data gathered in the survey needs to be analyzed and interpreted with care and imagination. After tabulating it as per a plan of analysis, suitable statistical investigation may be conducted, wherever possible and necessary. For purposes of statistical analysis, a variety of methods are available. They may be divided into two broad categories: parametric methods and non-parametric methods. Parametric methods assume that the variable or attribute under study conforms to some known distribution. Non-parametric methods do not presuppose any particular distribution.

Results of data based on sample survey will have to be extrapolated for the target population. For this purpose, appropriate inflatory factors, based on the ratio of the size of the target population and the size of the sample studied, will have be to be used. The statistical analysis of data should be directed by a person who has a good background in statistics as well as economics. It may be emphasized that the results of the market survey can be vitiated by- (i) non-representativeness of the sample, (ii) imprecision and inadequacies in the questions, (iii) failure of the respondents to comprehend the questions, (iv) deliberate distortions in the answers given by the respondents, (v) inept handling of the interviews by the investigators, (vi) cheating on the part of the investigators, (vii) slipshod scrutiny of data, and (viii) incorrect and inappropriate analysis and interpretation of data.

4.5. DEMAND FORECASTING

After gathering information about various aspects of the market and demand from primary and secondary sources, an attempt may be made to estimate future demand. Several methods are available for demand forecasting. The important ones are—

(i) Trend projection method

It consists of (i) determining the trend of consumption by analyzing past consumption statistics, and (ii) projecting future consumption by extrapolating the trend. The trend of consumption may be represented by one of the following relationships:

Linear Relationship: $Yt = a + bt$ … (1)

Exponential Relationship: $Yt = aebt$ … (2)

On logarithmic transformation this becomes:

$\log Yt = \log a + bt$

Polynomial Relationship: $Yt = a0 + a1t + a2t2 + \ldots + antn$ … (3)

Cobb Douglas Relationship: $Yt = atb$ … (4)

On logarithmic transformation this becomes:

$\log Yt = \log a + b \log t$

In the above equations Yt represents demand for year t, t is the time variable, a, b and aj's are constants.

Out of the above relationships the most commonly used relationship is-

$Yt = a + bt$

This relationship may be estimated by using one of the following methods: (i) visual curve fitting method, and (ii) least squares method.

Evaluation — The basic assumption underlying the trend projection method is that the factors which influenced the behaviour of consumption in the past would continue to influence the behaviour of consumption in the future. This hypothesis is sometimes referred to as the hypothesis of "mutually compensating effects". Clearly, this is a deterministic hypothesis of questionable validity. Notwithstanding this weakness, the trend projection method is used popularly in practice. Often a starting point in the forecasting exercise, it is likely to be relied upon heavily when no other viable method seems available. The ease with which it can be applied may induce a sense of complacency.

(ii) Consumption level method

Useful for a product which is directly consumed, this method estimates consumption level on the basis of elasticity coefficients, the important ones being the income elasticity of demand and the price elasticity of demand.

Income elasticity of demand — The income elasticity of demand reflects the responsiveness of demand to variations in income. It is measured as follows:

$$E_1 = \frac{Q_2 - Q_1}{I_2 - I_1} \times \frac{I_1 + I_2}{Q_2 + Q_1}$$

Where

- E1 = income elasticity of demand
- Q1 = quantity demanded in the base year
- Q2 = quantity demanded in the following year l1 = income level in the base year
- l2 = income level in the following year

Example — The following information is available on quantity demanded and income level: Q1 = 50, Q2 = 55, I1 = 1,000, and I2 = 1,020. The income elasticity of demand is

$$E1 = \frac{55 - 50}{1{,}020 - 1{,}000} \times \frac{1{,}000 + 1{,}020}{55 + 50} = 4.81$$

The information on income elasticity of demand along with projected income may be used to obtain a demand forecast. To illustrate, suppose the present per capita annual demand for paper is 1 kg and the present per capita annual income is Rs. 1,2000. The income elasticity of demand for paper is 2. The projected per capita annual income three years hence is expected to be 10 per cent higher than what it is now. The projected per capita demand for paper three years hence will be-

Present per capita income	1 + per capital change in income level	income elasticity of demand

$= (1)\ (1 + 0.10 \times 2) = 1.2$ kg.

The aggregate demand projection for paper will simply be

Projected per capita demand × Projected population

The income elasticity of demand differs from one product to another. Further, for a given product, it tends to vary from one income group to another and from one region to another. Hence, wherever possible, disaggregative analysis should be attempted. Price elasticity of demand. The price elasticity of demand measures the responsiveness of demand to variations in price. It is defined as:

$$Ep = \frac{Q2 - Q1}{P2 - P1} \times \frac{P1 + P2}{Q2 + Q1}$$

Where,

- Ep = price elasticity of demand
- Q1 = quantity demanded in the base year
- Q2 = quantity demanded in the following year
- P1 = price per unit in the base year
- P2 = price per unit in the following year

Example: The following information is available about a certain product: P1 = Rs. 600, Q1 = 10,000, P2 = Rs. 800, Q2 = 9,000. The price elasticity of demand is:

$$Ep = \frac{9000 - 10{,}000}{800 - 500} \times \frac{600 + 800}{9{,}000 + 10{,}000} = -0.37$$

The price elasticity of demand is a useful tool in demand analysis. The future volume of demand may be estimated on the basis of the price elasticity coefficient and expected price change. The price elasticity coefficient may also be used to study the impact of variable price that may obtain in future on the economic viability of the project. In using the price elasticity measure, however, the following considerations should be borne in mind: (i) the price elasticity coefficient is applicable to only small variations. (ii) The price elasticity measure is based on the assumption that the structure and behaviour remain constant.

(iii) End use method

Suitable for estimating the demand for intermediate products, the end use method, also referred to as the consumption coefficient method involves the following steps:

- Identify the possible uses of the product.
- Define the consumption coefficient of the product for various uses.
- Project the output levels for the consuming industries.
- Derive the demand for the product.

This method may be illustrated with an example. A certain industrial chemical is used by four industries, Alpha, Beta, Gamma, and Kappa. The consumption coefficients for these industries, the projected output levels for these industries for the year X, and the projected demand are shown in -Table 4.1

Table-4.1

	Consumption coefficient*	**Projected output in Year X**	**Projected demand in Year X**
Alpha	2.0	10,000	20,000
Beta	1.2	15,000	18,000
Kappa	0.8	20,000	16,000
Gamma	0.5	30,000	15,000

Total = 69,000 tones

*This is expressed in tones per unit of output of the consuming industry.

As is clear from the foregoing discussion, the key inputs required for the application of the end-use method are— (i) projected output levels of consuming industries (units), and (ii) consumption coefficients. It may be difficult to estimate the projected output levels of consuming industries (units). More important, the consumption coefficients may vary from one period to another in the wake of technological changes and improvements in the methods of manufacturing. Hence, the end-use method should be used judiciously.

(iv) Leading Indicator Method

Leading indicators are variables which change ahead of other variables, the lagging variables. Hence, observed changes in leading indicators may be used to predict the changes in lagging variables. For example, the change in the level of urbanization a leading indicator may be used to predict the change in the demand for air conditioners a lagging variable. Two basic steps are involved in using the leading indicator method: (i) First, identify the appropriate leading indicator(s). (ii) Second, establish the relationship between the leading indicator(s) and the variable to be forecast. The principal merit of this method is that it does not require a forecast of an explanatory variable. It, however, is characterized by certain problems. (i) It may be difficult to find an appropriate leading indicator(s). (ii) The lead-lag relationship may not remain stable over time. In view of these problems this method has limited use.

(v) Econometric method

An econometric model is a mathematical representation of economic relationship/s derived from economic theory. The primary objective of econometric analysis is to forecast the future behaviour of the economic variables incorporated in the model. Two types of econometric models are employed: the single equation model and the simultaneous equation model. The single equation model assumes that one variable, the dependent variable (also referred to as the explained variable), is influenced by one or more independent variables (also referred to as the explanatory variables). In other words, one-way causality is postulated. An example of the single equation model is given below:

$Dt = a0 + a1Pt + a2Nt$

Where,

- Dt = demand for a certain product in year t.
- Pt = price for the product in year t.
- Nt = income in year t.

The simultaneous equation model portrays economic relationships in terms of two or more equations. Consider a highly simplified three-equation econometric model of Indian economy.

$GNPt = Gt + It + Ct$ … (5)

$It = a0 + a1\ GNPt$ … (6)

$Ct = b0 + b1\ GNPt$ … (7)

Where

- GNPt = gross national product for year t
- Gt = governmental purchases for year t
- It = gross investment for year t
- Ct = consumption for year t

In the above model, Eq. (5) is just a definitional equation which says that the gross national product is equal to the sum of government purchases, gross investment and consumption. Eq. (6) postulates that investment is a linear function of gross national product; Eq. (7) posits that consumption is a linear function of gross national product.

The construction and use of an econometric model involves four broad steps:

- **Specification —** This refers to the expression of an economic relationship in mathematical form. Equation (6), for example, posits that investments are a linear function of gross national product.

- **Estimation —** This involves the determination of the parameter values and other statistics by a suitable method. The principal methods of estimation are the least squares method and the maximum likelihood method, the former being the most popular method in practice.
- **Verification —** This step is concerned with accepting or rejecting the specification as a reasonable approximation to truth on the basis of the results of estimation and appropriate statistical tests applied to them.
- **Prediction —** This involves projection of the value of the explained variable(s).
- **Evaluation —** The econometric method offers certain advantages- (i) The process of econometric analysis sharpens the understanding of complex cause-effect relationships, (ii) the econometric model provides a basis for testing assumptions and for judging how sensitive the results are to changes in assumptions.

The limitations of the econometric method are— (i) it is expensive and data-demanding. (ii) to forecast the behaviour of the dependent variable, one needs the projected values of independent variable (s). The difficulty in obtaining these may be the main limiting factor in employing econometric method for forecasting purposes. Market penetration for the product— Once a reasonably good handle over the aggregate demand is obtained, the next logical question is: What will be the likely demand for the product of the project under examination? The answer to this question depends on—

- Aggregate potential supply
- Nature of competition
- Consumer preferences
- Sales promotion efforts

If the aggregate potential domestic supply is likely to be significantly less than the aggregate potential domestic demand, the demand for the product of the project under examination is likely to be very strong, provided liberal imports which may hurt domestic manufacturers are not allowed.

4.6. UNCERTAINTIES IN DEMAND FORECASTING

Demand forecasts are subject to error and uncertainty which arise from three principal sources:

(i) Data about past and present market

The analysis of past and present market, which serves as the springboard for the projection exercise, may be vitiated by the following inadequacies of data:

- **Lack of standardization —** Data pertaining to market features like product, price, quantity, cost, income etc. may not reflect uniform concepts and measures.
- **Few observations —** Not enough observations may be available to conduct meaningful analysis.
- **Influence of abnormal factors —** Some of the observations may be influenced by abnormal factors like war or natural calamity.

(ii) Methods of forecasting

- Methods used for demand forecasting are characterized by limitations.
- **Inability to handle unquantifiable factors —** Most of the forecasting methods, quantitative in nature, cannot handle unquantifiable factors which sometimes can be of immense significance.
- **Unrealistic assumptions —** Each forecasting method is based on certain assumptions. For example, the trend projection method is based on the 'mutually compensation effects' premise and the end-use method is based on the constancy of technical coefficients. Uncertainty arises when the assumptions underlying the chosen method tend to be unrealistic and erroneous.

- **Excessive data requirement —** In general, the more advanced a method, the greater the data requirement. For example, to use an econometric model one has to forecast the future values of explanatory variables in order to project the explained variable. Clearly, predicting the future value of explanatory variables is a difficult and uncertain exercise.

(iii) Environmental changes

The environment in which a business functions is characterized by numerous uncertainties. The important sources of uncertainty are mentioned below:

- **Technological change —** This is a very important but hard-to-predict factor which influences business prospects. A technological advancement may create a new product which performs the same function more efficiently and economically, thereby cutting into the market for the existing product. For example, electronic watches have encroached on the market for mechanical watches.
- **Shift in governmental policy—** In India, governmental regulation of business is extensive. Changes in governmental policy, which may be difficult to anticipate, may have a telling effect on business environment, e.g. granting of licenses to new companies, particularly foreign companies, may alter the market situation significantly.; banning the import of a certain product may create a sheltered market for the existing producers; liberalizing the import of some product may lead to stiff competition in the market place; relaxation of price and distribution controls may widen the market considerably.
- **Developments on the international scene —** Developments on the international scene may have a profound effect on industries. The most classic example of recent times is the OPEC price hike, which led to near-stagnation in the Indian automobile industry.
- **Discovery of new sources of raw material —** Discovery of new sources of raw materials, particularly hydrocarbons, can have a significant impact on the market situation of several products.
- **Vagaries of monsoon —** Monsoon, which plays an important role in the Indian economy, is somewhat unpredictable. The behaviour of monsoon influences, directly or indirectly, the demand for a wise range of products.

4.7. COPING WITH UNCERTAINTIES

Given the uncertainties in demand forecasting, adequate efforts, along the following lines may be made to cope with uncertainties.

- Conduct analysis with data based on uniform and standard definitions.
- In identifying trends, coefficients, and relationships, ignore the abnormal or out-of-the-ordinary observations.
- Critically evaluate the assumptions of the forecasting methods and choose a method which is appropriate to the situation.
- Adjust the projections derived from quantitative analysis in the light of a due consideration of unquantifiable, but significant influences.
- Monitor the environment imaginatively to identify important changes.
- Consider likely alternative scenarios and their impact on market and competition.
- Conduct sensitivity analysis to assess the impact on the size of demand for unfavourable and favourable variations of the determining factors from their most likely levels.

4.8. SELF ASSESSMENT QUESTIONS

1. What types of information are required for market and demand analysis?
2. Discuss the steps involved in constructing and using an econometric model?
3. What are the sources of uncertainties in demand forecasting? Discuss them?
4. “Often secondary information is not adequate for market and demand analysis”. Comment?
5. Discuss the uncertainties in demand forecasting?

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Chapter-5
Project Formulation and Life Cycle

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To know the Characteristics and objectives of a project
- Explain the Steps in project preparation.
- Describe the various aspects of project formulation/ preparation.
- Explain the stages in Project life cycle
- To know how to Planning Time Scales

5.1. MEANING

Project is a specific investment activity with a specific starting and an ending point, intended to create capital assets that produce benefits over an extended period of time. Project is a combination of human and non-human resources pooled together in a temporary organization to achieve a specific purpose. Project is an "ONESHOT", time limited, member directed, major undertaking, requiring the commitment of varied skills and resources.

5.2. CHARACTERISTICS OF A PROJECT

1. It is non-routine, non-repetitive undertaking often plagued with uncertainties.
2. It involves coordination of the efforts of persons drawn from different departments and contributions of outside agencies and
3. The relationship in a project setting is dynamic, temporary and flexible.

Project objectives and policies

Well defined objectives and policies to be finalized before starting of a project. It serves a framework for the decisions to be made by the project manager. A clear articulation of the priorities of management will enable the project manager to take appropriate actions.

5.3. STEPS IN PROJECT PREPARATION:

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. Project appraisal

Feasibility analysis

It is the first stage in developing a project. Here through examination of pre-investment possibilities are made. It is important to design the future course of the project. Internal and external constraints should be studied in this stage.

Techno – economic analysis

Here demand potential and right technology is identified. Optimum size of the project, methodology, market share, researches and alternative technology are to be identified.

Project design and network analysis

In this stage evaluation of time and resources should be done. It studies the interrelationship of the activities it is the basis for development of financial and cost benefit analysis of the project.

Input analysis

Quantity and quality of input analysis during the construction phase and subsequent phases are analyzed.

Financial analysis

It involves project cost, estimation of the project operating cost and estimation of project fund requirement. Comparison of other investment alternative was done. Uncertainties should be accounted. Success depends on reliable data used in the project.

Social cost benefits analysis

It is very important in view of what is the benefit to the society / country in terms of employment, health and education. Project is considered if

- Technical configuration is fully defined.
- Techno-economic viability of the project is appraised and approved.

- The cost estimate is found.
- Financial arrangement has been made.
- Pre project activities have been completed and „zero data" is fixed.

5.4. ASPECTS OF PROJECT FORMULATION/ PREPARATION

1. Technical Aspects
2. Institutional/ Managerial and Administrative Aspects
3. Organizational Aspects
4. Social and Commercial Aspects
5. Financial Aspects
6. Economic Aspects

1. Technical Aspects

The technical appraisal of proposed project should be done by the competent technical staff and it should not be done in hurry. For instance the technical appraisal of proposed minor irrigation project should contain aspects such as the rate of recharge of underground water, the number of wells to be sunk in the area including existing wells, spacing/location of new wells, depth up to which wells are to be sunk, deep/shallow wells required, suitability of underground water for irrigation purpose, the cropping pattern, season-wise discharge of water from the well, etc. The technical analysis may also determine the potential yield in the project area, the coefficient of production, etc along with the marketing and storage facilities required for the successful operation of the project and the processing system needed.

2. Institutional/ Managerial and Administrative

To avoid opposition, the local institutions may also be duly involved right from planning to implementation levels. All concerned agencies/institutions should have an opportunity to comment upon the proposed project and their views may be fully incorporated. Ample provisions for managers and supervisors for getting latest information about the progress of project, special monitoring staff and training arrangements needed may also be looked into. The managerial ability of existing staff may be assessed before making huge investments.

3. Organizational Aspects

Organizations refer to the process of putting the priorities in an orderly form. Prepare the organizational hierarchy of the implementing agency.

The availability of staff at various cadres, demarcation of authority and linking of authority and responsibility, etc, are expected to be dealt with, under this aspect.

4. Social and Commercial Aspects

A proposed rural development project, besides employment and income generation also considers the provisions made for improved rural health services, better domestic water supplies, increased educational opportunities especially for rural women and children, etc. Moreover the project sites may be chosen in such a way that it should have notable scenic value and/or preserving the unique wildlife habitats. The backward and forward linkages of proposed project such as the supply and demand relationships pertaining to output, the credit requirements for marketing input and output, timely as well as quality supplies of modern inputs to adopt new technology/cropping patterns, an efficient marketing channel for supply of inputs and the procurements of equipment and supplies should also be examined. Besides, the supplies may be made not only in time but at fair price and with proper specifications.

5. Financial Aspects

The financial aspects deal primarily with sources of raising financial assistance and terms and conditions of obtaining finance from the credit agencies. The implementing agency should be in a position to estimate financial requirements and anticipated returns through farm planning and budgeting. Once the incremental income is arrived at, the repayment capacity duly giving considerations/margins for risk and uncertainty can be worked out.

6. Economic Aspects

The economic analysis is directed towards determining whether the project is likely to contribute significantly to the development of economy as a whole. The point of merit is to whom the project is going to benefit i.e. to one section of society or the entire area of the project. The indirect effect like, the income distribution, needs to be assessed. Under income distribution, the purpose is to know whether income inequalities are going to be narrowed down or widening up as a result of proposed projects. Overall it is expected from the project to bring largest contribution to the national economy.

5.5. PROJECT LIFE CYCLE

In general we can define Project Cycle Management as a tool that describes the management activities and decision making procedures used during the life-cycle of a project. The project cycle follows the life of a project, from the initial idea through its completion. It provides a structure to ensure that stakeholders are consulted, and defines the key decision, information requirements and responsibilities at each phase so that informed decision can be made at each phase in the life of the project.

A project is not a one shot activity. Even a shooting star has a time and life span. Project lifecycle is spread over a period of time. There is an unavoidable gestation period for the complex of activities involved to attain the objectives in view. This gestation period, however, varies from project to project but it is possible to describe, in general term, the time phasing of project planning activities common to most projects. The principal stages in the life of a project are:

- Identification
- Initial formulation
- Evaluation (selection or rejection)
- Final formulation (or selection)
- Implementation
- Completion and operation

Development projects are expressly designed to solve the varied problems of the economics whether in the short or long run. The surveys or in depth studies would locate the problems and the project planner will have to identify the projects that would solve the problems most effectively. At this stage, we are concerned with the kind of action and type of project that would be required in rather broad term. In other words the surveys and studies will give us ideas and throw up suggestions which would be worked out in detail later and then evaluated objectively before being accepted for implementation.

What types of surveys and studies are to be undertaken? The current socio-political economic situation has to be critically assessed. It will also be necessary to review it in its historical perspective necessitating the undertaking of a survey of the behaviour and growth of the economy during the preceding decades. On the basis of past trends, extrapolation may be made of future possible trends and tendencies, short and long term. There are scientific techniques for doing so which can be broadly grouped as forecasting methodology. It is however not sufficient to view the socio-economic panorama on the historical canvas. More detailed investigations from an operational point of view would be called for in respect of each economic sector.

a) **Initial Formulation:** Identification is only the beginning in the lifecycle of a project. Having identified the prospective projects, the details of each project will have to be worked out and analysed in order to determine which of them could be reckoned as suitable for inclusion in the plan, allocate funds and put into execution. As a follow up to the finding of techno-economic surveys, and number of feasibility study group are set up, as the name implies to examine the possibility of formulating suitable projects and to put concrete proposals in sufficient detail to enable authorities concerned to consider the feasibility of the proposal submitted.

b) **Evaluation or Project Appraisal:** After the socio-economic problems of an economy have been determined and developments objectives and strategies agreed, concrete steps have to be taken. The main form this takes is that of formulating appropriate development projects to achieve plan objectives and

meet the development needs of the economy. Proposals relating to them are then put to the plan authorities for consideration and inclusion in the plan. These proposals as pointed out above take the following forms of feasibility studies:

- Commercial viability
- Economic feasibility
- Financial feasibility
- Technical feasibility
- Management

The scope for scrutiny under each of these five heads would necessarily render their careful assessment and the examination of all possible alternative approaches. The process almost invariably involves making decision relating to technology, scale, location, costs and benefits, time of completion (gestation period), degree of risk and uncertainty, financial viability, organisation and management, availability of inputs, know-how, labour etc. The detailed analysis is set down in what is called a feasibility report.

c) Formulation: Once a project has been appraised and approved, next step would logically, appear to that of implementation. This is, however, not necessarily true, if the approval is conditional to certain modifications being affected or for other reasons, such as availability of funds, etc. The implementation stage will be reached only after these pre-conditions have been fulfilled. Project formulation divides the process of project development into eight distinct and sequential stages. These stages are:

- General information
- Project description
- Market potential
- Capital costs and sources of finance
- Assessment of working capital requirement
- Other financial aspect
- Economic and social variables.

d) Project Implementation: Last but not the least, every entrepreneur should draw an implementation time table for his project. The network having been prepared, the project authorities are now ready to embark on the main task of implementation the project. To begin with successful implementation will depend on how well the network has been designed. However, during the course of implementation, many factors arise which cannot be anticipated or adequately taken note of in advance and built into the initial network. A number of network techniques have been developed for project implementation. Some of them are PERT, CPM, Graphical Evaluation and Review Technique (GERT), Workshop Analysis Scheduling Programme (WRSP) and Line of Balance (LOB).

e) Project Completion: It is often debated as to the point at which the project life cycle is completed. The cycle is completed only when the development objectives are realized.

5.6. PLANNING TIME SCALES

Effective use of time is of vital importance in modern animal protection societies, where the potential amount of work is vast. Effective use of time can help staff to achieve animal protection objectives and to make their work more rewarding and less stressful. The main principles behind time management can be summarized as:

- It is essential to analyze your work, and to be clear about priorities.
- Value your time.
- You must spend time in order to save it.

You can only make good use of your time if you are clear about what you are trying to achieve. Fire fighters confuse urgent activities with important activities. Work smarter, not harder, sums up the overall approach. The key to effective time management is to know your priorities, establish goals and to ensure that your work is organized towards the achievement of these goals.

Work is often the enemy of achievements and should never be confused with results. How to use time is all about how to control the job, not the job controlling you. In fact, the most effective way of dealing with certain tasks may be to leave them undone (or at least to do them as quickly and simply as possible)! Key points in effective time management are: -

- Identify the kind of success you want to achieve
- Work out priorities, and specific goals
- Develop a system to work towards these goals
- Be aware of your own work style, and strengths and weaknesses
- Be aware of your staff's work styles, and their individual strengths and weaknesses
- Develop planning strategies, focusing on priorities
- Identify 'time wasters' and consider ways of coping with them

There are tried and tested time management techniques, and some key principles are given below:

Success
Success is very personal, subjective and relative. A key to success for animal protection societies is consciously deciding what you want to achieve – the mission - and pursuing a pathway to this. Managing mission-driven staff means aligning their goals to the organization's goal (or choosing staff who share your goal), and giving them the resources and support/development they need to achieve.

The vision of success is the start, beyond this important factors are
- Believing you will achieve success
- Focusing on achieving your goals towards success
- Cutting out things that are not central to your goal
- Being undeterred by setbacks
- Always concentrating on solutions, not problems
- Using your strengths and compensating for your weaknesses
- Maintaining balance in your life, and personal happiness

5.7. ANALYZING TIME MANAGEMENT:

Before you develop time management strategies, you need to assess your own skills (and problems). A good way of doing this is to keep a time analysis diary for a period (and to do this again periodically as a check that your systems are working). Where does your time go? How much of it is spent on your priorities? How much on jobs planned by you, as opposed to work 'outside your control'? How much of the work you do could be delegated? How much of your time is spent: in meetings, on the telephone, answering e-mails, finding and filing information? How often are you interrupted? How many times do you start jobs and move on to another without finishing? How often do you do things that turn out to be useless and/or overtaken by events?

This exercise will provide a useful starting point for you to consider your work style. Some people are verbal communicators, and may spend a lot of time in meetings or on the telephone, whereas others may prefer written communication, but may spend too much time answering e-mails or written correspondence. Do you always use the most effective means of communication? Do you sort and organise your work in a logical way? E.g. collect and reply to piles of letters or e-mails periodically (using short/stock replies where possible)?

Key Results Mapping

Another useful exercise is to agree your 'key results' (critical success factors) in order of importance, and then assess the amount of time spent on each e.g.

Key Results (Order of importance)	**Time Spent** (1-5, with 1 most)
1.	
2.	
3.	
4.	
5.	

Now map your most time-consuming tasks, and assess how much these contribute towards the achievement of your key results e.g.

Time Spent (Order of time spent)	**Key Results Achievement Factor** (1-5, with 1 most)
1.	
2.	
3.	
4.	
5.	

Consider how you can reduce time spent on time-consuming tasks that do not work towards key results (including major threats/opportunities). How can you ensure that time is spent in proportion to the key results priorities identified? The above analyses will help in this assessment.

5.8. IMPROVING TIME MANAGEMENT

Never let the 'urgent' take precedence over the 'important'. Recognize what is important to your success, and ensure that this is worked on proactively, and prioritized. Allocate your time to achieving key results. Consider how you can reduce time spent on time-consuming tasks that do not work towards key results. Consider how to ensure that time is spent in proportion to key results priorities, using the above assessment as a guide.

Remember 'Pareto's Law' – the 80/20 rule – concentrate on the 20 per cent of your work that produces 80 per cent of the results. Minimize the amount of work that you do on the remaining 80 per cent.

Key Tips are

- Plan (see separate chapter) and make action lists
- Agree strict priorities and deadlines with your manager/staff
- Negotiate resources around priorities (staff, money, contracting etc.)
- Learn to say 'no'!
- Train and delegate effectively
- Use your Secretary/PA/Assistant to help
- Find systems to deal quickly and minimally with routine/less important tasks
- Remember 'good enough is good' – don't waste time on non-priority tasks
- Ensure there are efficient communication channels

- Do not waste time in meetings – develop an effective meeting strategy (see separate chapter)
- Manage telephone, e-mail and correspondence flows
- Deal with quick tasks in one go ('single-touching')
- Periodically monitor your time usage again, and make any necessary changes

Preparing 'action lists' is the immediate part of the planning process. It is good practice to keep a list of outstanding action points in priority order. This list should be regularly reviewed and re-prioritized.

5.9. TIME MANAGEMENT MATRIX

The time management matrix is a good way of explaining the difference between the urgent and the important – which effective time management needs to distinguish between shown inTable-5.1

	Urgent	**Not urgent**
I	1	2
M	Activities:	Activities:
P	Crises	Prevention
O	Pressing problems	Strategy
R	Deadline-driven problems	Planning
T		Recognizing new opportunities
A		Relationship building
N		Recreation
T		
N	3	4
O	Activities:	Activities:
T	Interruptions	Trivia
	Some calls	Busy work
I	Some correspondence	Some calls
M	Some e-mails	Some correspondence
P	Some meetings	Some e-mails
O	Pressing matters	Some meetings
R	Popular activities	Time wasters
T		Pleasant activities
A		
N		
T		

Urgent activities appear to require immediate action - whereas importance has to do with results.

In the matrix, if you keep concentrating on quadrant 1, it gets bigger and bigger and dominates you.

People who spend their time in quadrant 3, often think they are in quadrant 1, but their achievements are not important. Effective people stay out of quadrants 3 and 4 urgent or not, because they are not important. They also shrink quadrant 1 down to size by spending more time in quadrant 2. Quadrant 2 is at the heart of effective time management.

5.10. SELF –ASSESSMENT QUESTIONS

1. Explain the Characteristics and objectives of a project?
2. Discuss the important Steps in project preparation?
3. Describe the various aspects of project formulation?
4. Explain the various stages in project life cycle?
5. What is time scale? Explain how to improving time management?

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Chapter - 6
Network Analysis

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of network analysis
- To know the procedure of PERT/ CPM
- Explain the time estimation and probability analysis
- To know worked examples on networks

6.1. INTRODUCTION

Network analysis helps the manager to calculate the duration and identify critical activities in a project. Critical activities are those activities, which determine the overall duration of the project. The duration of the project is not necessarily the simple arithmetical sum of the individual activity durations because several activities occur concurrently in the project. Project duration would be equal to the sum of all individual activity durations only when all the activities in the project are sequential. The starting and

The two most common and widely used project management techniques that can be classified under the title of Network Analysis are Programme Evaluation and review Technique (PERT) and Critical Path Method (CPM). Both were developed in the 1950's to help managers schedule, monitor and control large and complex projects. CPM was first used in 1957 to assist in the development and building of chemical plants within the DuPont corporation. Independently developed, PERT was introduced in 1958 following research within the Special Projects Office of the US Navy. It was initially used to plan and control the Polaris missile programme which involved the coordination of thousands of contractors. The use of PERT in this case was reported to have cut eighteen months off the overall time to completion.

6.2. THE PERT/CPM PROCEDURE

There are six stages common to both PERT and CPM

1. Define the project and specify all activities or tasks.
2. Develop the relationships amongst activities. Decide upon precedence's.
3. Draw network to connect all activities.
4. Assign time and/or costs to each activity.
5. Calculate the longest time path through the network: this is the "critical path".
6. Use network to plan, monitor and control the project.

Finding the critical path (step 5) is a major in controlling a project. Activities on the critical path represent tasks which, if performed behind schedule, will delay the whole project. Managers can derive flexibility by identifying the non-critical activities and replanning, rescheduling and reallocating resources such as manpower and finances within identified boundaries.

PERT and CPM differ slightly in their terminology and in network construction. However their objectives are the same and, furthermore, their project analysis techniques are very similar. The major difference is that PERT employs three time estimates for each activity. Probabilities are attached to each of these times which, in turn.

It is used for computing expected values and potential variations for activity times. CPM, on the other hand, assumes activity times are known and fixed, so only one time estimate is given and used for each activity. Given the similarities between PERT and CPM, their methods will be discussed together. The student will then be able to use either, deciding whether to employ variable (PERT) or fixed (CPM) time estimates within the network.

PERT and CPM can help to answer the following questions for projects with thousands of activities and events, both at the beginning of the project and once it is underway:

- When will the project be completed?
- What are the critical activities (i.e.: the tasks which, if delayed, will effect time for overall completion)?
- Which activities are non-critical and can run late without delaying project completion time?
- What is the probability of the project being completed by a specific date?
- At any particular time, is the project on schedule?
- At any particular time, is the money spent equal to, less than or greater than the budgeted amount?
- Are there enough resources left to complete the project on time?

- If the project is to be completed in a shorter time, what is the least cost means to accomplish this and what are the cost consequences?

6.3. CRITICAL PATH ANALYSIS

The objective of critical path analysis is to determine times for the following

- ES = Earliest Start Time. This is the earliest time an activity can be started, allowing for the fact that all preceding activities have been completed.
- LS = Latest Start Time. This is the latest time an activity can be started without delaying the start of following activities which would put the entire project behind schedule.
- EF = Earliest Finish Time. The earliest time an activity can be finished.
- LF = Latest Finish Time. The latest time that an activity can finish for the project to remain on schedule.
- S = Activity Slack Time. The amount of slippage in activity start or duration time which can be tolerated without delaying the project as a whole.

If ES and LS for any activity is known, then one can calculate values for the other three times as follows:

EF = ES + t

LF = LS + t

S = LS - ES or S = LF - EF

Analysis of the project normally involves

1. Determining the Critical Path. The critical path is the group of activities in the project that have a slack time of zero. This path of activities is critical because a delay in any activity along it would delay the project as a whole.
2. Calculating the total project completion time, T. This is done by adding the activity times of those activities on the critical path.

The steps in critical path analysis are as follows

a) Determine ES and EF values for all activities in the project: the Forward Pass through the network.

b) Calculate LS and LF values for all activities by conducting a Backward Pass through the network.

c) Identify the critical path which will be those activities with zero slack (i.e.: ES=LS and EF=LF).

d) Calculate total project completion time.

6.4. PERT AND ACTIVITY TIME ESTIMATION

The major distinguishing difference between PERT and CPM is the use of three time estimates for each activity in the PERT technique, with CPM using only one time for each activity using CPM.

The three time estimates specified for each activity in PERT are

- The optimistic time.
- The most probable time.
- The pessimistic time.

The optimistic, most likely and pessimistic time estimates are used to calculate an expected activity completion time which, because of the skewed nature of the beta distribution, is marginally grater than the most likely time estimate. In addition, the three time estimates can be used to calculate the variance for each activity. The formulae used are as follows:

$$t = \frac{o + 4m + p}{6}$$

$$v = \left[\frac{p - o}{6}\right]^2$$

Where

- o, m, p - optimistic, most likely, and pessimistic times
- t - expected completion time for task
- v - variance of task completion time

Knowing the details of a project, its network and values for its activity times (t) and their variances (v) a complete PERT analysis can be carried out. This includes the determination of the ES, EF, LS, LF and S for each activity as well as identifying the critical path, the project completion time (T) and the variance (V) for the entire project.

Normally when using PERT, the expected times (t) are calculated first from the three values of activity time estimates, and it is these values of t that are then used exactly as before in CPM. The variance values are calculated for the various activity times and the variance of the total project completion time (i.e. the sum of the activity expected times of those activities on the critical path) is the sum of the variances of the activities lying on that critical path.

6.5. PROBABILITY ANALYSIS

Once the expected completion time and variance (T and V) have been determined, the probability that a project will be completed by a specific date can be assessed. The assumption is usually made that the distribution of completion dates follows that of a normal distribution curve. Consider the example where the expected completion time for a project (T) is 20 weeks and the project variance (V) is 100. What is the probability that the project will be finished on or before week 25?

Answer: 0.69

6.6. WORKED EXAMPLES ON NETWORKS

1. A project has the following activities, precedence relationships, and activity durations:

Activity	Immediate Predecessors	Activity Duration (weeks)
A	-	3
B	-	4
C	-	3
D	C	12
E	B	5
F	A	7
G	E, F	3

Table-6.1

a) Draw a Gantt chart for the project.

b) Construct a CPM network for the project.

c) Identify those activities comprising the critical path.

d) What is the project's estimated duration?

e) Construct a table showing for each activity, its activity duration, earliest start time, latest start time, earliest finish time, latest finish time, and the activity slack.

Answers

c) C, D

d) 15 weeks

2. A project designed to refurbish a hospital operating theatre consists of the following activities, with estimated times and precedence relationships shown. Using this information draw a network diagram, determine the expected time and variance for each activity, and estimate the probability of completing the project within sixty days.

Activity	Immediate Predecessors	Optimistic Time	Most Likely Time	Optimistic Time
A	-	5	6	7
B	-	10	13	28
C	A	1	2	15
D	B	8	9	16
E	B, C	25	36	41
F	D	6	9	18

Table-6.2

3. An activity has these time estimates: optimistic time o = 15 weeks, most likely time m = 20 weeks, and pessimistic time p = 22 weeks.

a) Calculate the activity's expected time or duration t.

b) Calculate the activity's variance v.

c) Calculate the activity's standard deviation.

4. A project has the following activities, precedence relationships, and time estimates in weeks:

Activity	Immediate Predecessors	Optimistic Time	Most Likely Time	Optimistic Time
A	-	15	20	25
B	-	8	10	12
C	A	25	30	40
D	B	15	15	15
E	B	22	25	27
F	E	15	20	22
G	D	20	20	22

Table-6.3

a) Calculate the expected time or duration and the variance for each activity.

b) Construct the network diagram

c) Tabulate the values of ES,EF,LS,LF and slack for each activity

d) Identify the critical path, and the project duration.

e) What is the probability that the project will take longer than 57 weeks to complete?

5. The project detailed below has the both normal costs and "crash" costs shown. The crash time is the shortest possible activity time given that extra resources are allocated to that activity.

Activity	Immediate Predecessors	Normal Time	Normal Time Cost (£)	Crash Time	Crash Time Cost (£)
A	-	5	2 000	4	6 000
B	A	8	3 000	6	6 000
C	B	2	1 000	2	1 000
D	B	3	4 000	2	6 000
E	C	9	5 000	6	8 000
F	C, D	7	4 500	5	6 000
G	E, F	4	2 000	2	5 000

Table-6.4

Assuming that the cost per day for shortening each activity is the difference between crash costs and normal costs, divided by the time saved, determine by how much each activity should be shortened so as to complete the project within twenty-six days and at the minimum extra cost.

6.7. SELF–ASSESSMENT QUESTIONS

1. What Is Network? Explain Its Role In Project Management?
2. Discuss The Procedure Of PERT/ CPM?
3. Explain The Worked Examples On Network?
4. Discuss The Following.
   a) Critical Path Analysis
   b) Probability Analysis

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Chapter - 7
Material and Human Resources

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To Understand The Concept Of Material And HR In Project Management..
- To Understand The Importance Of Materials Management Systems
- To Know The Material Procurement, Delivery And Inventory Control.
- To Understand The Human Factors In Project Management

7.1. INTRODUCTION

Good project management in construction must vigorously pursue the efficient utilization of labor, material and equipment. Improvement of labor productivity should be a major and continual concern of those who are responsible for cost control of constructed facilities. Material handling, which includes procurement, inventory, shop fabrication and field servicing, requires special attention for cost reduction. The use of new equipment and innovative methods has made possible wholesale changes in construction technologies in recent decades. Organizations which do not recognize the impact of various innovations and have not adapted to changing. In contrast to this view of one large project, one may also point to the continual change and improvements occurring in traditional materials and techniques. Bricklaying provides a good

7.2. MATERIALS MANAGEMENT

Materials management is an important element in project planning and control. Materials represent a major expense in construction, so minimizing procurement or purchase costs presents important opportunities for reducing costs. Poor materials management can also result in large and avoidable costs during construction. First, if materials are purchased early, capital may be tied up and interest charges incurred on the excess inventory of materials. Even worse, materials may deteriorate during storage or be stolen unless special care is taken. For example, electrical equipment often must be stored in waterproof locations. Second, delays and extra expenses may be incurred if materials required for particular activities are not available. Accordingly, insuring a timely flow of material is an important concern of project managers. Materials management is not just a concern during the monitoring stage in which construction is taking place. Decisions about material procurement may also be required during the initial planning and scheduling stages. For example, activities can be inserted in the project schedule to represent purchasing of major items such as elevators for buildings.

The availability of materials may greatly influence the schedule in projects with a fast track or very tight time schedule: sufficient time for obtaining the necessary materials must be allowed. In some case, more expensive suppliers or shippers may be employed to save time.

Materials management is also a problem at the organization level if central purchasing and inventory control is used for standard items. In this case, the various projects undertaken by the organization would present requests to the central purchasing group. In turn, this group would maintain inventories of standard items to reduce the delay in providing material or to obtain lower costs due to bulk purchasing. This organizational materials management problem is analogous to inventory control in any organization facing continuing demand for particular items.

Materials ordering problems lend themselves particularly well to computer based systems to insure the consistency and completeness of the purchasing process. In the manufacturing realm, the use of automated materials requirements planning systems is common. In these systems, the master production schedule, inventory records and product component lists are merged to determine what items must be ordered, when they should be ordered, and how much of each item should be ordered in each time period. The heart of these calculations is simple arithmetic: the projected demand for each material item in each period is subtracted from the available inventory. When the inventory becomes too low, a new order is recommended. For items that are non-standard or not kept in inventory, the calculation is even simpler since no inventory must be considered. With a materials requirement system, much of the detailed record keeping is automated and project managers are alerted to purchasing requirements.

7.3. IMPORTANCE OF MATERIALS MANAGEMENT SYSTEMS

From a study of twenty heavy construction sites, the following benefits from the introduction of materials management systems were noted:

- In one project, a 6% reduction in craft labor costs occurred due to the improved availability of materials as needed on site. On other projects, an 8% savings due to reduced delay for materials was estimated.
- A comparison of two projects with and without a materials management system revealed a change in productivity from 1.92 man-hours per unit without a system to 1.14 man-hours per unit with a new system. Again, much of this difference can be attributed to the timely availability of materials.

- Warehouse costs were found to decrease 50% on one project with the introduction of improved inventory management, representing a savings of $ 92,000. Interest charges for inventory also declined, with one project reporting a cash flow savings of $ 85,000 from improved materials management.
- Against these various benefits, the costs of acquiring and maintaining a materials management system has to be compared. However, management studies suggest that investment in such systems can be quite beneficial.

7.4. MATERIAL PROCUREMENT AND DELIVERY

The main sources of information for feedback and control of material procurement are requisitions, bids and quotations, purchase orders and subcontracts, shipping and receiving documents, and invoices. For projects involving the large scale use of critical resources, the owner may initiate the procurement procedure even before the selection of a constructor in order to avoid shortages and delays. Under ordinary circumstances, the constructor will handle the procurement to shop for materials with the best price/performance characteristics specified by the designer. Some overlapping and rehandling in the procurement process is unavoidable, but it should be minimized to insure timely delivery of the materials in good condition.

The materials for delivery to and from a construction site may be broadly classified as: (1) bulk materials, (2) standard off-the-shelf materials, and (3) fabricated members or units. The process of delivery, including transportation, field storage and installation will be different for these classes of materials. The equipment needed to handle and haul these classes of materials will also be different.

Bulk materials refer to materials in their natural or semi-processed state, such as earthwork to be excavated, wet concrete mix, etc. which are usually encountered in large quantities in construction. Some bulk materials such as earthwork or gravels may be measured in bank (solid in situ) volume. Obviously, the quantities of materials for delivery may be substantially different when expressed in different measures of volume, depending on the characteristics of such materials.

Standard piping and valves are typical examples of standard off-the-shelf materials which are used extensively in the chemical processing industry. Since standard off-the-shelf materials can easily be stockpiled, the delivery process is relatively simple. Fabricated members such as steel beams and columns for buildings are pre-processed in a shop to simplify the field erection procedures. Welded or bolted connections are attached partially to the members which are cut to precise dimensions for adequate fit. Similarly, steel tanks and pressure vessels are often partly or fully fabricated before shipping to the field. In general, if the work can be done in the shop where working conditions can better be controlled, it is advisable to do so, provided that the fabricated members or units can be shipped to the construction site in a satisfactory manner at a reasonable cost.

As a further step to simplify field assembly, an entire wall panel including plumbing and wiring or even an entire room may be prefabricated and shipped to the site. While the field labor is greatly reduced in such cases, "materials" for delivery are in fact manufactured products with value added by another type of labor. With modern means of transporting construction materials and fabricated units, the percentages of costs on direct labor and materials for a project may change if more prefabricated units are introduced in the construction process.

In the construction industry, materials used by a specific craft are generally handled by craftsmen, not by general labor. Thus, electricians handle electrical materials, pipefitters handle pipe materials, etc. This multiple handling diverts scarce skilled craftsmen and contractor supervision into activities which do not directly contribute to construction. Since contractors are not normally in the freight business, they do not perform the tasks of freight delivery efficiently. All these factors tend to exacerbate the problems of freight delivery for very large projects.

7.5. INVENTORY CONTROL

Once goods are purchased, they represent an inventory used during the construction process. The general objective of inventory control is to minimize the total cost of keeping the inventory while making tradeoffs among the major categories of costs: (1) purchase costs, (2) order cost, (3) holding costs, and (4) unavailable cost. These cost categories are interrelated since reducing cost in one category may increase cost in others. The costs in all categories generally are subject to considerable uncertainty.

a) Purchase Costs

The purchase cost of an item is the unit purchase price from an external source including transportation and freight costs. For construction materials, it is common to receive discounts for bulk purchases, so the unit purchase cost declines as quantity increases. These reductions may reflect manufacturers' marketing policies, economies of scale in the material production, or scale economies in transportation. There are also advantages in having homogeneous materials.

For example, a bulk order to insure the same color or size of items such as bricks may be desirable. Accordingly, it is usually desirable to make a limited number of large purchases for materials. In some cases, organizations may consolidate small orders from a number of different projects to capture such bulk discounts; this is a basic saving to be derived from a central purchasing office.

The cost of materials is based on prices obtained through effective bargaining. Unit prices of materials depend on bargaining leverage, quantities and delivery time. Organizations with potential for long-term purchase volume can command better bargaining leverage. While orders in large quantities may result in lower unit prices, they may also increase holding costs and thus cause problems in cash flow. Requirements of short delivery time can also adversely affect unit prices. Furthermore, design characteristics which include items of odd sizes or shapes should be avoided. Since such items normally are not available in the standard stockpile, purchasing them causes higher prices.

The transportation costs are affected by shipment sizes and other factors. Shipment by the full load of a carrier often reduces prices and assures quicker delivery, as the carrier can travel from the origin to the destination of the full load without having to stop for delivering part of the cargo at other stations. Avoiding transshipment is another consideration in reducing shipping cost. While the reduction in shipping costs is a major objective, the requirements of delicate handling of some items may favor a more expensive mode of transportation to avoid breakage and replacement costs.

b) Order Cost

The order cost reflects the administrative expense of issuing a purchase order to an outside supplier. Order costs include expenses of making requisitions, analyzing alternative vendors, writing purchase orders, receiving materials, inspecting materials, checking on orders, and maintaining records of the entire process. Order costs are usually only a small portion of total costs for material management in construction projects, although ordering may require substantial time.

c) Holding Costs

The holding costs or carrying costs are primarily the result of capital costs, handling, storage, obsolescence, shrinkage and deterioration. Capital cost results from the opportunity cost or financial expense of capital tied up in inventory. Once payment for goods is made, borrowing costs are incurred or capital must be diverted from other productive uses. Consequently, a capital carrying cost is incurred equal to the value of the inventory during a period multiplied by the interest rate obtainable or paid during that period. Note that capital costs only accumulate when payment for materials actually occurs; many organizations attempt to delay payments as long as possible to minimize such costs. Handling and storage represent the movement and protection charges incurred for materials. Storage costs also include the disruption caused to other project activities by large inventories of materials that get in the way.

Obsolescence is the risk that an item will lose value because of changes in specifications. Shrinkage is the decrease in inventory over time due to theft or loss. Deterioration reflects a change in material quality due to age or environmental degradation. Many of these holding cost components are difficult to predict in advance; a project manager knows only that there is some chance that specific categories of cost will occur. In addition to these major categories of cost, there may be ancillary costs of additional insurance, taxes (many states treat inventories as taxable property), or additional fire hazards. As a general rule, holding costs will typically represent 20 to 40% of the average inventory value over the course of a year; thus if the average material inventory on a project is $ 1 million over a year, the holding cost might be expected to be $200,000 to $400,000.

d) Unavailability Cost

The unavailability cost is incurred when a desired material is not available at the desired time. In manufacturing industries, this cost is often called the stockout or depletion cost. Shortages may delay work, thereby wasting labor resources or delaying the completion of the entire project. Again, it may be difficult to forecast in advance exactly when an item may be required or when an shipment will be received. While the project schedule gives one estimate, deviations from the schedule may occur during construction. Moreover, the cost associated with a shortage may also be difficult to assess; if the material used for one activity is not available, it may be possible to assign workers to other activities and, depending upon which activities are critical, the project may not be delayed.

7.6. TRADEOFFS OF COSTS IN MATERIALS MANAGEMENT

To illustrate the type of trade-offs encountered in materials management, suppose that a particular item is to be ordered for a project. The amount of time required for processing the order and shipping the item is uncertain. Consequently, the project manager must decide how much lead time to provide in ordering the item. Ordering early and thereby providing a long lead time will increase the chance that the item is available when needed, but it increases the costs of inventory and the chance of spoilage on site.

Let T be the time for the delivery of a particular item, R be the time required for process the order, and S be the shipping time. Then, the minimum amount of time for the delivery of the item is T = R + S. In general, both R and S are random variables; hence T is also a random variable. For the sake of simplicity, we shall consider only the case of instant processing for an order, i.e. R = 0. Then, the delivery time T equals the shipping time S. Since T is a random variable, the chance that an item will be delivered on day t is represented by the probability p(t). Then, the probability that the item will be delivered on or before t day is given by:

Fig-7.1

$$P_r\{T \le t\} = \sum_{u=0}^{t} p(u)$$

If a and b are the lower and upper bounds of possible delivery dates, the expected delivery time is then given by:

Fig-7.2

$$E[T] = \sum_{t=a}^{b} t[p(t)]$$

The lead time L for ordering an item is the time period ahead of the delivery time, and will depend on the tradeoff between holding costs and unavailability costs. A project manager may want to avoid the unavailable cost by requiring delivery on the scheduled date of use, or may be to lower the holding cost by adopting a more flexible lead time based on the expected delivery time. For example, the manager may make the tradeoff by specifying the lead time to be D days more than the expected delivery time, i.e.

Fig-7.3

$$L = E[T] + D$$

Where D may vary from 0 to the number of additional days required to produce certain delivery on the desired date. In a more realistic situation, the project manager would also contend with the uncertainty of exactly when the item might be required.

Even if the item is scheduled for use on a particular date, the work progress might vary so that the desired date would differ. In many cases, greater than expected work progress may result in no savings because materials for future activities are unavailable.

Lead time for ordering with no processing time

Table 7.4. summarizes the probability of different delivery times for an item. In this table, the first column lists the possible shipping times (ranging from 10 to 16 days), the second column lists the probability or chance that this shipping time will occur and the third column summarizes the chance that the item arrives on or before a particular date. This table can be used to indicate the chance that the item will arrive on a desired date for different lead times. For example, if the order is placed 12 days in advance of the desired date (so the lead time is 12 days), then there is a 15% chance that the item will arrive exactly on the desired day and a 35% chance that the item will arrive on or before the desired date. Note that this implies that there is a 1 - 0.35 = 0.65 or 65% chance that the item will not arrive by the desired date with a lead time of 12 days. Given the information in Table 7.4, when should the item order be placed?

Table-7.4: Delivery Date on Orders and Probability of Delivery for an Example

Delivery Date t	Probability of delivery on date t p(t)	Cummulative probability of delivery by day t Pr{T $\leq$ t}
10	0.10	0.10
11	0.10	0.20
12	0.15	0.35
13	0.20	0.55
14	0.30	0.85
15	0.10	0.95
16	0.05	1.00

Suppose that the scheduled date of use for the item is in 16 days. To be completely certain to have delivery by the desired day, the order should be placed 16 days in advance. However, the expected delivery date with a 16 day lead time would be:

Fig-7.5

$$E[T] = \sum_{t=10}^{16} t[p(t)] =$$

= (10)(0.1) + (11)(0.1) + (12)(0.15) + (13)(0.20) + (14)(0.30) + (15)(0.10) + (16)(0.05) = 13.0

Thus, the actual delivery date may be 16-13 = 3 days early, and this early delivery might involve significant holding costs. A project manager might then decide to provide a lead time so that the expected delivery date was equal to the desired assembly date as long as the availability of the item was not critical. Alternatively, the project manager might negotiate a more certain delivery date from the supplier. Queue as an orderly line of customers waiting for a stationary server such as a ticket seller. However, the demands for service might not be so neatly arranged. For example, we can speak of the queue of welds on a building site waiting for inspection. In this case, demands do not come to the server, but a roving inspector travels among the waiting service points.

Waiting for resources such as a particular piece of equipment or a particular individual is an endemic problem on construction sites.

If workers spend appreciable portions of time waiting for particular tools, materials or an inspector, costs increase and productivity declines. Insuring adequate resources to serve expected demands is an important problem during construction planning and field management. In general, there is a trade-off between waiting times and utilization of resources. Utilization is the proportion of time a particular resource is in productive use. Higher amounts of resource utilization will be beneficial as long as it does not impose undue costs on the entire operation.

A few conceptual models of queuing systems may be helpful to construction planners in considering the level of adequate resources to provide. First, we shall consider the case of time-varying demands and a server with a constant service rate. This might be the situation for an elevator in which large demands for transportation occur during the morning or at a shift change. Second, we shall consider the situation of

randomly arriving demands for service and constant service rates. Finally, we shall consider briefly the problems involving multiple serving stations.

7.7. HUMAN FACTORS IN PROJECT MANAGEMENT

A project is a unique venture with a beginning and an end, conducted by people to meet established goals within parameters of cost, time and quality. Project management is the combination of people, systems, and techniques required to coordinate the resources needed to complete projects within established goals. Human Resource Management (HRM) in project-oriented organizations is a relatively unexplored topic though it is essential to the success of the organization and its competitive advantage. Project-oriented organizations operate differently from classic business organizations in that they adopt temporary organizations in the form of projects and programs, therefore the HRM approach they adopt should support this unique structure. Human Resource Management in the Project-Oriented Organization takes a look at the multiple facets of HRM and how HRM should be applied in project-oriented organizations.

It is important for both human resource managers and project managers to adopt specific HRM practices and processes when working in project-oriented organizations due to the effect these procedures have on employee perception of the work environment and the employment relationship. Through four in-depth case studies over a spread of organizations, Human Resource Management in the Project Oriented-Organization investigates the distinctive characteristics of project-oriented organizations that lead to the need for specific HRM practices and considers the implications for organizations, projects and individuals.

7.8. LEADERSHIP AND MOTIVATION FOR THE PROJECT TEAM

The project manager, in the broadest sense of the term, is the most important person for the success or failure of a project. The project manager is responsible for planning, organizing and controlling the project. In turn, the project manager receives authority from the management of the organization to mobilize the necessary resources to complete a project. The project manager must be able to exert interpersonal influence in order to lead the project team. The project manager often gains the support of his/her team through a combination of the following:

- Formal authority resulting from an official capacity which is empowered to issue orders.
- Reward and/or penalty power resulting from his/her capacity to dispense directly or indirectly valued organization rewards or penalties.
- Expert power when the project manager is perceived as possessing special knowledge or expertise for the job.
- Attractive power because the project manager has a personality or other characteristics to convince others.

In a matrix organization, the members of the functional departments may be accustomed to a single reporting line in a hierarchical structure, but the project manager coordinates the activities of the team members drawn from functional departments. The functional structure within the matrix organization is responsible for priorities, coordination, administration and final decisions pertaining to project implementation. Thus, there are potential conflicts between functional divisions and project teams. The project manager must be given the responsibility and authority to resolve various conflicts such that the established project policy and quality standards will not be jeopardized. When contending issues of a more fundamental nature are developed, they must be brought to the attention of a high level in the management and be resolved expeditiously.

In general, the project manager's authority must be clearly documented as well as defined, particularly in a matrix organization where the functional division managers often retain certain authority over the personnel temporarily assigned to a project. The following principles should be observed:

- The interface between the project manager and the functional division managers should be kept as simple as possible.
- The project manager must gain control over those elements of the project which may overlap with functional division managers.
- The project manager should encourage problem solving rather than role playing of team members drawn from various functional divisions.

7.9. INTERPERSONAL BEHAVIOR IN PROJECT ORGANIZATIONS

While a successful project manager must be a good leader, other members of the project team must also learn to work together, whether they are assembled from different divisions of the same organization or even from different organizations. Some problems of interaction may arise initially when the team members are unfamiliar with their own roles in the project team, particularly for a large and complex project. These problems must be resolved quickly in order to develop an effective, functioning team.

Many of the major issues in construction projects require effective interventions by individuals, groups and organizations. The fundamental challenge is to enhance communication among individuals, groups and organizations so that obstacles in the way of improving interpersonal relations may be removed. Some behavior science concepts are helpful in overcoming communication difficulties that block cooperation and coordination. In very large projects, professional behavior scientists may be necessary in diagnosing the problems and advising the personnel working on the project. The power of the organization should be used judiciously in resolving conflicts.

The major symptoms of interpersonal behavior problems can be detected by experienced observers, and they are often the sources of serious communication difficulties among participants in a project. For example, members of a project team may avoid each other and withdraw from active interactions about differences that need to be dealt with. They may attempt to criticize and blame other individuals or groups when things go wrong. They may resent suggestions for improvement, and become defensive to minimize culpability rather than take the initiative to maximize achievements. All these actions are detrimental to the project organization. While these symptoms can occur to individuals at any organization, they are compounded if the project team consists of individuals who are put together from different organizations. Invariably, different organizations have different cultures or modes of operation. Individuals from different groups may not have a common loyalty and may prefer to expand their energy in the directions most advantageous to themselves instead of the project team.

7.10. PERCEPTIONS OF OWNERS AND CONTRACTORS

Although owners and contractors may have different perceptions on project management for construction, they have a common interest in creating an environment leading to successful projects in which performance quality, completion time and final costs are within prescribed limits and tolerances. It is interesting therefore to note the opinions of some leading contractors and owners who were interviewed in 1984. From the responses of six contractors, the key factors cited for successful projects are:

- Well defined scope
- Extensive early planning
- Good leadership, management and first line supervision
- Positive client relationship with client involvement
- Proper project team chemistry
- Quick response to changes

Conversely, the key factors cited for unsuccessful projects are

- Ill-defined scope
- Poor management
- Poor planning
- Breakdown in communication between engineering and construction
- Unrealistic scope, schedules and budgets
- Many changes at various stages of progress
- Lack of good project control

The responses of eight owners indicated that they did not always understand the concerns of the contractors although they generally agreed with some of the key factors for successful and unsuccessful projects cited by the contractors. The significant findings of the interviews with owners are summarized as follows:

- All owners have the same perception of their own role, but they differ significantly in assuming that role in practice.
- The owners also differ dramatically in the amount of early planning and in providing information in bid packages.
- There is a trend toward breaking a project into several smaller projects as the projects become larger and more complex.
- Most owners recognize the importance of schedule, but they adopt different requirements in controlling the schedule.
- All agree that people are the key to project success.
- From the results of these interviews, it is obvious that owners must be more aware and involved in the process in order to generate favorable conditions for successful projects.

7.11. THE KEY CONCEPTS RELATED TO PROJECT HUMAN RESOURCE MANAGEMENT

a) The knowledge area of Project Human Resource Management consists of the following processes:

Human Resource Management Processes	Project Phase	Key Deliverables
Plan Human Resource Management	Planning	Human Resource Plan
Acquire Project Team	Execution	Project Staff assignments
Develop Project Team	Execution	Team performance assessments
Manage Project Team	Execution	Change requests

b) Plan Human Resource Management process involves identifying and documenting project roles and responsibilities. The table below gives the inputs, tools and techniques, and Outputs for the Plan Human Resource Management process:

Plan Human Resource Management Process Inputs	Tools and Techniques	Outputs
Enterprise environmental factors	Organization charts and position descriptions	Human resource plan
Organizational process assets	Organizational Theory	
Activity resource requirements	Networking	

c) Acquire project team process involves identifying and obtaining the team necessary to execute the project. The table below gives the inputs, tools and techniques, and Outputs for the Acquire project team process -

Acquire project team process Inputs	Tools and Techniques	Outputs
Project management plan	Pre-assignment	Project staff assignments
Enterprise environmental factors	Negotiation	Resource calendars
Organizational process assets	Acquisition	Project management plan updates
	Virtual teams	

d) Develop project team process involves improving the competencies of the team members and improving teamwork between the team. The table below gives the inputs, tools and techniques, and Outputs for the Develop project team process:

Develop project team process Inputs	Tools and Techniques	Outputs
Project staff assignment	Interpersonal skills	Team performance assessments
Project management plan	Training	Enterprise environmental factors updates
Resource calendars	Team-building activities	
	Ground rules	
	Co-location	
	Recognition and rewards	

e) Manage project team process is the process of tracking team member performance and managing issues within the team. The table below gives the inputs, tools and techniques, and Outputs for the Manage project team process:

Manage project team process Inputs	Tools and Techniques	Outputs
Project staff assignments	Observation and conversation	Enterprise environmental factors updates
Project management plan	Project performance appraisals	Organizational process assets updates
Team performance assets	Conflict management	Change requests
Performance reports	Issue log	Project management plan updates
Organizational process assets	Interpersonal skills	

- War room is a technique for team building. As part of this the project team meets in one room. It helps to create a project identity.
- Halo Effect is the assumption that because the person is good at a technology, he will be good as a project manager.
- There are many organizational theories. Some of the main ones are - Expectancy Theory, McGregory Theory, Herzberg Theory, Maslow's Hierarchy of needs.
- Expectancy Theory - People accept to be rewarded for their efforts. This is a motivation factor. People put in more efforts because they accept to be rewarded for their efforts.
- McGregory Theory of X and Y - There are two type of employees. Employees of type X need to be always watched. They cannot be trusted and need to be micro managed. Employees of type Y, on the other hand, are self-motivated. They can work independently.
- Herzberg Theory - Hygiene factors (salary, cleanliness etc.) if not present can destroy motivation. However good hygiene alone does not improve motivation. What motivates people is the work itself. The motivation factors for employees include responsibility, self-actualization, growth, recognition etc.
- Maslow's Hierarchy of needs - there are various levels of needs for an employee. When a lower level is met, employee attempts to reach the next higher level. The maximum satisfaction is achieved when the employee reaches the highest level of satisfaction - self-fulfillment. These level of needs from the highest to lowest are:
  - Self-fulfillment
  - Esteem
  - Social
  - Safety
  - Physiology

7.12. SELF ASSESSMENT QUESTIONS

1. Explain the need and importance material management in the project?
2. Discuss the Trade offs of Costs in Materials Management?
3. Describe the Human Factors in Project Management?
4. Discuss the key concepts related to Project Human Resource Management?
5. Discuss the following:
   a) Interpersonal Behavior in Project Organizations
   b) Inventory Control in Project management.

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Chapter - 8
Project Costing and Financing

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- Meaning And Importance Of Project Finance.
- Identification Of Project Costs And Benefits.
- Discuss The Various Sources Of Project Financing And Financial Institutions Structure In India.
- Norms Of Finance And Term Loan Procedure.
- Describe The SEBI Guidelines Regarding Public Issues And Debentures.

8.1. INTRODUCTION

Finance is the lubricant of the process of economic growth. When finance mode is available, industrial activities can be initiated which gives rise to new investment opportunities towards industrialization. The Indian financial institutions have been very important constituent of the Indian economy. This importance they have derived from their financial muscle and they have linked it to the industrial development in the country. For years now the Indian financial institutions have been the life line of credit for the Indian corporate. This has been mainly because of their strong financial muscle and the various concessions they received from the Central Government for their role. In India, special financial institutions have been developed to provide finance to the upliftment of industrial activities in all regions so as to sustain an equitable industrial growth in the county. Financial assistance is being extended to the industrial enterprises by the financial institutions and development banks on confessional terms of finance as per their bye laws in the state.

8.2. IDENTIFICATION OF PROJECT COSTS AND BENEFITS

In economic analysis of various projects we compare costs and benefits and determine which among the alternative projects have an acceptable return. Thus, we not only identify the costs and benefit streams but these are also priced. The costs and benefits are identified and valued "with" the proposed project and it is compared with the situation "without" project to determine the net incremental benefit. This approach is entirely different to that of "before" and "after" approach where changes in production without project are not taken into account and leads to erroneous statement of benefits. In fact, there may be progress even without the project and it would be inappropriate to attribute all the progress to the projects, as if the normal development process had come to a halt. The cost and benefits of a proposed project can be categorized as follow:

- Tangible costs and benefits or Primary costs and benefits
- Intangible costs and benefits of agri projects or secondary costs and benefits

Identification of project costs

The various types of costs involved in the project are

a) Project costs: These include the value of the resources used in maintaining and operating the projects.

b) Associated Costs: The cost that is incurred to produce immediate products and services of the projects for use and sale.

c) Primary Costs or Direct costs: These include costs incurred in construction, maintenance and operation of the projects.

d) Secondary or Indirect costs: Value of goods and services incurred in providing indirect benefits from the projects such as houses, schools, hospitals etc.

e) Real cost and Nominal costs: The costs worked out at current market prices are known as nominal costs, whereas if costs are deflated by the general price index, these are termed as real costs.

f) Deflating: It is the process of making allowances for the effect of changing price levels. A rise in price level means a reduction in the purchasing power of money.

8.3. MEANING AND IMPORTANCE OF PROJECT FINANCE

Project finance refers to the financing of long-term infrastructure, industrial projects and public services based upon a non-recourse or limited recourse financial structure where project debt and equity used to finance the project are paid back from the cash flow generated by the project.

Project finance is used by private sector companies as a means of funding major projects off balance sheet. At the heart of the project finance transaction is the concession company, a special purpose Vehicle (SPV) which consists of the consortium shareholders who may be investors or have other interests in the project (such as contractor or operator). The SPV is created as an independent legal entity which enters into contractual agreements with a number of other parties necessary in the project finance deals.

The attractiveness of project finance is the ability to fund projected in the off balance sheet with limited or non-recourse to the equity investors i.e. if a project fails, the project lenders recourse is to ownership of the actual project and they are unable to pursue the equity investors for debt. For this reason lenders focus on the projects cash flow as the main source for repaying project debt.

Importance of Project finance

Project financing is being used throughout the world across a wide range of industries and sectors. This funding technique is growing in popularity as governments seek to involve the private sector in the funding and operation of public infrastructure. Private sector investment and management of public sector assets is being openly encouraged by governments and multilateral agencies who recognize that private sector companies are better equipped and more efficient than government in developing and managing major public services. Project finance is used extensively in the following sectors.

- Oil and gas
- Mining
- Electricity Generation
- Water
- Telecommunications
- Road and highways
- Railways and Metro systems
- Public services

8.4. MEANS OF FINANCE AND SOURCES OF PROJECT IN INDIA

The long-term sources of finance used for meeting the cost of project are referred to as the means of finance. To meet the cost of project, the following sources of finance may be available:

- Equity Capital
- Preference Capital
- Debentures
- Rupees term loans
- Foreign currency term loans
- Euro issues
- Deferred credit
- Bill rediscounting scheme
- Suppliers line of credit
- Seed capital assistance
- Government subsidies
- Sales tax deferment and exemption
- Unsecured loans and deposits
- Lease and hire purchase finance
- Public Deposit
- Bank Credit

a) Equity Capital

This is the contribution made by the owners of business, the equity shareholders, who enjoy the rewards and bear the risks of ownership. However, their liabilities, limited to their capital contribution. From the point of view of the issuing film, equity capital offers, two important advantages: (i) It represents permanent capital. Hence there is no liability for repayment. (ii) It does not involve any fixed obligation for payment of dividend. The disadvantages of raising funds by way of equity capital are : (i) The cost of equity capital is high because equity dividend are not tax-deductible expenses. (ii) The cost of issuing equity capital is high.

b) Preference Capital

A hybrid form of financing, preference capital partakes some characteristics of equity capital and some attributes of debt capital. It is similar, to equity capital because preference dividend, like equity dividend, is not a tax-deductible payment. It resembles debt capital because the rate of preference dividend is fixed. Typically, when preference dividend is skipped it is payable in future because of the cumulative feature associated with it. The near-fixity of preference dividend payment renders preference capital somewhat unattractive in general as a source of finance. It is, however, attractive when the promoters do not want a reduction in their share: share of equity and yet there is need for widening the net worth base (net worth consists of equity and preference capital) to satisfy the requirements of financial institutions. In addition to the conventional preference shares, a company may issue Cumulative Convertible Preference Shares (CCPS). These shares carry a dividend rate of 10 per cent (which; if unpaid, cumulates) and are compulsory convertible into equity shares between three and five years from the date of issue.

c) Debenture Capital

In the last few years, debenture capital has emerged as an important source for project financing. There are three types of debentures that are commonly used in India: Non-Convertible Debentures (NCDs), Partially Convertible Debentures (PCDs), and Fully Convertible Debentures (FCDs).

Akin to promissory, NCDs are used by companies for raising debt that is generally retired over a period of 5 to 10 years. They are secured by a charge on the assets of the issuing company. PCDs are partly convertible into equity shares as per pre-determined terms of conversion. The unconverted portion of PCDs remains like NCDs. FCDs, as the name implies, are converted wholly into equity shares as per pre-determined terms of conversion. Hence FCDs may be regarded as delayed equity instruments.

d) Rupee Term Loans

Provided by financial institutions and commercial banks, rupee term loans which represent secured borrowings are a very important source for financing new projects as well as expansion, modernization, and renovation schemes of existing units. These loans are generally repayable over a period of 8-10 years which includes a moratorium period of l-3 years.

e) Foreign Currency Terms Loans

Financial institutions provide foreign currency term loans for-meeting the foreign currency expenditures towards import of plant, machinery, equipment and also towards payment of foreign technical know-how fees. Under the general scheme, the periodical liability towards interest and principal remains in the currency/currencies of the loan/ s and is translated into rupees at the then prevailing rate of exchange for making payments to the financial institution. Apart from approaching financial institutions (which typically serve as intermediaries between foreign agencies and Indian borrowers), companies can directly obtain foreign currency loans from international lenders. More and more companies appear to be doing so presently.

f) Euro Issues

Beginning with Reliance Industries' Global Depository Receipts issue of approximately $150 ml in May 1992, a number of companies have been making euro issues. They have employed two types of securities: Global Depository Receipts (GDRs) and Euro convertible Bonds (ECBs).

Denominated in US dollars, a GDR is a negotiable certificate that represents the publicly traded local currency (Indian Rupee) equity shares of a non-US (Indian) company. (Of course, in. theory, a GDR may represent a debt security; in practice it rarely does so.) GDRs are issued by the Depository Bank (such as the Bank of New York) against the local currency shares (such as Rupee shares) which are delivered to the depository's local custodian banks. GDRs trade freely in the overseas markets.

A Euro convertible Bond (ECB) is an equity-linked debt security. The holder of an ECB has the option to convert it into equity shares at a pre-determined conversion ratio during a specified period. ECBs are regarded as advantageous by the issuing company because (i) they carry a lower rate of interest compared to a straight debt security, (ii) they do not lead to dilution of earnings per share in the near future, and (iii) they carry very few restrictive covenants.

g) Deferred Credit

Many a time the suppliers of machinery provide deferred credit facility under which payment for the purchase of machinery is made over a period of time. The interest rate on deferred credit and the period of payment vary rather widely. Normally, the supplier of machinery when he offers deferred credit facility insists that the bank guarantee should be furnished by the buyer.

h) Bills Rediscounting Scheme

Operated by the IDBI, the bills rediscounting scheme is meant to promote the sale of indigenous machinery on deferred payment basis. Under this scheme, the seller realizes the sale proceeds by discounting the bills or promissory notes accepted by the buyer with a commercial bank which in turn rediscounts them with the IDBI.

This scheme is meant primarily for balancing equipments and machinery required for expansion, modernization, and replacement schemes.

i) Suppliers' Line of Credit

Administered by the ICICI, the Suppliers' Line of Credit is somewhat similar to the IDBI's Bill Rediscounting Scheme. Under this arrangement, ICICI directly pays to the machinery manufacturer against usance bills duly accepted or guaranteed by the bank of the purchaser.

j) Seed Capital Assistance

Financial institutions, through what may be labelled broadly as the 'Seed Capital Assistance scheme, seek to supplement the resources of the promoters and of medium scale industrial units which are eligible for assistance from All-India financial institutions and/ or state-level financial institutions. Broadly three schemes have been formulated:

- Special Seed Capital Assistance Scheme The quantum of assistance under this scheme is Rs 0.2 million or 20 per cent of the project cost, whichever is lower. This scheme is administered by the State. Financial Corporations.
- Seed Capital Assistance Scheme The assistance order this scheme is applicable to projects costing not more than Rs 20 million. The assistance per project is restricted to Rs 1.5 million. The assistance is provided by IDBI through state level financial institutions. In special cases, the IDBI may provide the assistance directly.
- Risk Capital Foundation Scheme Under this scheme, the Risk Capital Foundation, an autonomous foundation set up and funded by the IFCI, offers assistance to promoters of projects costing between Rs 20 million and Rs 150 million. The ceiling on the assistance provided between Rs 1.5 million and Rs 4 million depending on the number of applicant promoters.

k) Government Subsidies

Previously the central government as well as the state governments provided subsidies to industrial units located in backward areas. The central subsidy has been discontinued but the state subsidies continue. The state subsidies vary between 5 per cent to 25 per cent of the fixed capital investment in the project, subject to a ceiling varying between Rs 0.5 million and Rs 2.5 million depending on the location.

l) Sales Tax Deferments and Exemptions

To attract industries, the states provide incentives, inter alia, in the form of sales tax deferments and sales tax exemptions. Under the sales tax deferment scheme, the payment of sales tax on the sale of finished goods may be deferred for a period ranging between five to twelve years. Essentially, it implies that the project gets an interest-free loan, represented by the quantum of sales tax deferred, during the deferent period.

Under the sales tax exemption scheme, some states exempt the payment of sales tax applicable on purchases of raw materials, consumables, packing, and processing materials from within the state which are used for manufacturing purposes. The period of exemption ranges from three to nine years depending upon the state and the specific location of the project within the state.

m) Unsecured Loans and Deposits

Unsecured loans are typically provided by the promoters to fill the gap between the promoters' contribution required by financial institutions and the equity capital subscribed by the promoters. These loans are subsidiary to the institutional loans. The rate of interest chargeable on these loans is less than the rate of interest on the institutional loans. Finally these loans cannot be taken back without the prior approval of financial institutions.

Deposits from public, referred to as public deposits, represent unsecured borrowing of two to three years' duration. Many existing companies prefer to raise public deposits instead of term loans from financial institutions because restrictive covenants do not accompany public deposits. However, it may not be possible for a new company to raise public deposits. Further, it maybe difficult for it to repay public deposits within three years.

n) Foreign Currency Loans

Apart from rupee term loans, financial institutions provide foreign currency loans. This assistance is now provided only for the import of capital equipment (as per the liberalised exchange risk management system, foreign currency required for other purposes has to be purchased from authorized dealers at market rates). On foreign currency loans sanctioned under the general scheme, the interest rate charged is typically a floating rate as determined by the lenders, (the foreign agency that has given a line of credit to the financial institution for onward lending) and the risk of exchange rate fluctuation is born by the borrower. On foreign currency loans sanctioned under the Exchange Risk Administration Scheme, the principal repayment obligations of the borrower are rupee tied at the rate of exchange prevailing on the dates of disbursement. On such rupee-tied loan liability, the borrower pays by way of servicing his loan a composite, cost every quarter. The composite cost consists of three elements: (i) the interest portion which is arrived on the basis of the weighted average interest cost of the various components of the currency pool, (ii) the spread of the financial institutions, and (iii) the exchange risk premium. The 'composite cost' is a variable rate determined at six-monthly intervals. It has a floor and a cap. Both the floor and the cap as well as the rate of interest applicable for the period is reviewed and announced from time to time.

o) Leasing and Hire Purchase Finance

With the emergence of scores of finance companies engaged in the business of leasing and hire purchase finance, it may be possible to get a portion, albeit a small portion, of the assets financed under a lease or a hire purchase arrangement.

Typically, a project is financed partly by financial institutions and partly through the resources raised from the capital market. Hence, in finalizing the financing scheme for a project, you should bear in mind the norms and policies of financial institutions and the guidelines of Securities Exchange Board of India and the requirements of the Securities Contracts Regulation Act (SCRA).

p) Public Deposit

Public deposits have been a peculiar feature or industrial finance in India. Companies have been receiving public deposits for a long time in order to meet their medium-term and long-term requirements for finance. This system was very popular in the cotton textile mills or Bombay, Ahmadabad and Sholapur and in the tea gardens or Assam and Bengal. In recent years, the method or raising finance through the public deposits has again become popular for various reasons. Rates or interest offered by the companies are higher than those offered by banks. At the same time the cost of deposits to the company is less than the cost or borrowings from banks.

While accepting public deposits, a company must follow the provisions or the companies Act and the directions issued by the Reserve bank of India. According to the companies (Acceptance of Deposits Rules, 1975 as amended in 1984) Act, no company can receive secure and unsecured deposits in excess of 10% and 25% respectively of paid up share capital plus free reserves. The Central Government has laid down that no

company shall invite a deposit unless an advertisement, including a statement showing the financial position of the company, has been issued in the prescribed form. Under the new rule, deposits can be renewed.

The rate of interest payable on deposits must not exceed 15% per annum. In order to repay the deposits maturing in a particular year, the company must deposit 110% or the deposits with a scheduled bank or in specified securities.

q) Bank Credit

Commercial banks in the country serve as the single largest source or short-term finance to business firms. They provide it in the form of Outright Loans. Cash credit, and Lines of Credit.

8.5. FINANCIAL INSTITUTION STRUCTURE AND FINANCIALASSISTANCE

This part concerned with the various aspects of financial institutions and their functioning in India, is divided into six sections as follows:

a) Institutional Structure

b) Financial assistance : direct and indirect

c) Special schemes

d) Term loan procedures

e) Project appraisal

f) Key financial indicators

a) Institutional Structure

The structure of financial institutions in India is as follows:

I. All India institutions

- Industrial Finance Corporation of India
- Industrial Credit and Investment Corporation of India
- Industrial Development Bank of India
- Other all-India institutions

II. State-level institutions

- State Financial Corporations
- State Industrial Development Corporations

a. Industrial Finance Corporation of India (IFCI)

Industrial Finance Corporation of India (IFCI)- The IFCI is the first industrial financing institution to be Set up in India soon alter independence. It was set up as a statutory corporation in July, 1948 But was later converted in to a Government Company. The IFCI provides financial assistance to any public limited company and co-operative society registered in India. Such units must be engaged in the manufacture, preservation or processing of goods, or in the shipping, mining or hotel industry, or in the generation and distribution of electricity or any other form of power. Public limited companies in the public sector are also eligible to receive assistance from the IFCI. But proprietary concerns, partnership firms and private companies are not eligible for financial assistance from the corporation. The corporation may grant assistance ranging from Rs.30 lakhs to Rs.2 crores to a single enterprise. Assistance may be given in anyone or more of the above forms for a maximum period of 25 years.

State Financial Corporations (SFC's)- As the Industrial finance Corporation does not provide industrial finance to all types or enterprises, the need was felt for state level financial institutions to finance the needs or non-corporate and other small enterprises. On September 2, 1951, the Parliament passed the State Financial Corporations Act. The Act came in to force with effect from 1st August, 1952. It empowers the State Governments to establish financial institutions for their respective States.

b. Industrial Credit and Investment Corporation of India (lCICI)

In view of the limited risk capital which IFCI and SFC s provide, need was felt far a more enterprising and flexible institution to facilitate industrial development in the private sector in India. A World Bank-cum-American Investment Mission visited India in 1954 and recommended the establishment or special institution the purpose of assisting industries in the private sector. Accordingly, the ICICI was set up on January 5, 1955 as a public limited company under the Companies Act. The Corporation was set up as a privately owned institution but later on the Life Insurance Corporation of India (a statutory corporation) became its major shareholder.

The lCICI has wide powers. It can provide any amount of financial assistance to any public or private company in the private sector. It can now give assistance to projects in the joint sector and co-operative sector. 11 is authorized to provide foreign currency loans to partnerships and proprietary concerns also. Ordinarily Rs.5 lakhs is the minimum limit and Rs.l crore is the higher limit for financial assistance to a single concern. Loans are given generally for the purpose of buying capital assets like land, buildings and machinery. In fact, the ICICI specializes in providing loans in foreign currency.

c. Industrial Development Bank of India

The Industrial Development Bank of India was established in 1964 as a subsidiary of the Reserve Bank of India. It is headquartered in Bombay. It is the apex term-lending financial institution in India. It has been designated as the principal financial institution of the country for coordinating, in conformity with national priorities, the working of institutions engaged in financing, promoting, and developing industry. IDBI finances the industry directly and also provides principal support to State Finance Corporations and State Industrial Development Corporations and commercial banks in their financing of industries, through refinancing and bill discounting facilities. The resources of IDBI consist of paid-up capital, reserves repayment of loans, market borrowings both within and outside the country, temporary credit from the Reserve Bank of India, and foreign lines of credit from the World Bank, Asian Development Bank and others.

d. Life Insurance Corporation of India

The Life Insurance Corporation of India (LIC, hereafter) came into being in 1956 after the nationalization and merger of about 250 independent life insurance societies. It is headquartered in Bombay. The primary activity of LIC is to conduct the life insurance business, but it has gradually developed into an important all-India financial institution which provides substantial support to industry.

e. General Insurance Corporation

The General Insurance Corporation (GIC, hereafter) was founded when the management of general insurance business in India was taken over by the government in 1971 and subsequently nationalised in 1973. It is headquartered in Bombay. GIC provides substantial assistance to industrial projects be way of term loans, subscription to equity capital and debentures, and underwriting of securities.

f. Industrial Reconstruction Bank of India

The industrial Reconstruction Bank of India, headquartered in Calcutta, was set up when its precursor, the Industrial Reconstruction Corporation of India, was reconstituted in 1984. IRBI is primarily an agency to help the reconstruction and rehabilitation of industrial units which have closed down or which face the risk of closure. IRBI offers assistance in various forms : (i) financial assistance which is not available from normal channels of finance and banking, (ii) technical assistance and guidance to sick units to revive them, (iii) managerial in the fields of administration, finance, marketing, industrial relations, etc. and (iv) suggestions for reconstruction and rationalization.

State Level Institutions State Financial Corporations

The State Financial Corporation, set up under the State Financial Corporation Act, 1951, render assistance to medium and small scale industries in their respective states. Their shareholders are the respective state governments, IDBI, insurance companies, credit cooperatives and private shareholders.

State Industrial and Development Corporations

The State Industrial Development Corporation, were set up by the state governments during the 1960s to serve as catalytic agents in the industrialization process of their respective states. Presently almost every state has an SIDC which is fully owned by the respective state government.

- Financial Assistance: Direct and Indirect Direct Financial Assistance

Financial institutions provide direct financial assistance in the following ways

- Rupee term loans
- Foreign currency term loans
- Subscription to equity shares
- Seed capital

Indirect Financial Assistance

Besides providing direct financial assistance, financial institutions extend help to industrial units in obtaining finance/credit through the following ways :

- Deferred payment guarantee
- Guarantee for foreign currency loans
- Underwriting

Deferred Payment Guarantee

Financial institutions issue guarantee on behalf of the buyer of industrial machinery to the supplier offering the facility of deferred payments. Should there be a default by the buyer in the payment of deferred installments, financial institutions make the payment and subsequently recover the amount form the assisted unit. A nominal commission is charged for providing such guarantee.

Guarantee for Foreign Currency Loans

Financial institutions provide guarantee for foreign currency loans obtained by industrial concerns from institutions and banks abroad. A nominal commission is charged to the assisted unit for such guarantee.

Underwriting

Special Schemes

Several special schemes have been designed to serve the varied needs of industry. The important ones are:

- Bill rediscounting scheme
- Suppliers line of credit
- Soft loan scheme
- Equipment finance scheme

8.6. NORMS OF FINANCE AND TERM LOAN PROCEDURE

The principal norms and policies of financial institutions are described below

Eligibility

Till recently, long term loans were provided by financial institutions to concerns in certain industries and denied to concerns in industries placed in the negative list. Now, however, a shift is taking place in their policy.

Debt-equity Ratio

Presently, the general debt-equity norm for medium and large scale projects is 1.5:1. This serves as a broad guideline against which variations are permitted on a case to case basis, especially under the following circumstances: (a) high degree of capital intensity, (b) location in a backward area, and (c) background' of the promoter. Other things being equal: (i) a capital intensive project is eligible for a higher debt-equity ratio, (ii) a project in a backward area qualifies for a higher debt-equity ratio, and (ill) a project promoted by a technocrat-promoter is entitled to a higher debt-equity ratio.

How are debt and equity defined for the purpose of calculating the debt-equity ratio? Debt consists of the following: (i) loans and deposits that are repayable after one year (this includes interest bearing unsecured loans from government agencies, promoters, etc.), (ii) non-convertible debentures and convertible debentures (except that part which is compulsorily convertible into equity) until they are converted, irrespective of the maturity period, (ill) deferred payments, and (iv) preference shares due for redemption within three years.

Equity consists of the following: (i) paid-up ordinary share capital, (ii) irredeemable preference shares, cumulative convertible preference shares where the redemption period is due after three years, (iii) premium on share issues, (iv) central/ state cash subsidy, (v) long term interest-free unsecured loans from state governments or government agencies or promoters subordinate to loan from financial institutions, and (vi) free reserves (including surplus in profit and loss account) less any accumulated losses, arrears or unabsorbed depreciation, intangible assets (like goodwill), expenditures not written off (like preliminary expenses), and investments in other undertakings where these are 'prima facie' considered unrealisable.

Promoters Contribution

Financial institutions require promoters to contribute 25 to 30 per cent of the project cost. This is lowered selectively in certain cases like capital-intensive projects, high priority projects, and technocrat-promoted projects. Contributions made by the following or of the following kinds represent promoters' contribution (i) equity investment by promoters, their friends, relatives and associates (including NRIs), (ii) equity investment by other companies controlled by promoters, (iii) equity participation by shareholders of other promoter companies, (iv) foreign collaborators,' (v) investment from oil exporting developing countries, (vi) state government, in the case of joint sector or assisted sector projects, (vii) seed capital assistance, (viii) unsecured loan from promoters, (ix) venture capital participation, (x) mutual fund participation, (xi) internal accruals in the case of an existing company, (xii) rights issue to existing shareholders, and (xiii) any other contribution approved as promoters' contribution.

Term Loan Procedure

The procedure associated with a term loan involves the following principal steps.

1. Submission of loan application: The borrower may submit the application to any of the three term lending institutions, viz, IDBI, ICICI, and IFCI. The borrower is required to fill out a common application form.
2. Initial processing of loan application
3. Appraisal of the proposed projects
4. Issue of the letter of sanction
5. Acceptance of the terms and conditions by the borrowing unit
6. Execution of loan agreement
7. Disbursement of loans
8. Creation of security
9. Monitoring

Project Appraisal

Financial institutions appraise a project form the marketing, technical, financial, economic, and managerial angles. The principal issues considered and the criteria employed in such appraisal are discussed below (for detail see in lesson 1)

1. Market Appraisal
2. Technical Appraisal
3. Financial Appraisal
4. Economic Appraisal
5. Managerial Appraisal

Key Financial Indicators

The key financial indicators used by financial institutions while evaluating projects are the internal rate of return, the debt service coverage ratio, and the break-even point. The manner in which these indicators are calculated is discussed below.

Internal Rate of Return

For calculating the internal rate of return of project, its cash outflows and cash inflows are defined as follows:

Table-8.1

Outlay on fixed assets	Cash Outflows Cost of Project
	Working capital margin
	Interest during construction period
Outlay on current assets	Current asset investment in the beginning
	As well as additional investment in current assets in future.
	Cash Inflows
Operating inflows	Earnings before depreciation, interest, and taxes (EBDIT)
Terminal inflow	Residual value of fixed assets + Realisable value of current assets

Debt service Coverage Ratio

The debt service coverage ratio is defined as:

Profit after tax + Depreciation + Other non-cash charges + Interest on term loan Interest on term loan + Repayment of term loan

Break-even Point

The break-even point for a project is calculated with reference to the year when the project is expected to reach its target level of capacity utilisation, which is usually the third of the fourth operating year.

8.7. SEBI GUIDELINES

The Capital Issues Control Act, 1947 (and the exemption orders and rules made there under) was the primary legislation regulating the issue of securities by the corporate sector till recently. This Act was repealed in May 1992 and capital issues were brought under the purview of the Securities Exchange Board of India (SEBI hereafter) which was clothed with statutory powers when the SEBI Act, 1992 was passed. On June 12, 1992, SEBI released its guidelines applicable to capital issues. A comparison of these guidelines with the guidelines that were followed under the earlier regime (that is under the Capital Issues Control Act, 1947) suggests that the thrust of regulation is no longer on product and price control.

In the earlier regime, there were restrictions on the kinds of securities that could be issued, the pricing of these securities, and .the interest rates or dividend rates payable on them. Under the new regime there is virtually no restriction on the types of securities (financial instruments) that can be issued, there is substantial freedom in pricing these securities, and there is no ceiling on interest/ dividend rate payable ‘on these securities. While the new regime more or less does away with product and price controls, it lays stress on adequate disclosure, seeks to safeguard the interest of investors, and emphasises prudential controls. The key SEBI guidelines are summarised below.

New Instruments

While there is no restriction on the kinds of financial instruments, the issuer of capital shall make adequate disclosures’ regarding the terms and conditions, redemption, security, conversion, and any other features of the instrument so that an investor can make a reasonable determination of risks, returns, safety, and liquidity of the instruments. The disclosures shall be vetted by SEBI in this regard.

Pricing of Public Issues of Equity Capital

The salient features of SEBI guidelines with respect to the pricing of public issues of equity capital are as follows:

- A new company set up by entrepreneurs without a track record will be permitted to issue capital to public only at par.
- A new company set up by existing companies with a five year track record of consistent profitability will be .free to price its issue provided the participation of the promoting companies is not less than 50 per cent of the equity of the new company and the issue price is made applicable to all new investors uniformly.
- An existing private/closely held company with a three year track record of consistent profitability shall be permitted to freely price the issue.
- An existing listed company can raise fresh capital by freely pricing further issue.
- Fully Convertible Debentures (FCDs)/Partially Convertible Debentures (PCDs)/Non-convertible Debentures (NCDs)

The guidelines relevant to these instruments are as follows

1. Credit rating is compulsory in the case of FCDs if the conversion is effected after 18 months and in the case of NCDs/PCDS if the maturity period exceeds 18 months.
2. In the case of FCDs/PCDs the terms of conversion (time of conversion and conversion price) shall be predetermined and stated in the prospectus.
3. Any conversion in part or whole of the debenture will be optional at the hands of the debenture holder, if the conversion takes place at or after 18 months from the date of allotment, but before 36 months. FCDs having a conversion period exceeding 36 months must have 'put' and 'call' option (the 'put' option gives the debenture holder the right to sell the debentures back to the company at a specified price whereas the 'call' option gives the company first right to buy back the debentures at a specified price).
4. A Debenture Redemption Reserve (DRR) shall be created by all companies raising debentures, except when the debenture issue has a maturity of 18 months or less, on the following basis: (a) A moratorium up to the date of commercial production can be provided for creation of the DRR in respect of debentures raised for project finance. (b) The DRR may be created either in equal installments for the remaining period or higher amounts if profits permit. (c) In the case of PCDs, the DRR should be created in respect of the non-convertible portion of the debenture issue on the same lines as applicable to NCDs. In respect of convertible issues by new companies, the creation of the DRR should commence from the year the company earns profits for the remaining life of debentures. (d) Companies may distribute dividends out of general reserves in certain years if residual profits after transfer to the DRR are inadequate to distribute reasonable dividends. (e) The DRR will be treated as a part of general reserve for consideration of bonus issue proposals and for price fixation related to post-tax return. (f) In the case of new companies, distribution of dividend shall require approval of the trustees to the issue and the lead institution, if any. (g) The company should create the DRR equivalent to 50 per cent of the amount of debenture issue before the debenture redemption commences. Drawl from the DRR is permissible only after 10 per cent of the debenture liability has been actually redeemed by the company.

Promoters' Contribution and Lock-In Period

The key provisions in this regard are as follows: (a) Equity capital to be subscribed in any issue to the public by promoters, i.e., those described in the prospectus as promoters, directors, friends, relatives and associates should not be less than 25 per cent of the total issue of equity capital up to Rs 1000 million and 20 per cent of the issue above Rs 1000 million. In the case of FCDs, one third of issue amount should be contributed by promoters, directors, friends, relatives and associates by way of equity before the issue is made. In the case of PCDs, one third of the convertible portion should be brought in as contribution of promoters, directors, friends, relatives and associates before the issue is made. The minimum subscription by each of the friends/relatives and associates under the promoters' quota should not be less than Rs 0.1 million. (b) The promoters' contribution shall not be diluted for a lock-in period of five years from the date of commencement of the production or date of allotment whichever is later. Promoters must bring in their "full subscription to issues in advance before public issue. (c) All firm allotments, preferential allotments to collaborators, shareholders of promoter companies, whether corporate or individual, shall not be transferable for three years from the date of the commencement of production or date of allotment whichever is later.

8.8. SELF ASSESSMENT QUESTIONS

1. Define The Project Finance. Discuss The Role Of Project Finance.
2. What Is The Means Of Finance? Explain The Various Sources Of Project Finance In India
3. Write A Detail Note On
   a) Euro Issues
   b) Consortium Finance
   c) Subordinate Debt
   d) Debenture
4. Discuss In Detail Financial Institution Structure In India
5. Explain The SEBI Guidelines Regarding Public Issues And Debentures

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Chapter - 9
Project Organisation

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- Introduction To Project Organization
- Reasons For Increased Project-Oriented Organizations
- Types Of Project Management Organization

9.1. INTRODUCTION

An enterprise, if successful, has a tendency towards growth and development, it employs and trains qualitative staff, provides resources and develops the organizational structure. In general, the structure is focused on specialization of the group staff. If the organizational structure is unable to perform some task, the tendency of its rejection will appear. When such a situation becomes dangerous for the firm, the increasing pressure will be exerted on reorganization.

Every elementary book dealing with management problems includes the elements of specialization, and especially always popular functional organizations dividing and organizing the enterprise to product lines, geographical position of some parts, on the basis of production process, types of consumers, and so on. In addition, large companies can be organized in auxiliary segments, doing it often according to different methods at different operative levels. Recently, several different forms of project organizations have appeared in professional literature, as “project management”, “organization management by means of projects”, “project-oriented firms”, and so on. The forms are described as “applying project management practice and its tools in the enterprise”.

As a potential source of these organizational forms, fast increasing software industry is identified that has developed the long practice in developing big software application programs, decomposing them into the series of comparative small software projects. When all software projects are complete, they integrate into the whole applicative system.

This has caused that many enterprises, non-software similar to software ones, have accepted the system by means of which they can keep on working their traditional work, already done in the traditional way, in the way which will not change the form of project realization.

9.2. REASONS FOR INCREASED PROJECT-ORIENTED ORGANIZATIONS

There are many reasons for the fast increase of number of project-oriented organizations, but in the literature they are usually grouped into four general fields:

- The first cause is speed of the answer to the increasing rhythm of market changes determining the speed of answers to these changes (they can be both danger and chances), as an absolute condition for successful competitiveness. In addition, from the aspect of competitiveness, it is not any more acceptable development of a product or service in the traditional way where in this process it passes from one functional field to the other one without evaluating that it is ready for production and sale. In today’s business ambient, realizing the possibility to appear in the market with products or services is considered one of the biggest competitive advantages. The application of modern organizational forms, as well as contemporary software tools has drastically reduced the time of developing new products, and the consequence is a drastic reduction of product living cycle. Similar to this, the possibility of broadening modality has been created in many fields, in essence the same product; thus, it suits to the consumer’s wishes even more.
- Development of new products or services, almost always requires the application of knowledge from different and specialized fields of knowledge. Unfortunately, combination is specific for every field. It means that there is a need of creating ad hoc teams composed of experts needed for that case and which will be disbanded when the work is finished.
- Another characteristic of the contemporary business environment is a strong development and expansion of technological possibilities, causing, as one of the consequences, destabilization of the organizational structure. This is a tendency in different economic and non-economic fields; we consider it unnecessary to list, because it is an obvious fact in all the sectors, for example, from banking to ferrous metallurgy. This is especially present in developed market economies in Western countries, but we consider that this orientation of changes will be generated in our economy by different processes in the future which has already begun by the process of privatization. The process of uniting, some of the enterprise’s parts, becomes independent, reducing management levels, and similar serious disturbances of the current practice will require the broad system of answers.

- Transfer of non-routine activities of the enterprises, conditioned by market and technological changes (with a view of using chances and evading danger) in projects, enables forcing the obligations to perform activities as unavoidability of project planning, their integration with all the necessary and related activities and enabling constant reporting about the progress of realization of these activities
- Transfer of a non-profit ambient into that where projects are used for realizing specific tasks, i.e. to the complete project-oriented organization represents for top management an extremely complex transition which should be realized. There are many reasons for such a statement.
- This process takes time. Even in case when all the necessary resources are collected and when there is complete readiness of management for such a change, it is still difficult.

9.3. TYPES OF PROJECT MANAGEMENT ORGANIZATION

Further, we shall try, in accordance with the recent and professional attitudes, to represent three basic forms of the organization for project management, with their description, characteristics, advantages and disadvantages, as well as to try to identify cases where some of them can be seen.

Models planned to be elaborated are

1. Functional type of organization where the project is part of the functional organization of the enterprise.
2. Pure project organization, and
3. Combined or matrix systems.

9.3.1. Functional type of the project management organization

This type, as one of the possible forms of realizing a project in the organization, represents the possibility of its realizing in one, existing, functional part of the enterprise.

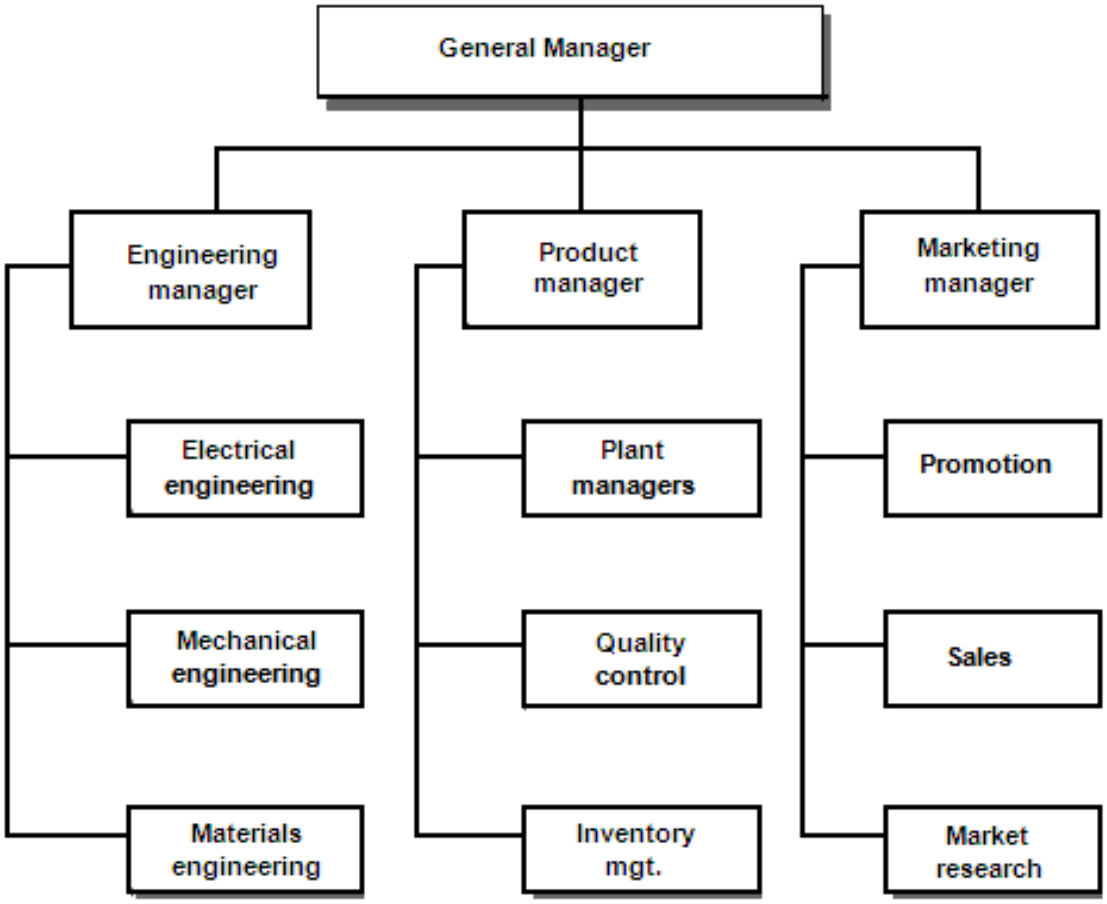

Fig-9.1: Functional type of the project management organization

Advantages of this model of realization can be, generally speaking, found in the fact that, in this case, functional dimensions of the existing organization are used. The major advantages of this model can be grouped in the following way:

- There is a maximal flexibility in using the staff. In case that the correct functional department of the organization is selected for realizing the project, the department will have the primary and administrative base for individuals with technical knowledge in the fields relevant for the project. They can be temporary engaged in cases when their contribution is necessary and then they can be returned to perform their regular activities.
- Some experts can be engaged in many different projects. With the broad basis of the technical staff available to the functional department, if it is the case, the people can be easily moved from one project to the other one.
- Experts in the department can be grouped to exchange knowledge and experiences they possess. Thus, the project team has the access to any technical knowledge existing in that functional group. Further, it can be the big resource of synergic solution for solving some technical problems;
- Functional departments also serve as a basis of technological continuity when some experts decide to quit the project team, and the enterprise, too. It is equally important, both in technological continuity and in the continuity of procedural, administrative and other policies which will result when the project continues in that department of the home enterprise.
- The last, but not the least important is that the functional department possesses the organized way of advancing individuals as experts in their functional fields. The project can be an opportunity for promotion all those who took part in its successful work, but the functional department is their home base and the focus of their professional advancement.
- It is normal that so described way of project carrying out, besides all cited advantages, has also its disadvantages which can be grouped as follows:
  - The essential shortage of this way for project carrying out is that the client in not in the center of activities and attention. The functional department, namely, has its own major work which, the most often, has an advantage over the wok within the framework of the project, therefore, the client's interests are pushed into the background's.
  - Functional departments have the tendency of orientation to specific activities associated with their activities. This not an unimportant problem in order to realize the project successfully;
  - Sometimes, in projects carried out by this form, neither individual is completely responsible for the project. The lack of this precision usually means that the project manager is authorized and responsible for some part of the project, but some other person is authorized for other parts. This is obvious lack of coordination which is very important in realization.
  - The same reasons bring to the lacks of coordinated efforts which can have tendencies to reduce the responsibilities for the client's needs because there are several management levels between the project and the client.
  - There is also a tendency of suboptimal execution of the project that some people working in the department where the project is realized very carefully and efficiently, are interested in realizing some segments of the project and so neglecting and even ignoring, more or less, the other ones;
  - Motivation of the people working in the project has a tendency to grow weaker because the project is not paying appropriate attention and some team members can understand assigning their activities in the project as going astray from their basic activities;
  - This organized approach does not enable the holistic approach to the project. Complex projects, technically considered (development of complex and sophisticated products, and similar) cannot be qualitatively designed by this method. Mutual inter departmental communication and necessary knowledge exchange is insufficient.

9.3.2. Pure project management organization

The pure project organization is at the other end of the spectrum of organizational possibilities for project management. The essential characteristic of this approach is that the project is separated from the home organization. It becomes an independent segment with its special technical staff, its own administration, connected with the home organization by wakened links which are manifested in the periodical reports on the project advancement and some exceeding. When we talk about the way of work performance, there are different solutions in business practice. Some home organizations issue rules of administrative, financial, staff and control procedures in detail. Contrary to this, some home organizations give the project an absolute freedom. The previously cited points to the fact that there is a wide spectrum of possible organizational varieties between these two extreme modalities; the choice depends on many factors. Figure. 9.2 is a graphical illustration of the model of a pure project organization for project management.

The pure project organization has its advantages and disadvantages, identically as the functional model of project management organization.

The advantages of this approach to project management can be classified as follows

- The project manager is fully responsible and authorized for the project. Although he has to report senior management of the home organization about the advancement of project realization, the complete labor is allocated to the project. Figure.9. 2 Pure project management organization
- The complete labor, engaged in the project is directly responsible to the project manager. In this case, permits and advices of department bosses are not necessary. The only director in this model is the project manager;
- In case of realizing complex projects, when some phases are moved from one to another functional department, communication lines are shortened because the whole functional structure is bypassed, and the project manager communicates directly with the top management structure;
- If several, similar projects are realized successfully, the pure project organization can enable permanent, more or less expert staff which can develop necessary skills for some technologies. This can be very important because, in case these groups exist, it can be a good reference for the organization and it will attract consumers;
- The project team, having a strong and its own identity, has a tendency of developing the high level of communications and the exchange of knowledge and experience among its members;
- As the authority is centralized, the possibility of fast decision-making is increased. In this way, the organization is enabled to react fast on the demands of clients or top management.
- The rule of the united management is respected. The value of particular organizational principles cannot be exaggerated, and the quality of subordination is doubtlessly bigger when this subordination is done by one person;
- The pure project organization is structurally simple and flexible; it enables its relatively simple application and understanding;
- This type of the organizational structure has a tendency to support the holistic approach to the project. The tendency of focusing and optimization of project segments, relating to the whole project, can often result in technical errors in the project.
- As any model used for carrying jobs, generally speaking, so this form of project management has its advantages and disadvantages. We have previously pointed to the very important advantages of the project organization. Similarly, this form has very serious weaknesses. In addition, we shall point to the disadvantages of this organizational form of project management:
- If the home organization has taken several projects at the same time, it is logic to expect that every of them (if the same organization model) be completely equipped and supplied by all resources. This may double or tripled, as a consequence, the efforts in every fields, from the office staff to the most sophisticated (and most expensive) units for technological support.

- In essence, the need to ensure the accessibility to technological knowledge results in the attempt of exaggerated accumulation of equipments and technological supports with a view of ensuring that they will be available in every moment when it is needed. Therefore, the people with critical technical skills can be engaged in the project longer than it is necessary. Similarly, there may be a tendency that the project manager wishes to keep them in the project longer than they should be in order to protect them from possible bad events.
- Keeping the project out of the technical control of the functional department may have its advantages, but also serious disadvantages, especially in cases when it belongs to the fields of "high technologies". The functional departments are still the base of technological knowledge and it is not so simple to determine that only some of them can be part of the pure project team.
- In the pure project organization, we have already cited, during defining one of the characteristics f the project, the project has its own independent life span or cycle, with the beginning and the end. The team members are strongly associated with the project and among themselves. The increase of division "we – they" deforms the relationships between the team members and the other team members and the relations in the home organization. Rivalry among friends can become keen or hostile competition.
- At the end, but is not the least important. At the beginning, we have pointed that the project has the life span with the beginning and the end. Within this context, there is a question: what to do after the project? It is necessary to emphasize great uncertainty of the team members' future after finishing the project, their further engagement, equipments, and so on.

9.3.3. The matrix form of project management organization

From the above- cited, it is obvious that considered forms have their serious advantages, each of them separately, which qualify them as acceptable, but there are also serious disadvantages. Trying to collect advantages of the pure project organization with determined and desired characteristics, as well to avoid disadvantages of any of them, a matrix organization for project management has been developed. In essence, careful consideration of all the cited, as well as all that is appearing in practice, draws a conclusion that the previous two forms, functional and matrix, represent the extremes on the spectrum of varieties of possible forms for organizing project management. Thus, the matrix organization can be considered as the combination of these two forms so we can find in the professional literature that it is about covering the pure matrix organization over the functional departments in the home organization.

The fact that it represents the combination of two extreme forms generates the existence of different modalities and which will be differentiated if it is more similar to functional or pure matrix ones. If the form of project management organization is more similar to the pure project organization of project management, then we talk about the "strong matrix organization". If contrary to this case, then we talk about the "coordinating", "functional", or weak matrix organization more similar to the functional one. As there is the middle in every dilemma, there is the so-called "balanced" matrix organization being between these two. In the project practice of case studies in this field, there is unlimited number of varieties of organizational forms, between these extremes, and the primary difference between these forms is determined by the level at which the power of decision-making is, i.e. it is concentrated in the project or functional manager.

Methodologically considered, it is easier to explain the "strong matrix organization". Instead of standing aside in relation to the home organization, as in case of the pure matrix one, it is not separated. This form of the organization is illustrated in

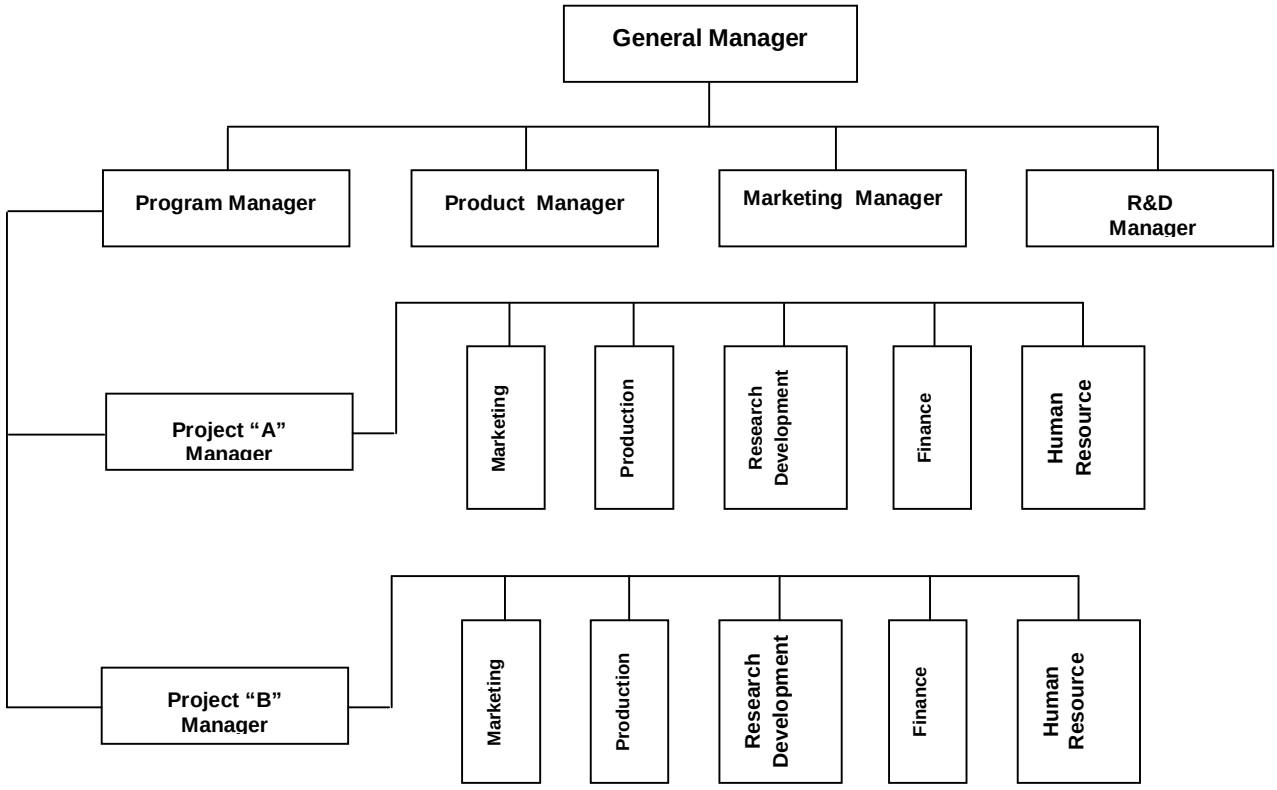

Fig-9.2: Matrix organization for project management

The matrix organization is balanced between these extremes which is nothing else but the balance of the cited approaches where there are many different mixtures of project and functional responsibilities. So, for example, in cases when projects require the group work, before all, it is usual to prefer the group work to their transfer in projects.

As for the previous models, the matrix approach also identifies some advantages and disadvantages.

Advantages can be classified as follows

- The project is paid the central attention, as with the pure matrix organization. The individual, i.e. the project manager, takes over the full responsibility for project management, its realization as planned, within the framework of in advance defined budget, specifications and quality;
- The fact that the project organization includes functional departments, temporary taking over workers and their skills from these departments, draws the logical conclusion that this enables the use of all resources from all functional departments. This is especially important when many projects are carried out at the same time and experts for all departments are available to all projects; it drastically reduces the multiple resource use, as with the pure project organization;
- Here, the team members are not so much afraid for their destiny after finishing the project, even in case of their strong association with the project because they are the personnel of the home department;
- The answer to the client's needs is equally fast as with the project approach, but the matrix is more flexible because it is included into the organization which already functions and it has to adapt to these needs;
- With this type of organization, management will have the possibility to use the existing administrative staff. The result of this is the consistency with policies, procedures and practice of the existing enterprise which will be saved.
- In case of simultaneous realization of several projects, the matrix organization enables better resource use, from the aspect of the company on the whole. This, holistic, approach of considering the enterprise,

as an entirety, enables the supply of needed resources for the period which enable the optimization of using resources of the whole company.

- Contrary to the pure project organization representing the extreme in the spectrum of possible varieties, the matrix organization tries to include the wide field of these extreme approaches.

These cited advantages of the matrix approach sound very strongly, but disadvantages, which will list, are also very serious and they are mostly manifested in the conflict of two diametrically supposed principles.

- In the functional approach of organizing the project, all the power for decision-making is doubtlessly concentrated in the functional department while in the project approach, it is with the manager. This power, which can be very important in relation to the project destiny, is very balanced in the matrix approach. If there is any doubt about the responsibility, the project suffers. If there is uncertainty about the positive result of the project, the struggle for the prestige according to the question "who is responsible for praise and glory" can increase;
- We have already cited that one of the advantages of this approach is manifested in the possibility to carry out several projects simultaneously and control time, costs and performance quality. This possibility, however, has its shortages. The set of projects must be considered on the whole although it is very difficult. In addition, transferring resources from project to project with the need to satisfy different term plans of every project can specially increase conflicts between project managers. The consequence of this cannot be optimal performance of objectives of the organization;
- Similar to the existing problems relating to the end of the projecting, they are present in the project organization and they cannot be simply evaded because it is the work with the beginning and the end.
- The project management controls administrative decisions in matrix organized project realization; technical decisions are controlled by the responsible manager in the functional department. This distinction explained in the handbook in this way sounds logical and understandable, but it can be very delicate in the concrete project management of job distribution and authority in decision-making and division of responsibilities. The capability of the project manager to negotiate about all resources for technical support and their delivery on time can be of the key importance for the whole work;
- This management model directly violates one of the principles of the management-unity command. The staff involved in the project has at least two managers, their functional, as well as permanent, and the project manager, whose function stops when the project ends, but its realization is in progress and he is the key manager. This represents a very serious problem.

9.4. SELF ASSESSMENT QUESTIONS:

1. What Is Project Organization? Explain The Reasons For Increased Project-Oriented Organizations?
2. Discuss The Types Of Project Management Organization?
3. Explain What Is Functional Type Of The Project Management Organization? Discuss Its Advantages?

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Chapter - 10

Project Profitability Appraisal

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of Profitability Appraisal.
- To understand the key principles in project and investment appraisal
- To know the various Methods of Profitability Appraisal
- To understand the Multi Criteria Analysis and its process

10.1. INTRODUCTION

The financial analysis of a project helps determine the financial sustainability of the project and its overall success. In its simplest form, one can describe the financial analysis of a project as a process that entails the organization of specific data requirements in certain statements, followed by the application of certain investment criteria to these statements to determine the financial profitability or sustainability of the project. This process requires an understanding of the concepts, principles and common conventions that underlie a correct financial appraisal. Moreover, the understanding of these concepts and principles is important in defining the data requirements for conducting the financial appraisal of the project.

The basic purpose of systematic appraisal is to achieve better spending decisions for capital and current expenditure on schemes, projects and programmes. Project and investment appraisal refers to evaluations of decisions made by organizations on allocating resources to investments of a significant size. Typical capital spending and investment decisions include the following:

- Make or buy decisions and outsourcing certain organizational functions
- Acquisition and disposal of subsidiary organizations
- Entry into new markets
- The purchase (or sale) of plant and equipment
- Developing new products or services, or discontinuing them, or decisions on related research and development programs
- The acquisition or disposal of new premises or property by purchase, lease, or rental
- Marketing programs to enhance brand recognition and to promote products or services
- Significant programs of staff development or training
- Restructuring of supply chain
- Revision of distribution networks
- Replacing existing assets.

10.2. THE KEY PRINCIPLES IN PROJECT AND INVESTMENT APPRAISAL

The key principles underlying widely accepted good practice are

- When appraising multi-period investments, where expected benefits and costs and related cash inflows and outflows arise over time, the time value of money should be taken into account.
- The time value of money should be represented by the opportunity cost of capital.
- The discount rate used to calculate the NPV in a DCF analysis should properly reflect the systematic risk of cash flows attributable to the project being appraised, and not the systematic risk of the organization undertaking the project.
- A good decision relies on an understanding of the business and should be considered and interpreted in relation to an organization’s strategy and its economic, social, and competitive position.
- Cash flows should be estimated incrementally, so that a DCF analysis should only consider expected cash flows
- All assumptions used in undertaking DCF analysis, and in evaluating proposed investment projects, should be supported by reasoned judgment, particularly where factors are difficult to predict and estimate. Using techniques such as sensitivity analysis to identify key variables and risks helps to reflect worst, most likely, and best case scenarios, and, therefore, can support a reasoned judgment.
- A post-completion review or audit of an investment decision should include an assessment of the decision-making process and the results, benefits, and outcomes of the decision.

10.3. METHODS OF PROFITABILITY APPRAISAL

An understanding of discounting and Net Present Value (NPV) calculations is fundamental to proper appraisal of projects and programmes. A good understanding of Cost Benefit Analysis (CBA), Internal Rate of Return (IRR), Multi Criteria Analysis (MCA) and Cost Effectiveness Analysis (CEA) is also essential for economic appraisal purposes. Some of the profitability methods are discussed here under.

10.3.1. Analytical Methods

The recommended analytical methods for appraisal are generally discounted cash flow techniques which take into account the time value of money. People generally prefer to receive benefits as early as possible while paying costs as late as possible. Costs and benefits occur at different points in the life of the project so the valuation of costs and benefits must take into account the time at which they occur. This concept of time preference is fundamental to proper appraisal and so it is necessary to calculate the present values of all costs and benefits.

a) Net Present Value Method (NPV)

In the NPV method, the revenues and costs of a project are estimated and then are discounted and compared with the initial investment. The preferred option is that with the highest positive net present value. Projects with negative NPV values should be rejected because the present value of the stream of benefits is insufficient to recover the cost of the project.

Compared to other investment appraisal techniques such as the IRR and the discounted payback period, the NPV is viewed as the most reliable technique to support investment appraisal decisions. There are some disadvantages with the NPV approach. If there are several independent and mutually exclusive projects, the NPV method will rank projects in order of descending NPV values.

However, a smaller project with a lower NPV may be more attractive due to a higher ratio of discounted benefits to costs particularly if there affordability constraints.

Using different evaluation techniques for the same basic data may yield conflicting conclusions. In choosing between options A and B, the NPV method may suggest that option A is preferable, while the IRR method may suggest that option B is preferable. However in such cases, the results indicated by the NPV method are more reliable. The NPV method should be always be used where money values over time need to be appraised. Nevertheless, the other techniques also yield useful additional information and may be worth using. The key determinants of the NPV calculation are the appraisal horizon, the discount rate and the accuracy of estimates for costs and benefits.

b) Discount rate

The discount rate is a concept related to the NPV method. The discount rate is used to convert costs and benefits to present values to reflect the principle of time preference. The calculation of the discount rate can be based on a number of approaches including, among others:

- The social rate of time preference
- The opportunity cost of capital
- Weighted average method

The same basic discount rate (usually called the test discount rate or TDR) should be used in all cost-benefit and cost-effectiveness analyses of public sector projects. The current recommended TDR is 5%. However, if a commercial State Sponsored Body is discounting projected cash flows for commercial projects, the cost of capital should be used or even a project-specific rate.

c) Internal Rate of Return (IRR)

The IRR is the discount rate which, when applied to net revenues of a project sets them equal to the initial investment. The preferred option is that with the IRR greatest in excess of a specified rate of return. An IRR of 10% means that with a discount rate of 10%, the project breaks even. The IRR approach is usually associated with a hurdle cost of capital/discount rate, against which the IRR is compared. The hurdle rate corresponds to the opportunity cost of capital. In the case of public projects, the hurdle rate is the TDR. If the IRR exceeds the hurdle rate, the project is accepted.There are disadvantages associated with the IRR as a

performance indicator. It is not suitable for the ranking of competing projects. It is possible for two projects to have the same IRR but have different NPV values due to differences in the timing of costs and benefits. In addition, applying different appraisal techniques to the same basic data may yield contradictory conclusions.

d) Benefit / Cost ratio (BCR)

The BCR is the discounted net revenues divided by the initial investment. The preferred option is that with the ratio greatest in excess of 1. In any event, a project with a benefit cost ratio of less than one should generally not proceed. The advantage of this method is its simplicity. Using the BCR to rank projects can lead to suboptimal decisions as a project with a slightly higher BCR ratio will be selected over a project with a lower BCR even though the latter project has the capacity to generate much greater economic benefits because it has a higher NPV value and involves greater scale.

e) Payback and Discounted payback

The payback period is commonly used as an investment appraisal technique in the private sector and measures the length of time that it takes to recover the initial investment. However this method presents obvious drawbacks which prevent the ranking of projects. The method takes no account of the time value of money and neither does it take account of the earnings after the initial investment is recouped. For example, a project requires a 3 million dollars investment and Option 1 returns 2 million dollars in the first year and Option 2 returns 3 million dollars for the same year.

On this basis Option 2 is the preferred option as the payback period is shorter but if the cash flows changed in subsequent years and Option 1 returned 2 million dollars annually while Option 2 only earned 1 million dollars annually, the chosen option would have been incorrect. The ordinary payback period should not be used as an appraisal technique for public investment projects.

A variant of the payback method is the discounted payback period. The discounted payback period is the amount of time that it takes to cover the cost of a project, by adding the net positive discounted cash flows arising from the project. It should never be the sole appraisal method used to assess a project but is a useful performance indicator to contextualize the project's anticipated performance.

f) Sensitivity analysis

An important feature of a comprehensive CBA is the inclusion of a risk assessment. The use of sensitivity analysis allows users of the CBA methodology to challenge the robustness of the results to changes in the assumptions made (i.e. discount rate, time horizon, estimated value of costs and benefits, etc). In doing so, it is possible to identify those parameters and assumptions to which the outcome of the analysis is most sensitive and therefore, allows the user to determine which assumptions and parameters may need to be re-examined and clarified.

Sensitivity analysis is the process of establishing the outcomes of the cost benefit analysis which is sensitive to the assumed values used in the analysis. This form of analysis should also be part of the appraisal for large projects. If an option is very sensitive to variations in a particular variable (e.g. passenger demand), then it should probably not be undertaken. If the relative merits of options change with the assumed values of variables, those values should be examined to see whether they can be made more reliable. It can be useful to attach probabilities to a range of values to help pick the best option.

Sensitivity analysis requires a degree of exploratory analysis to ascertain the most sensitive variables and should lead to a risk management strategy involving risk mitigation measures to ensure the most pessimistic values for key variables do not materialize or can be managed appropriately if they do materialise. It is important to take into account the level of disaggregation of project inputs and benefits – sensitivity analysis based on a mix of highly aggregated and disaggregated variables may be misleading.

g) Scenario analysis

The scenario analysis technique is related to sensitivity analysis. Whereas the sensitivity analysis is based on a variable by variable approach, scenario analysis recognises that the various factors impacting upon the stream of costs and benefits are inter-independent. In other words, this approach assumes that that altering individual variables whilst holding the remainder constant is unrealistic (i.e. for a tourism project, it is unlikely that ticket sales and café-souvenir sales are independent). Rather, scenario analysis uses a range of

scenarios (or variations on the option under examination) where all of the various factors can be reviewed and adjusted within a consistent framework.

A number of scenarios are formulated – best case, worst case, etc – and for each scenario identified, a range of potential values is assigned for each cost and benefit variable. When formulating these scenarios, it is important that appropriate consideration is given to the sources of uncertainty about the future (i.e. technical, political, etc). Once the values within each scenario have been reviewed, the NPV of each scenario can then be recalculated.

h) Switching values

This process of substituting new values on a variable-by-variable basis can be referred to as the calculation of switching values. These can provide interesting insights such as what change(s) would make the NPV equal zero or alternatively, by how much must costs or benefits fall or rise, respectively, in order to make a project worthwhile. The switching value is usually presented as a % i.e. a 20% increase in investment costs reduces project NPV to 0.

This is very useful information and should be afforded a prominent place in any decision-making process. Moreover, given the importance of this information the switching values chosen should be carefully considered and should be realistic and justifiable. For example, for capital projects requiring an Exchequer commitment over the medium to long-term, operating and maintenance costs should always be examined. Similarly, any project reliant upon user charges should always examine the impact of changes in volumes and the level of charges.

Finally, the European Commission have suggested that when undertaking a sensitivity analysis a useful determinant of the most critical variables is those for which a 1 per cent variation (+/-) produces a corresponding variation of 5 per cent or more in the NPV.

Distributional Analysis The calculation of NPV's makes no allowance for the distribution of costs and benefits among members of society. This is an important drawback if the intended objectives of a programme/project aimed at specific income groups. Differential impact may arise because of income, gender, ethnicity, age, geographical location or disability and any distributional effects should be explicit and quantified where appropriate. A common approach to take account of distributional issues is to divide the relevant population into different income groups and analyse the impact of the programme/project on these groups. Weights can be attached to the different groups to reflect Government policy. Carrying out a distributional analysis can be a difficult task because costs and benefits are redistributed in unintended ways.

10.3.2. Economic appraisal techniques

Economic analysis aims to assess the desirability of a project from the societal perspective. This form of appraisal differs from financial appraisal because financial appraisal is generally done from the perspective of a particular stakeholder e.g. an investor. Sponsoring Authority or the Exchequer. Economic analysis also considers non-market impacts such as externalities.

a) CBA

The general principle of cost benefit analysis is to assess whether or not the social and economic benefits associated with a project are greater than its social and economic costs. To this end, a project is deemed to be desirable where the benefits exceed the costs. However, should the benefits exceed the costs, this does not necessarily imply that a projects will proceed as other projects with a higher net present value (NPV) may be in competition for the same scarce resources. In addition, there are affordability constraints which mean that projects should not proceed even if the NPV is positive.

In cost-benefit analysis all of the relevant costs and benefits, including indirect costs and benefits, are taken into account. Cash values, based on market prices (or shadow prices, where no appropriate market price exists) are placed on all costs and benefits and the time at which these costs/benefits occur is identified. The analytic techniques outlined above (i.e. NPV method, IRR method, etc.) are applied using the TDR. The general principle of cost-benefit analysis is that a project is desirable.

If the economic and social benefits are greater than economic and social costs. It is vital that cost-benefit analysis is objective. Its conclusions should not be prejudged. It should not be used as a device to justify a

case already favoured for or against a proposal. Factors of questionable or dubious relevance to a project should not be introduced into an analysis in order to affect the result in a preferred direction. A more detailed guide on how to carry out a CBA is set out in Public Spending Code D.03 – Guide to Economic Appraisal: Carrying out a CBA.

B) COST EFFECTIVENESS ANALYSIS (CEA)

It is difficult to measure the value to society of public investment in social infrastructure because the outputs may be difficult to specify accurately and to quantify, and are not frequently marketed. In cases like these, the cost of the various alternative options should be first determined in monetary terms. A choice can then be made as to which of the options (if they all achieve the same effects) is preferable. CEA is not a basis for deciding whether or not a project should be undertaken. Rather, it is concerned with the relative costs of the various options available for achieving a particular objective. CEA will assist in the determination of the least cost way of determining the capital project objective. A choice can then be made as to which of these options is preferable.

Evaluating options in CEA is best done by applying the principles of the NPV method to the stream of cash outflows or costs. The recurring costs of using facilities as well as the capital costs of creating them should be taken into account, particularly if they differ between alternative options. Usually, the aim will be to select the option which minimises the net present cost.

There is a particular need for consistency in the assumptions and parameters adopted for CBA and CEA appraisals. CEA is most applicable to healthcare, scientific and educational projects where benefits can be difficult to evaluate.

c) Cost Utility Analysis (CUA)

CUA is a variant of CEA that measures the relative effectiveness of alternative interventions in achieving two or more objectives. It is often used in health appraisals. In a CUA, costs are expressed in monetary terms and outcomes/ benefits are expressed in utility terms e.g. outcomes are often defined in quality adjusted life years (QALYs). This outcome measure is a combination of duration of life and health related quality of life. Whereas in a CBA, there is a requirement to attempt to place a monetary value on all benefits, CUA allows for a comparison of the benefits of health interventions without having to place a financial value on health states.

d) Multi Criteria Analysis (MCA)

Multi-criteria analysis (MCA) establishes preferences between project options by reference to an explicit set of criteria and objectives. These would normally reflect policy/programme objectives and project objectives and other considerations as appropriate, such as value for money, costs, social, environmental, equality, etc. MCA is often used as an alternative to appraisal techniques because it incorporates multiple criteria and does not focus solely on monetary values.

MCAs often include “scoring and weighting” of the relevant criteria reflecting their relative importance to the objectives of the project. Care should be taken to try and minimize the subjectivity of decision making in an MCA as this is a common problem with carrying out MCA’s. The relative importance of objectives and criteria to achievement of the project will vary from sector to sector. The Sponsoring Agency should agree these with the Sanctioning Authority. In constructing a multi criteria analysis scorecard and determining the weightings to be given to criteria the aim should be to achieve.

An objective appraisal of project options and consistency in decision making. Judgments regarding the scoring of investment options should be based on objective, factual information. The justification for scoring and weighting decisions must be documented in detail. In this regard, the system should be capable of producing similar results if the selection criteria were applied by different decision makers.

The main steps in the MCA process include

- Identify the performance criteria for assessing the project.
- Devise a scoring scheme for marking a project under each criterion heading.
- Devise a weighting mechanism to reflect the relative importance of each criterion.

- Allocate scores to each investment option for each of the criteria.
- Document the rationale for the scoring results for each option.
- Calculate overall results and test for robustness.
- Report and interpret the findings.

The importance of explaining the weights and scores fully, and interpreting the results carefully, cannot be over-stressed.

10.4. SELF –ASSESSMENT QUESTIONS

1. What is Profitability Appraisal? Explain Key Principles in Project and Investment Appraisal?
2. Discuss the Analytical methods Profitability Appraisal?
3. What are the Economic appraisal techniques? Discuss?
4. What is Multi Criteria Analysis? Explain its process?

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Chapter - 11
Project Risk Analysis

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- Describe The Procedure For Analyzing The Project Risk.
- Explain The Various Forms Of Market Risk.
- Discuss About Firm Risk And Its Types.

11.1. INTRODUCTION

It is a well established fact that every project involves risk. Moreover, it is a practice to include a short summary of project risks in the project appraisal report. There are certain projects for which economic benefits can be quantified while for others, such quantification is not possible. Firm risk stem from technological change in production process, managerial inefficiency, availability of raw material, labour problems and changes in consumer preferences. The financial risk considers the difference between EBIT and EBT while business risk causes the variations between revenue and EBIT. These are ways and means to reduce the project risks.

11.2. ANALYSIS OF PROJECT RISKS

It is the normal practice to include a short summary of project risks in each appraisal report. The purpose of this chapter is to provide a summary of project risks in order to help ensure uniformity and consistency in appraisal reports. Section-1 relates to projects for which economic benefits can be quantified and section-2 deals with projects for which such quantification is not possible.

11.2.1. Projects with quantified benefits

The economic internal rate of return (EIRR) is the measure most often used to indicate the economic viability of financed projects. Calculation of the EIRR requires a set of assumptions regarding the conditions faced by the project which in the judgment of the appraisal mission are most likely to prevail during its life. However, since bank financed projects normally have a very long life, the conditions faced by the project may change for a variety of reasons. Sensitivity analysis is, therefore, carried out to determine the effects of possible changes in the values of key variables (costs, yields, and price of inputs and outputs) on the project's EIRR.

The number of risks facing a project could be large, and it is neither possible nor desirable to identify all possible risks associated with a project. The risks discussed in the appraisal report should essentially be those which entail major economic consequences. These should be identified from the sensitivity analysis and described in descending order of importance with regard to their impact on the EIRR.

Particular attention should be paid to risks that would substantially reduce the project's EIRR or render the project uneconomic by reducing its EIRR below the opportunity cost of capital. In this context, both the base-case EIRR and the sensitivity indicators are relevant. If the base-case EIRR is high, the discussion of project risks should generally include risks to which the project is highly sensitive. For example, the EIRR of most projects is highly sensitive to changes in project output, which may in turn depend on a number of factors. A discussion of the safeguards employed to minimize the risk of the outputs falling substantially below the level expected should therefore be included.

For example, in an irrigation project, apart from the availability of water, output may depend on the supply of other inputs, provision of extension services, effectiveness of water management by farmer's groups, and availability of adequate infrastructure and storage facilities. Measures taken to ensure adequate and timely availability of each should be briefly explained.

Risks are obviously greater in projects for which the base-case EIRR is only marginally higher than the opportunity cost of capital. These larger risks are even greater if the EIRR is highly sensitive to changes in key variables since even a small reduction in the EIRR would render the project unviable. Even when the EIRR is relatively insensitive to changes in key variables, combinations of adverse changes might easily affect the project's viability. Thus, in such cases, the remedial action proposed or adopted should be fully explained.

If the project output is traded internationally, one risk may be future changes in the price of the output, particularly if the share of a project or the country's output is small relative to the world market. In such cases, a review of world demand and supply forecasts for the good in question should be included.

By their very nature, certain types of projects such as gas and oil exploration involve very high risks. For such projects, it is necessary to supplement the sensitivity analysis with a probability analysis. The latter provides a range of possible outcomes in terms of a probability distribution and based on that project related decision could be made more intelligently. But the analysis is more complex and requires more information

about events affecting the project. Due to the considerable work involved,, probability analysis of risks is usually undertaken only for project carrying a high degree of risk or for large projects where miscalculations could lead to a major loss to the economy. For such projects, the nature of the risks involved and the measures taken or recommended to minimize the risks, together with the results of the analyses, should be discussed in the appraisal report.

11.2.2. Projects for which benefits are not quantifiable

For projects in certain sectors or sub-sectors such as education, health, sanitation and family planning, project benefits cannot be quantified and the risks cannot be measured by sensitivity analysis. In such cases, the relationship of project risks to the project's objectives should be explained. The eventualities that might impede the realization of the objectives should be discussed in relation to the project cost and output, and also in relation to the socio-economic objectives sought by the project. In such projects, the risks are greater on the benefit side than on the cost side. For instance, in education projects, school buildings and equipment are provided to help achieve a prescribed annual output of graduates with a certain skill level.

However, provision of the facilities alone may not ensure achievement of the project objectives. Their achievement may depend more upon the availability of trained teachers, provision of sufficient funds for the recurring expenditures of the institutions, curriculum and admission standards, and motivation of the students. While it is not possible to eliminate all such risks, it is essential to minimize them. Major risks of this type should be identified and explained along with the remedial measures proposed in the section in which project risks are discussed.

The real benefits of this type of project relate to broad socio-economic goals. For education projects, these may include increased income level for the trainees and a higher level of industrial and agricultural productive.

For family planning projects, the broad goals may be an increased number of acceptors and a consequent reduction in the rate of population growth. The success of these projects depends not merely on the facilities provided, but also on the continued favourable conditions assumed by the appraisal mission. For such projects, the assumptions made regarding the relationship between the facilities provided and project's long-term objectives should be clearly explained. The conditions or facilities necessary but external to the project should also be identified, together with relevant assurances received from the government. For projects such as these, this is one of the most important aspects to be discussed in the section dealing with project risks.

11.3. MARKET RISK

The market risk affects all the projects in an industry and not a particular project. In this section, the concept of market risk has been explained with respect to factors which are beyond the control of individual corporates. The market risk is further sub-divided into:

a) **Security market risk:** Often we read in the newspaper that the stock market is in the bear hug or in the bull grip. This indicates that the entire market is moving in a particular direction either downward or upward. The economic conditions, political situations and the sociological changes affect the security market. The recession in the economy affects the profit prospect of the industry and the stock market. The 1998 recession experienced by developed and developing countries has affected the stock markets all over the world. The South East Asian crisis has affected the stock market world wide. There factors are beyond the control of the corporate and the investor. They cannot be entirely avoided by the investor. It drives home the point that the market risk is unavoidable. Jack Clark Francis has defined market risk as that portion of total variability of return caused by the alternating forces of bull and bear markets. When the security index moves upward haltingly for a significant period of time, it is known as bull market. In the bull market, the index moves from a low level to the peak. Bear market is just a reverse to the bull market; the index declines haltingly from the peak to a market low point called trough for a significant period of time. During the bull and bear market more than 80 per cent of the securities' prices rise or fall along with the stock market indices. The forces that affect the stock market are tangible and intangible events. The tangible events are real events such as earthquake, war, political uncertainty and fall in the value of currency. Another example that can be cited is the Pokhran blast on May 13, 1998, and the fall of BSE sensex by 162 points. Impending sanctions, dampened sentiments and FIIs selling of stocks set a

bear phase. Several examples like fall in the value of rupee and post-budget blue can be cited for triggering the bear phase. Intangible events are related to market psychology. The market psychology is affected by the real events. But reactions to the tangible events become over reactions and they push the market in a particular direction. Take for instance, the bull run in 1994 FII's investment and liberalization policies gave buoyancy to the market. The market psychology was positive. Small investors entered the market and prices of stocks without adequate supportive fundamental factors soared up. In 1996, the political turmoil and recession in the economy resulted in the fall of share prices and the small investors lost faith in the market. There was a rush to sell the shares and the stocks that were floated in the primary market were not received well.

b) Interest rate risk: Interest rate risk is the variation in the single period rates of return caused by the fluctuations in the market interest rate. Most commonly interest rate risk affects the price of bonds, debentures and stocks. The fluctuations in the interest rates are caused by the changes in the government monetary policy and the changes that occur in the interest rates of treasury bills and the government bonds. The bonds issued by the government and quasi-government are considered to be risk free. If higher interest rates are offered, investor would like to switch his investments from private sector bonds to public sector bonds. If the government to tide over the deficit in the budget floats a new loan/bond of a higher rate of interest, there would be a definite shift in the funds from low yielding bonds to high yielding bonds and from stocks to bonds. Likewise, if the stock market is in a depressed condition, investors would like to shift their money to the bond market, to have an assured rate of return. The best example is that in April 1996, most of the initial public offerings of many companies remained under subscribed but IDBI and IFC bonds were oversubscribed. The assured rate of return attracted the investors from the stock market to the bond market. The rise of fall in the interest rate affects the cost of borrowing. When the call money market rate changes, it affects the badla rate too. Most of the stock traders trade in the stock market with the borrowed funds. The increase in the cost of margin affects the profitability of the traders. This would dampen the spirit of the speculative traders who use the borrowed funds. The fall in the demand for securities would lead to a fall in the value of the stock index. Interest rates not only affect the security traders but also the corporate bodies who carry their business with borrowed funds. The cost of borrowing would increase and a heavy outflow of profit would take place in the form of interest t the capital borrowed. This would lead to a reduction in earnings per share and a consequent fall in the price of share.

c) Purchasing Power Risk: Variations in the returns are caused also by the loss of purchasing power of currency. Inflation, is the reason behind the loss of purchasing power. The level of inflation proceeds faster than the increase in capital value. Purchasing power risk is the probable loss in the purchasing power of the returns to be received. The rise in price penalizes the returns to the investor, and every potential rise in price is a risk to the investor. The inflation may be demand-pull or cost-push inflation. In the demand pull inflation, the demand for goods and services are in excess of their supply. At full employment level of factors of production, the economy would not be able to supply more goods in the short run and the demand for products pushes the price upward the supply cannot be increased unless there is an expansion of labour force or machinery for production. The equilibrium between demand and supply is attained at a higher price level. The cost-push inflation, as the name itself indicates that the inflation or the rise in price is caused by the increase in the cost. The increase in the cost of raw material, labour and equipment makes the cost of production high and ends in high price level. The producer tries to pass the higher cost of production to the consumer.

11.4. FIRM RISK

Firm risk is unique and peculiar to a firm or an industry. Firm risk stems from managerial inefficiency, technological change in the production process, availability of raw material, changes in the consumer preference, and labour problems. The nature and magnitude of the above mentioned factors differ from industry to industry, and company to company. They have to be analyzed separately for each industry and firm. The changes in the consumer preference affect the consumer products like television sets, washing machine, refrigerators, etc. more than they affect the iron and steel industry. Technological changes affect the information technology industry more than that of consumer product industry. Thus, it differs from industry to industry. Financial leverage of the companies that is debt-equity portion of the companies differs

from each other. The nature and mode of raising finance and paying back the loans, involve a risk element.

All these factors from the firm risk and contribute a portion in the total variability of the return. Broadly, firm risk can be classified into:

1. Business risk
2. Financial risk

1. Business risk: Business risk is that portion of the firm risk caused by the operating environment of the business. Business risk arises from the inability of a firm to maintain its competitive edge and the growth or stability of the earnings. Variation that occurs in the operating environment is reflected on the operating income and expected dividends. The variation in the expected operating income indicates the business risk. For example take ABC and XYZ companies. In ABC company, operating income could grow as much as 15 per cent and as low as 7 per cent. In XYZ company, the operating income can be either 12 per cent or 9 per cent. When both the companies are compared, ABC company's business risk is higher because of its high variability in operating income compared to XYZ company. Thus, business risk is concerned with the difference between revenue and earnings before interest and tax. Business risk can be divided into external business risk and internal business risk.

a) Internal Business Risk: Internal business risk is associated with the operational efficiency of the firm. The operational efficiency differs from company to company. The efficiency of operation is reflected on the company's achievement of its pre-set goals and the fulfillment of the promises to its investors. The various reasons of internal business risk are discussed below:

- **Fluctuations in the sales —** The sales level has to be maintained. It is common in business to lose customers abruptly because of competition. Loss of customers will lead to a loss in operational income. Hence, the company has to build a wide customer base through various distribution channels. Diversified sales force may help to tide over this problem. Big corporate bodies have long chain of distribution channel. Small firms often lack this diversified customer base.
- **Research and development (R&D) —** Sometimes the product may go out of style or become obsolescent. It is the management, who has to overcome the problem obsolescence by concentrating on the in-house research and development program. For example, if Maruti Udyog has to survive the competition, it has to keep its Research and Development section active and introduce consumer oriented technological changes in the automobile sector. This is often carried out by introducing sleekness, seating comfort and break efficiency in their automobiles. New products have to be produced to replace the old one. Short sighted cutting of R & D budget would reduce the operational efficiency of any firm.
- **Personnel management —** The personnel management of the company also contributes to the operational efficiency of the firm. Frequent strikes and lock outs result in loss of production and high fixed capital cost. The labour productivity also would suffer. The risk of labour management is present in all the firms. It is up to the company to solve the problems at the table level and provide adequate incentives to encourage the increase in labour productivity. Encouragement given to the labourers at the floor level would boost morale of the labour force and leads to higher productivity and less wastage of raw materials and time.
- **Fixed cost —** The cost components also generate internal risk if the fixed cost is higher in the cost component. During the period of recession or low demand for product, the company cannot reduce the fixed cost. At the same time in the boom period also the fixed factor cannot vary immediately. Thus, the high fixed cost component in a firm would become a burden to the firm.
- **Single product** — The internal business risk is higher in the case of firm producing a single product. The fall in the demand for a single product would be fatal for the firm. Further, some products are more vulnerable to the business cycle while some products resist and grow against the tide. Hence, the company has to diversify the products if it has to face the competition and the business cycle successfully. Take for instance, Hindustan Lever Ltd., which is producing a wide range of consumer cosmetics is thriving successfully in the business. Even in diversification, diversifying the product in the

unknown path of the company may lead to an internal risk. Unwidely diversification is as dangerous as producing a single good.

- **External risk —** External risk is the result of operating conditions imposed on the firm by circumstances beyond its control. The external environments in which it operates exert some pressure on the firm. The external factors are social and regulatory factors, monetary and fiscal policies of the government, business cycle and the general economic environment within which a firm or an industry operates. A government policy that favours a particular industry could result in the rise in the stock price of the particular industry. For instance, the Indian sugar and fertilizer industry depend much on external factors. The various external factors are being discussed below:

- **Social and regulatory factors —** Harsh regulatory climate and legislation against the environmental degradation may impair the profitability of the industry. Price control, volume control, import/export control and environment control reduce the profitability of the firm. This risk is more in industries related to public utility sectors such as telecom, banking and transportation. The governments' tariff policy of the telecom sector has a direct bearing on its earnings. Likewise, the interest rates and the directions given in the lending policies affect the profitability of the banks. Calcutta Electric and Supply Company (CESC) has not been able to increase its power tariff due to the stiff resistance by the West Bengal government. The Pollution Control Board has asked to close most of the tanneries in Tamil Nadu, which has affected the leather industry.

- **Political risk —** Political risk arises out of the change in the government policy. With a change in the ruling party, the policy also changes. When Sri. Manmohan Singh was the finance minister, liberalization policy was introduced. During the Bharathiya Janta Party government, even though efforts are taken to augment the foreign investment, more stress is given to Swadeshi. Political risk arises mainly in the case of foreign investment. The host government may change its rules and regulations regarding the foreign investment. From the past, an example can be cited. In 1977, the government decided that the multinationals must dilute their equity and share their growth with the Indian investors. This forced many multinationals to liquidate their holdings in the Indian companies.

- **Business cycle —** The fluctuations of the business cycle lead to fluctuations in the earnings of the company. Recession in the economy leads to a drop in the output of many industries. Steel and white consumer goods industries tend to move in tandem with the business cycle. During the boom period, there would be hectic demand for steel products and white consumer goods. But at the same time, they would be hit much during the recession period. At present, the information technology industry has resisted the business cycle and moved counter cyclically during the recession period. The effects of the business cycle vary from one company to another. Sometimes, companies with inadequate capital and consumer base may be forced to close down. In some other case, there may be a fall in the profit and the growth rate may decline. This risk factor is external to the corporate bodies and they may not be able to control it.

2. Financial risk

It refers to the variability of the income to the equity capital due to the debt capital. Financial risk in a company is associated with the capital structure of the company. Capital structure of the company consists of equity funds and borrowed funds. The presence of debt and preference capital results in a commitment of paying interest or pre fixed rate of dividend. The residual income alone would be available to the equity holders. The interest payment affects the payments that are due to the equity investors. The debt financing increases the variability of the returns to the common stock holders and affects their expectations regarding the return. The use of debt with the owned funds to increase the return to the share holders is known as financial leverage. Debt financing enables the corporate to have funds at a low cost and financial leverage to the shareholders.

As long as the earnings of a company are higher than the cost of borrowed funds, shareholders' earnings are increased. At the same time when the earnings are low, it may lead to bankruptcy to equity holders. This can be illustrated with the help of the following example:

Table-11.1

		Years	
	1996	**1997**	**1998**
	Company A		
Equity capital Rs. 10 per share	20,00,000	20,00,000	20,00,000
Debt fund (10% interest)	10,00,000	10,00,000	10,00,000
Operating income	30,00,000	40,00,000	20,00,000
Earning per share	1.0	1.5	0.5
	Company B		
Equity capital Rs. 10 per share	10,00,000	10,00,000	10,00,000
Debt fund (10% interest)	20,00,000	20,00,000	20,00,000
Operating income	30,00,000	40,00,000	20,00,000
Earnings per share	1.0	2.0	Nil

The above example deals with three different situations. In the year 1996, both the companies earned the same amount and the earnings per share were same. But, in the year 1997 there was 33.33 per cent hike in the earnings of the two companies. In company A 33.33 per cent rise in operating income has resulted in a 50 per cent increase in earnings per share. In the company B, earnings per share has increased by cent per cent i.e. from Rs. 1 to Rs. 2, because the bond holders receive only the fixed interest whether the company fared well or not. The increase in earnings per share would cause a change in the capital appreciation in the shares of the "B" company during a good year.

In the year 1998, the economic climate has changed and there is a fall in the operating profit by 33.33 per cent for both the companies. This has caused 50 per cent fall in earnings per share for company a compared to 1996. But company "B"s earnings per share has fallen to zero and the shareholders are affected adversely in the bad year,. If we assume another situation of negative earnings, the situation would be worse in company B and the shareholders will be affected much. A few years of persistent negative earnings will erode the shareholders' equity. Fixed return on borrowed capital either enhances or reduces the return to shareholders.

The financial risk considers the difference between EBIT and EBT (earnings before tax). The business risk causes the variations between revenue and EBIT. The payment of interest affects the eventual earnings of the company stock. Thus, volatility in the rates of return on the stock is magnified by the borrowed money. The variations in income caused by the borrowed funds in highly levered firms are greater compared to the companies with low leverage. The financial leverage or financial risk is an avoidable risk because it is the management who has to decide, how much to be funded with the equity capital and borrowed capital.

11.5. SELF ASSESSMENT QUESTIONS

1. Discuss the procedure for analyzing the project risk.
2. Explain the various forms of market risks.
3. "Market risks are not firm specific". Elucidate.
4. Discuss the various reasons of internal business risks.

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Chapter - 12

Risk Management in Corporate Investment Decisions

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of Risk management.
- To understand the process of Risk management
- To understand the Capital Investment Decisions.
- To know the Important considerations in investment risk management process
- To study the Different Types of Corporate Risk Management

12.1. INTRODUCTION

The term risk management can mean different things to different people. In the last few decades, with the rise of financial engineering, the term risk management has become strongly associated with the derivatives trading desks of investment banking houses and hedge funds. In a few commodity industries certain firms have developed profitable trading operations built on the same principles. In non-financial corporations, risk management evokes an image of the treasury office buying or selling foreign currency futures to lock in the dollar value of foreign product sales. There is also an entirely distinct discipline that goes by the same label, risk management, and that is involved in identifying and limiting the probability of calamitous events, such as plant explosions or the theft of corporate secrets or the loss of key personnel. Insurance companies both cover and help to manage and minimize these sorts of risks.

In truth, risk management is not a specialized activity properly relegated to any single type of financial institution nor to any single office of the firm. Managers in all parts of a company regularly make all types of decisions involving choices and tradeoffs about risk. The marketing department designs types of contracts for customers that share risk between the firm and its customers.

Business unit managers evaluate alternative lines of business with different risk characteristics. Asset development teams alter project designs so as to minimize risk without sacrificing return. Supply chain management regularly evaluates alternative means of sourcing based on risk factors. The tax, legal and accounting departments are concerned with risk, with hedging and with the corporate governance issues. At the highest level of the company key questions about the firm's strategy and its ability to fund its operations must be answered with an eye on the risks of each alternative and strategic decisions that can secure the greatest value for share holders.

Most business decisions involve a choice about risk. Everybody is a risk manager. Risk management is the science of assessing these tradeoffs involving risk – quantifying the exposure, determining the cost of risk to the activities of your department or business unit or customer, understanding how the marketplace values and prices risk, and using this knowledge too.

12.2. PROJECT RISK MANAGEMENT

Risk is inevitable in a business organization when undertaking projects. However, the project manager needs to ensure that risks are kept to a minimal. Risks can be mainly divided between two types, negative impact risk and positive impact risk. Not all the time would project managers be facing negative impact risks as there are positive impact risks too. Once the risk has been identified, project managers need to come up with a mitigation plan or any other solution to counter attack the risk.

Managers can plan their strategy based on four steps of risk management which prevails in an organization. Following are the steps to manage risks effectively in an organization:

- Risk Identification
- Risk Quantification
- Risk Response
- Risk Monitoring and Control

Let's go through each of the step in project risk management

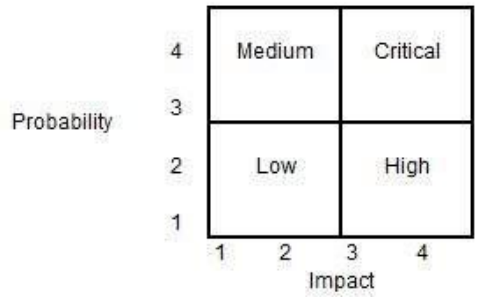
Risk Identification

Managers face many difficulties when it comes to identifying and naming the risks that occur when undertaking projects. These risks could be resolved through structured or unstructured brainstorming or strategies. It's important to understand that risks pertaining to the project can only be handled by the project manager and other stakeholders of the project.

Risks, such as operational or business risks will be handled by the relevant teams. The risks that often impact a project are supplier risk, resource risk and budget risk. Supplier risk would refer to risks that can occur in case the supplier is not meeting the timeline to supply the resources required. Resource risk occurs when the human resource used in the project is not enough or not skilled enough. Budget risk would refer to risks that can occur if the costs are more than what was budgeted.

Risk Quantification

Risks can be evaluated based on quantity. Project managers need to analyze the likely chances of a risk occurring with the help of a matrix. Using the matrix, the project manager can categorize the risk into four categories as Low, Medium, High and Critical. The probability of occurrence and the impact on the project are the two parameters used for placing the risk in the matrix categories. As an example, if a risk occurrence is low (probability = 2) and it has the highest impact (impact = 4), the risk can be categorized as 'High'. Fig.12.1



Risk Response

When it comes to risk management, it depends on the project manager to choose strategies that will reduce the risk to minimal. Project managers can choose between the four risk response strategies, which are outlined below:

- Risks can be avoided
- Pass on the risk
- Take corrective measures to reduce the impact of risks
- Acknowledge the risk

Risk Monitoring and Control

Risks can be monitored on a continuous basis to check if any change is made. New risks can be

12.3. RISK REGISTER

Often project managers will compile a document, which outlines the risks involved and the strategies in place. This document is vital as it provides a huge deal of information. Risk register will often consists of diagrams to aid the reader as to the types of risks that are dealt by the organization and the course of action taken. The risk register should be freely accessible for all the members of the project team.

12.4. PROJECT RISK-AN OPPORTUNITY OR A THREAT

As mentioned above, risks contain two sides. It can be either viewed as a negative element or a positive element. Negative risks can be detrimental factors that can haphazard situations for a project. Therefore, these should be curbed once identified. On the other hand, positive risks can bring about acknowledgements from both the customer and the management. All the risks need to be addressed by the project manager.

12.5. CAPITAL INVESTMENT DECISIONS

Capital investment decisions also can be called ‘capital budgeting’ in financial terms. Capital investment decisions aim includes allotting the capital investment funds of the firm in the most effective manner to make sure that the returns are the best possible returns. Assessing projects as well as the allocation of the capital depends on the project requirements are some of the most crucial capital investment decisions aspects.

There might be many different criteria’s for choosing the appropriate and right capital investment decision. For e.g., a company might stress on projects that assure for prompt returns while a few other companies might assert on projects which ensure for a growth in the long term. The important aim of capital investment decision is increasing the firms’ value by taking on a good project at the perfect time.

The power to study as well as take capital investment decisions permits an individual as the manager or owner of a particular business to make sure that their resources which are limited are apportioned to the

project(s) which would best accomplish their strategically goals (thus they also are at times denoted as strategic capital investment decisions). These kinds of decisions could be associated to capital investments decisions like constructing a new factory, dedication towards a new campaign for marketing, acquiring a business or developing or creating a new website. The aim of a business while making capital investment decisions is maximizing the wealth of the shareholder by acquiring assets and yielding profit and to be able to do this, as the owner of your business, you should to be able to find out and determine as to what projects of capital investment would yield a cash flow which is positive and when there are constrained resources, as they generally are in case of start-up or small business or usually for most of the businesses that are facing the credit-crunch, rate the projects in the bases of priority depending on the kind of value they generate.

Capital investment decisions mostly are regulated by the procedure of rating and identifying the organization's capital investments. The company ought to decide as to which of the capital investments that are given, would ensure the maximum value to their business and thus they can make their capital investment decision. The capital investment decisions suffer from a many constraints generally. The sum of capital which an organization collects is restricted and thus it gets the restraint on the firms' choice down to an extent, over several project investments. When the firms' debt is raised, the firms' debt-equity ratio too is increased and thus it gets hard for a business to be able to increase more debts. Making strategic capital investment decisions which are consistent could also be problematic because a lot of people prefer using capital investment appraisal techniques which increases the chances of having their favourite projects accepted.

Most of the investment projects which are strategic have problems which are ill-structured, calling for an approach which might never have been ever put to use before, thus, complexity, novelty, irreversibility and ambiguity characterize these capital investment decision projects. It's important that we recognize thus and put the strategies in place to deal with such issues and problems because if you make one wrong capital investment decision, then it can impact a business's value negatively thereby making creditors and investors not really willing or keen to fund the business any time in future.

The capital investment decision of project ranking plays a crucial role in capital investment decisions. Depending upon the kind of project a firm has at a particular point of time, the companies prioritize the various projects. Project ranking is dependent on the fact as to how much would a particular project return as well as which project has the ability to provide the business, a maximum value. There are a lot of measures which give an estimate of the firms' return over several investment projects.

12.6. CAPITAL INVESTMENT DECISION PROCESS

The process of making a capital investment decision involves these steps:

- Identification of a project
- Definition of a project and screening
- Analyzing and accepting
- Implementation
- Monitoring
- Post audit

In practice actually, a lot of capital investment decisions are reached with specified time period and information generally leaving out one or more than one steps in capital investment making process. The political activity inside an organization might also effect a capital investment decision, where individuals or groups have a set interest in certain projects. The capital investment decisions aren't regularized by 1 or 2 components or factor because the problem of investment is not just one of the problems of substituting old equipment with new, but it's related to replacing an existent procedure within a system with a new one that makes the whole system better and much more effective. These are some of the factors which affect capital investment decisions:

- The outlook of the management
- Opportunities which are created by technological changes
- Strategy of the competitor
- Cash flow budget
- Fiscal Incentives
- Market Forecast
- Other non-economic factors

These motives would explain clearly as to why capital investment decisions are extremely important for an organization:

- **Expansion:** Capital investment decisions are aimed at the expansion of operation levels. It's achieved through acquiring fixed assets by buying plant facilities and property, which ensure a good investment and capital investment balancing in turn.
- **Replacement:** Post the period of maturity, when the growth of a firm slows down, the firms; worn out or outdated assets need to be replaced, like machinery, vehicles, equipment, etc. Hence, an organization can turn back to its production full-flegedly and yield the desired benefits.
- **Renewal:** As a substitute to replacing, renewal might involve rebuilding, retrofitting or overhauling an existent asset. This definitely increases the firms' profits and productions.

12.7. IMPORTANT CONSIDERATIONS IN INVESTMENT RISK MANAGEMENT PROCESS

- Each person involved in the process of planning needs to identify and understand the risks pertaining to the project.
- Once the team members have given their list of risks, the risks should be consolidated to a single list in order to remove the duplications.
- Assessing the probability and impact of the risks involved with the help of a matrix.
- Split the team into subgroups where each group will identify the triggers that lead to project risks.
- The teams need to come up with a contingency plan whereby to strategically eliminate the risks involved or identified.
- Plan the risk management process. Each person involved in the project is assigned a risk in which he/she looks out for any triggers and then finds a suitable solution for it.

12.8. THE DIFFERENT TYPES OF CORPORATE RISK MANAGEMENT:

Although the many different parts of the firm all face problems involving risk, the problems are very different. The problem facing a commodity trader is not the same problem that faces the business unit manager and not the same problem that faces the CFO. To gain a comprehensive view of what risk management is requires a short tour through the various types of problems facing managers who play these different roles within the firm.

Valuation and Pricing

Valuation is central to a wide range of business decisions, from the price to pay for an asset to the price to charge for a product. And risk is central to valuation. Better measurement of risk and better pricing of risk leads to a more accurate valuation. Armed with more accurate valuations, management is able to make better decisions. The workhorse for valuations is the discounted cash flow (DCF) model. In many cases the DCF model produces a reasonably accurate estimate of the value. This is true because the risk profile fits the usual assumptions employed by the DCF model, at least to the degree of precision at hand in real world cases.

But in certain situations the structure of the risk is markedly different from the usual one, and the standard DCF calculation gets the valuation wrong. In these cases, a more thorough analysis of risk is needed in order

to get the valuation right. Amending the DCF model to handle this more complicated risk structure is possible. The tools of risk management show how it can be done.

There are many complicated patterns for which a more careful treatment of risk is needed. However, two very common patterns requiring more careful analysis are:

Risk is not symmetric; this happens, for example, when risk is truncated by a guarantee clause, by the option to switch or abandon, by floor or ceiling price structures, and so on. Risk changes through time; this happens, for example, when the success or failure of a project is decided within a concentrated window of time or when a project goes through markedly different stages during which specific risks become resolved. Once you start thinking carefully about it, many projects and assets exhibit these feature. Companies often enter into supply agreements with various floor and ceiling price clauses. Supply contracts often have quantity options of various sorts. If the market price of a critical input rise too far, engineers will be put to work to find substitutes or to redesign the product to minimize the amount required. Shutdown of operations, whether at just one plant or one product line or of an entire business line, is the most drastic "truncation" of all.

Operating Decisions and Asset Management

Better valuation tools also empower management to make better operating decisions and manage assets more profitably.

Here are some examples

For example of an asset manager at an integrated oil and gas company is responsible for working up the program for development and exploitation of its proven, but undeveloped reserves of oil.

At current prices, the NPV of development is positive. But the price of oil is very risky and could fall dramatically so that the low revenues would not repay the sunk development expenditures. Holding the properties undeveloped until the price rises further could be the wiser strategy. The value of these properties is really a call option on the price of oil. When should this option be exercised? How high does the oil price have to be before it makes sense? Solving this development problem requires a sophisticated understanding of oil price dynamics. It is important to distinguish between short-run, transitory price shocks that one can predict will dissipate relatively quickly, and shocks to the price that is long-lasting. Important information can be gleaned from the term structure of oil futures prices, so that the development decision should depend not just on the current price of oil, but on the full term structure. Finally, the asset manager need to decide what s/he anticipates about the likely evolution of drilling costs and other costs –are they tied to the price of oil or independent of it.

Cash Management and Transaction Hedging

The Finance/Comptroller/Treasury Office is responsible for managing the short-run cash flow of the firm. Uncertainty in the cash inflows and outflows is expensive. The more uncertainty, the larger the reserve of cash and other very liquid, low return assets the Treasury must maintain. Risk management tools can be used to minimize expensive uncertainty in short-term cash flow, lowering the amount of working capital the firm requires. These assets can then be invested in less liquid investments that yield a higher return. Alternatively, the freed up assets are available for major corporate investments or can be returned to shareholders.

This type of hedging—managing the firm's short-run cash flow—is called transaction hedging. The classic example of transaction hedging is a multinational firm that has made a sale in a foreign currency for which payment will not be received until delivery is complete some months hence. The firm wishes to lock in its domestic currency income and it does so by selling a forward contract on the foreign currency, exchanging future payment of the foreign currency for future payment of the domestic currency.

The right size and structure of a transaction hedge is simplest to assess after the underlying transaction has formally been executed. In many cases, however, it is possible to anticipate with a reasonable degree of certainty many transactions expected in the near term, and the firm may hedge these as well.

Most natural resource extraction companies can predict a minimum quantity of production within a term of a number of months or a year. Because these sales have not yet been closed, these sales will be made at whatever turns out to be the market price in the months ahead. Over a longer term the company might want to adjust its production in response to changes in the market price. But in the near term, the volume of

production may not vary significantly and the firm simply hedges to reduce the risk of this near term cash flow. Hedging transactions is very different from supply management or product pricing, because hedging is a purely financial action. A transaction hedge does not generate delivery of an input or an output. Although transaction hedging is the simplest form of hedging, occasionally things don't work out as planned.

Liability Management

On a longer time frame, the firm also worries about risk exposure created by the debt it has issued. Some companies attempt to structure their liabilities to match their assets on various dimensions. For example, companies with long-lived assets may be more willing to issue long-term debt, while companies in a high asset turnover business will choose shorter-term debt that turns over more often. Companies with tangible assets may be willing to borrow more.

Companies also try to match the currency denomination of their debt to the currency of their revenues, avoiding the mismatch in cash flow that can arise if the exchange rate quickly falls. This matching can be done either by issuing the debt in the relevant currency, or by issuing the debt in one currency and supplementing the debt with a hedge. The hedge could be a long-term swap of currencies, or it could be a dynamic portfolio of futures on the two currencies. An interesting example of liability risk matching is the issuance of commodity linked debt by companies who mine and sell the commodity. Not all firms may be trying to lower their risk when managing their liabilities. Some may actually be trying to play the market, using their balance sheet to make a bet on the direction of interest.

Financial Policy and Strategic Management

A company's financial needs are dynamic and respond to changes in the key risk factors shaping the company's cash flow. The changing marketplace for its products has repercussions for the company's investments in future product development. Some products reach maturity and require little incremental investment and the product margin is free cash flow to the firm. Other product lines enter into a stage of transition and face new competitive pressures, so that additional investments in those lines are a drain on free cash flow. Changes in macro variables such as exchange rates, interest rates, commodity prices shape the timing of these developments and the size of the cash flow freed up or the investments demanded.

The company's financial policy, therefore, needs to be dynamic. The policy needs to be designed in anticipation of these risky developments and cash flow needs. Risk management is about shaping the company's relationship to external capital markets through time and in response to these exogenous factors. A company may wish to tailor the dynamic risk profile of its sources of cash so that they match the company's strategy and match the risk profile of its investment plans, or so that they give the company a competitive boost when it is most valuable against its competitors.

12.9. EVIDENCE ON HOW FIRMS MANAGE RISK

Evidence on how firms manage risk comes in several different forms. Knowledge of cases such as those discussed above is one form. A broad acquaintance with the diverse practices of various companies is certainly an important perspective on the question of how firms manage risk. A second form is a survey about specific practices. A survey can be conducted through a questionnaire, or by analyzing corporate financial reports.

Surveys have been made about the capital budgeting tools firms use – for example, do they limit themselves to traditional DCF, do they employ the Real Options method? Surveys have also been made about whether and how companies used derivative securities for hedging exposures. In fact, the adopted accounting rules require companies to disclose information about their portfolios of derivative securities, and so this data provides a window on companies' hedging activities. A third form of data is the indirect empirical evidence that identifies how risk management practices.

12.10. SELF–ASSESSMENT QUESTIONS:

1. What is project risk management? Explain its process?
2. Discuss the Important considerations in investment risk management
3. Explain the various Capital investment decision process
4. Discuss the Different Types of Corporate Risk Management

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Chapter - 13

Capital Expenditure Decision

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- Meaning, Nature And Importance Of Capital Expenditure
- Capital Expenditure Decisions
- Capital Expenditure Budget Process And
- Criteria Of Capital Expenditure Decisions.

13.1. INTRODUCTION

The efficient allocation of funds is among the main functions of financial management. Allocation of funds means investment of funds in assets or activities. It is also called investment decision because we have to select the assists in which investment has to be made. These assets can be classified into two parts:

a) Short-term or Current Assets.

b) Long-term or Fixed Assets.

13.2. MEANING AND FEATURES OF CAPITAL EXPENDITURE OR BUDGETING DECISIONS

A capital budgeting decisions may be defined as the firm's decision to invest its current funds most efficiently in the long-term assets in anticipation of an expected flow of benefits over a series of years. In other words, "capital budgeting is used to evaluate the expenditure decisions such as acquisition of fixed assets, changes in old assets and their replacement." Activities such as change in the method of sales distribution or undertaking an advertisement campaign or a research and development programme have long-term implication for the firm's expenditure and benefits and therefore, they may also be evaluated as investment decisions.

Features of Capital Budgeting Decisions

Following are the features of investment decisions

- Investment of fund is made in long-term assets.
- The exchange of current funds for future benefits.
- Future profits accrue to the firm over several years.
- These decisions are more risky.

It is significant to emphasize that expenditure and benefits of an investment should be measured in cash. In the investment analysis, it is cash flow which is important, not the accounting profit.

It may also be pointed out that investment decisions affect the firm's value. The firm's value will increase if investment is profitable. Investment should be evaluated on the basis of criteria on which it is compatible with the objective of the shareholder's wealth maximization. An investment will add to the shareholder's wealth if it yields benefits in excess of the minimum benefits as per the opportunity cost of capital.

13.3. IMPORTANCE OF CAPITAL EXPENDITURE DECISION

Investment decisions require special attention because of the following reasons

1. **Growth:** The effects of investment decisions extend into the future and have to endure for a longer period than the consequences of the current operating expenditure. A firm's decisions to invest in long-term assets have a decisive influence on the rate direction of its growth. Wrong decisions can prove disastrous for the continued survival of the firm.
2. **Risk:** A long-term commitment of funds may also change the risk complexity of the firm. If the adoption of an investment increases average gain but causes frequent fluctuations in its earnings, the firm will become very risky.
3. **Funding:** Investment decisions generally involve large amount of funds. Funds are scarce resource in our country. Hence the capital budgeting decision is very important.
4. **Irreversibility:** Most investment decisions are irreversible
5. **Complexity:** Investment decisions are among the firm's most difficult decisions. They are concerned with assessment of future events which are difficult to predict. It is really a complex problem to correctly estimate the future cash flow of investment.

Objectives of Capital Budgeting Decision

Capital budgeting helps in selection of profitable projects. A company should have system for estimating cash flow of projects. A multidisciplinary team of managers should be assigned the task of developing cash flow estimates. Once cash flow have been estimated, projects should be evaluated to determine their

profitability. Evaluations criteria chosen should correctly rank the projects. Once the projects have been selected they should be monitored and controlled. Proper authority should exist for capital spending. Critical projects involving large sum of money may be supervised by the top management. A company should have a sound capital budgeting and reporting system for this purpose. Based on the comparison of actual and expected performance.

13.4. KINDS OF CAPITAL EXPENDITURE DECISIONS

Capital expenditure decisions are of following types:

a) Expansion and diversification

A company may add capacity to its existing product lines to expand existing operations. For example, a fertilizer company may increase its plant capacity to manufacture in more areas. Diversification of a existing business require investment in new product and a new kind of production activity within the firm. Investment in existing or new products may also be called as revenue-expansion investment.

b) Replacement and modernization:

The main objective of modernization and replacement is to improve operating efficiency and reduce costs. Assets become out dated and obsolete as a result of technological changes. The firm must decide to replace those assets with new assets that operate more economically. If a cement company changes from semi-automatic drying equipment to fully automatic drying equipment to fully automatic drying equipment, it is an example of modernization and replacement. Yet another useful way to classify investment is as follow:

- Mutually exclusive investments
- Independent investments
- Contingent investments

c) Mutually exclusive investment

Mutually exclusive investment serves the same purpose and competes with each other. If one investment is selected other will have to be rejected. A company may, for example, either use more labour-intensive, semi-automatic machine or employ a more capital intensive, highly machine for production.

d) Independent Investment

Independent investment serves different purposes and do not compete with each other. For example a heavy engineering company may be considering expansion of its plant capacity to manufacture additional excavators and adding new production facilities to manufacture a new product - Light commercial vehicles. Depending on their profitability and availability of funds, the company can undertake both investments.

e) Contingent Investment

Contingent investment is dependent projects. The choice of one investment necessitates under taking one or more other investments. For example, if a company decided to build a factory in a remote backward area, it may have to invest in houses, road, hospitals, schools etc. The total expenditure will be treated as one single investment.

13.5. CAPITAL BUDGETING PROCESS:

Capital budgeting is a complex process which may be divided into five broad phases. These are

a) Planning

b) Analysis

c) Selection

d) Implementation

e) Review

a) Planning

The planning phase of a firm's capital budgeting process is concerned with the articulation of its broad strategy and the generation and preliminary screening of project proposals. This provides the framework which shapes, guides and circumscribes the identification of individual project opportunities.

b) Analysis

The focus of this phase of capital budgeting is on gathering, preparing and summarizing relevant information about various project proposals which are being considered for inclusion in the capital budget. Under this a detail analysis of the marketing, technical, economic and ecological aspects in undertaken.

c) Selection

Project would be selected in the order in which they are ranked and cut off point would be reached when the cumulative total cost of the projects become equal to the size of the plan funds. A wide range of appraisal criteria have been suggested for selection of a project.

Criteria Of Capital Budgeting

There are two broad criteria of capital budgeting:

1. Non Discounting Criteria

The method of capital budgeting are the techniques which are used to make comparative evaluation of profitability of investment. The non-discounting methods of capital are as follows:

- Payback period method (PBP)
- Accounting rate of return method (ARR)

2. Discounting Criteria

- Net present value method (NPV)
- Internal rate of return method (IRR)
- Profitability index method (PVI)

3. Non-discounting criteria

Payback Period Method

Under this method the payback period of each project investment proposal is calculated. The investment proposal which has the least payback period is considered profitable. Actual pay back is compared with the standard one if actual payback period is less than the standard the project will be accepted and in case, actual payback period is more than the standard payback period, the project will be rejected. So, payback period is the number of years required for the original investment to be recouped. For example, if the investment required for a project is Rs. 20,000 and it is likely to generate cash flow of Rs. 10,000 for 5 years. Payback Period will be 2 years. It means that investment will be recovered in first 2 years of the project. Method of calculating payback period is:

$$PB = \frac{\text{Investment}}{\text{Annual Cash in Flow}}$$

Accounting Rate of Return

This method is also called average rate of return method. This method is based on accounting information rather than cash flows. It can be calculated as:

$$ARR = \frac{\text{Average annual profit after taxes}}{\text{Average Investment}} \times 100$$

$$\frac{\text{Total of after but profit it of all the years}}{\text{Number of years}}$$

$$\text{Average Investment} = \frac{\text{Original Investment + Salvage value}}{2}$$

Discounted Criteria

Under these methods the projected future cash flows are discounted by a certain rate called cost of capital. The second main feature of these methods is that they take into account all the benefits and costs accruing during the life time of the project. Discounted cash flow methods are briefly described as follow:

Net Present Value Method (NPV)

Net present value (NPV) is a method of determining the current value of all future cash flows generated by a project after accounting for the initial capital investment. It is widely used in capital budgeting to establish which projects are likely to turn the greatest profit.

The formula for NPV varies slightly depending on the consistency with which returns are generated. If each period generates returns in equal amounts, the formula for the net present value of a project is:

$NPV = C \times \{(1 - (1 + R)^{-T}) / R\} - \text{Initial Investment}$

where C is the expected cash flow per period, R is the required rate of return, and T is the number of periods over which the project is expected to generate income.

However, many projects generate revenue at varying rates over time. In this case, the formula for NPV is:

$NPV = (C \text{ for Period } 1 / (1 + R)^{1}) + (C \text{ for Period } 2 / (1 + R)^{2}) \ldots (C \text{ for Period } x / (1 + R)^{x}) - \text{Initial Investment}$

In both scenarios, the required rate of return is used as the discount rate for future cash flows to account for the time value of money. In corporate finance, the general consensus is that a dollar today is worth more than a dollar tomorrow. Therefore, when calculating the present value of future income, sums that will be earned down the road must be reduced to account for the delay. If the specific target rate is not known, 10% is often used as the baseline rate.

NPV is used in capital budgeting to compare projects based on their expected rates of return, required investment, and anticipated revenue over time. Typically, projects with the highest NPV are pursued.

For example, consider two potential projects for company ABC:

Project X requires an initial investment of $35,000 but is expected to generate revenues of $10,000, $27,000 and $19,000 for the first, second and third years, respectively. The target rate of return is 12%. Since the cash inflows are uneven, the second formula listed above is used.

$NPV = \{\$10,000 / (1 + 0.12)^{1}\} + \{\$27,000 / (1 + 0.12)^{2}\} + \{\$19,000 / (1 + 0.12)^{3}\} - \$35,000$

$NPV = \$8,929 + \$21,524 + \$13,524 - \$35,000$

$NPV = \$8,977$

Project Y also requires a $35,000 initial investment and will generate $27,000 per year for two years. The target rate remains 12%. Because each period produces equal revenues, the first formula above can be used.

$NPV = \$27,000 \times \{(1 - (1 + 0.12)^{-2}) / 0.12\} - \$35,000$

$NPV = \$45,631 - \$35,000$

$NPV = \$10,631$

Despite the fact that both projects require the same initial investment and Project X actually generates more total income than Project Y, the latter project has a higher NPV because income is generated faster, meaning the discount rate has a smaller effect.

Internal Rate of Return Method (IRR)

Under this method initial cost and annual cash inflows are given. The unknown rate of return is ascertained. In other words "The internal rate of return is that rate which equates the present value of cash inflows with the present value of cash outflows of an investment project." At the internal rate of return NPV of a project is zero. Like NPV method IRR method also considers time value of money. In IRR method, the discount rate (r) depends upon initial investment expenditure and the future cash inflows. IRR is calculated as follows:

$$C = \frac{A_1}{(1+r)^1} + \frac{A_2}{(1+r)^2} + \frac{A_3}{(1+r)^3} + \ldots\ldots + \frac{A_n}{(1+r)^n}$$

Where,

- C = initial cash outflow n = number of years
- r = rate of return which is to be calculated.

A1 A2 A3.....An are cash inflows in various years.

Profitability Index/ Benefit-Cost Ratio

It is the ratio of value of future cash benefits discounted at some required rate of return to the initial cash outflows of the investment PI method should be adopted when the initial costs of projects are different. NPV method is considered good when the initial cost of different projects is the same. PI can be calculated as under:

$$PI = \frac{\text{Present value of Cash inflows}}{\text{Present value of Cash outflows}}$$

If PI>1 the project will be accepted. If PI<1 the project will be rejected. When PI>1, NPV will be positive, when PI<1 NPV will be negative. In case, more than one project have PI>1 then the project whose PI is the highest will be given first preference and the project with minimum PI will be given last preference.

d) Implementation

Every entrepreneur should draw an implementation scheme or a time table for his project to ensure the timely completion of all activities involved in setting upon enterprise. Timely implementation is important because if there is delay it causes, among other things, a project cost overrun. In India delay in project implementation has become a common feature. Implementation phase for an industrial project, which involves settings up of manufacturing facilities, consists of several stages. These are:

- Project and engineering design
- Negotiation and contracting
- Construction
- Training
- Plant and commissioning

Translating an investment proposal into a concrete projects is a complex, time consuming and risky task. Delays in implementation, which are common can lead to substantial cost overruns. For expeditious implementation at a reasonable cost, the following are useful:

- Adequate formulation projects
- Use of the principle of responsibility accounting
- Use of network techniques

Hence, there is a need to draw up an implementation schedule for the project and then to adhere. Following is a simplified implementation schedule for a small project.

An illustrative implementation schedule

Table-13.1

Task/months	1	2	3	4	5	6	7	8	9	10
Formulation of project report										
Application for term loan										
Term loan sanction										
Possession of land										
Construction of building										
Getting power and water										
Placing order for machinery										
Receipt and installation of machinery										
Man power recruitment										
Trail production										
Commencement of Production										

The above schedule can be broken up into scores of specific tasks involved in setting up the enterprise. Project evaluation and review technique (PERT) and critical path method (CPM) can also be used to get better in sight into all activities related to implementation of the project.

e) Review

Once the project is commissioned, the review phase has to be set in motion. Performance review should be dome periodically compare actual performance with projected performance. A feedback device is useful in several ways.

- It throws light on how realistic were the assumption underlying the project.
- It provides a documented log of experience that is highly valuable in future decision.
- It suggests corrective action to be taken in the light of actual performance. It helps in uncovering judgmental basis.

13.6. RESOURCE ALLOCATION FRAMEWORK:

The resource allocation framework of the firm, which shapes, guides, and circumscribes individual project decisions, addresses two key issues: What should be the strategic posture of the firm? What pattern of resource allocation sub serves the chosen strategic posture? It is divided into following section:

- Key criteria
- Elementary investment strategies
- Portfolio planning tools
- Strategic position and action evaluation

a) Key criteria:

The objective of maximizing the wealth of shareholders is reflected, at the operational level, in three key criteria: profitability, risk, and growth.

1. Profitability: Profitability reflects the relationship between profit and investment. While there are numerous ways of measuring profitability, return on equity is one of the most widely used methods. It is defined as:

$$\text{Profitability} = \frac{\text{Profit after tax}}{\text{Net Worth}}$$

2. Risk: It reflects variability. How much do individual outcomes deviate from the expected value? A simple measure of variability is the range of possible outcomes, which is simply the difference between the highest and net outcomes.

3. Growth: This is manifested in the increase of revenue, assets, net worth, profits, dividends, and so on. To reflect the growth of a variable, the measure commonly employed is the compound rate of growth.

b) Elementary Investment Strategies

The building blocks of the corporate resource allocation strategy are the following elementary investment strategies:

1. Replacement and modernization
2. Capacity expansion
3. Vertical integration
4. Concentric diversification
5. Conglomerate diversification
6. Divestment

1) Replacement and Modernization

It means to maintain the production capacity of the firm, improve quality, and reduce costs. Without such investments, which are undertaken more or less routinely by well-managed firms, the competitive strength of the firm in its existing line of business can be significantly impaired.

2) Capacity Expansion

When a company anticipates growth in the market size of its product range or increase in the market share enjoyed by it in its product range, expansion of the capacity of the existing product range would have great appeal. Such an expansion offers several advantages familiarity with technology, production methods and market conditions, lower capital costs due to the existence of surplus capacity in certain sections of the factory, reduction in unit overhead costs because of larger volume or production.

3) Vertical Integration

Vertical integration may be of two types backward integration and forward integration. Backward integration involves manufacture of raw materials and components required for the existing operations of the company. For example, Reliance Industries Limited set up a unit for the manufacture of polyester filament yarn required for its textile units. Forward integration involves the manufacture of products which use the existing products of the company as input.

4) Concentric Diversification

Many companies seek to widen their product range by adding related products. For example, a soap manufacturer may enter the field of detergents; a scooter producer may add motorcycles to its product line; a truck manufacturer may go for passenger cars.

5) Conglomerate Diversification

Conglomerate diversification involves investment in fields unrelated to the existing line of business. For example, when an engineering company like Larsen and Toubro invests in shipping it is a case of conglomerate diversification.

6) Divestment

Divestment is the opposite of investment. It involves termination or liquidation of the plant or even a division of a firm. The disposal of the Chembur plant of Union Carbide to Oswal Agro is an example of divestment.

c) Portfolio Planning Tools

To guide the process of strategic planning and resource allocation, several portfolio planning tools have been developed. Two such tools highly relevant in this context are:

1. BCG Product Portfolio Matrix
2. General Electric's Stoplight Matrix

1) BCG Product Matrix

A tool for strategic (product) planning and resource allocation, the Boston Consulting Group (BCG) product portfolio matrix analyses products on the basis of

(a) Relative market share and (b) industry growth rate. The BCG matrix, shown in Exhibit 2.1, classifies products into four broad categories as follows:

BCG Product Portfolio Matrix
Relative Market Share

		High	**Low**
Industry Growth Rate	High	Stars	Question marks
	Low	Cash cows	Dogs

Fig-13.2: BCG Product Portfolio Matrix

- Stars Product which enjoy a high, market share and a high growth rate are referred to as stars.
- Question marks Products with high growth potential but low present market share are called question marks.
- Cash Cows Products which enjoy a relatively high market share but low growth potential are called cash cows.
- Dogs Products with low markets share and limited growth potential are referred to as dogs.

2) General Electric's Stoplight Matrix

The General Electric Company of US is widely respected for the sophistication maturity, and quality of its planning systems. The matrix developed by his company for guiding resource allocation is called the General Electric's Stoplight Matrix. It calls for analyzing various products of the firm in terms of two key issues.

- Business Strength: How strong is the firm vis-a-vis its competitors?
- Industry attractiveness: What is the attractiveness or potential of the industry?

d) Strategic Position and Action Evaluation (Space)

SPACE is an approach to hammer out an appropriate strategic posture for a firm arid its individual business. An extension of the two-dimensional portfolio analysis, SPACE involves a consideration of four dimensions:

- Company's competitive advantage.
- Company's financial strength.
- Industry strength.
- Environmental stability

13.7. CAPITAL BUDGETING DIFFICULTIES

While capital expenditure decisions are extremely important they also pose difficulties which stem from three principal sources:

- **Measurement problems**: Identifying and measuring the costs and benefits of a capital expenditure proposal tends to be difficult. This is more so when a capital expenditure has a bearing on some other activities of the firm (like cutting into the sales of some existing product) or has some intangible consequences (like improving the morale of workers).
- **Uncertainty:** A capital expenditure decision involves costs and benefits that extend far into future. It is impossible to predict exactly what will happen in future. Hence, there is usually a great deal of uncertainty characterizing the cost and benefits of a capital expenditure decision.
- **Temporal spread:** The costs and benefits associated with a capital expenditure decision are spread out over a long period of time, usually 10-20 years for industrial projects and 20-50 years for infrastructure projects.

13.8. SELF ASSESSMENT QUESTIONS

1. What is capital expenditure? Explain its needs and significance.
2. Explain briefly the method of evaluating investment project.
3. What is capital budgeting? Explain its significance. What are the various kind of capital budgeting decisions?
4. Why are the capital expenditure often the most important decisions taken by a firm?
5. Discuss the various phases of capital expenditure projects.
6. Write short notes on

   (i) Net present value

   (ii) Internal rate of return

   (iii) Average rate of return

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Chapter - 14
Project Audit and Replacement

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To know objective of an auditing
- To understand what is audit program and types of audit
- To know what is audit project selection
- To understand what is replacement policy
- To familiar with elements and attributes

14.1 INTRODUCTION

Auditing refers to a systematic and independent examination of books, accounts, documents and vouchers of an organization to ascertain how far the financial statements present a true and fair view of the concern. It also attempts to ensure that the books of accounts are properly maintained by the concern as required by law. Auditing has become such an ubiquitous phenomenon in the corporate and the public sector that academics started identifying an "Audit Society". The auditor perceives and recognizes the propositions before him/her for examination, obtains evidence, evaluates the same and formulates an opinion on the basis of his judgment which is communicated through his audit report.

Any subject matter may be audited. Audits provide third party assurance to various stakeholders that the subject matter is free from material misstatement. The term is most frequently applied to audits of the financial information relating to a legal person. Other areas which are commonly audited include: internal controls, quality management, project management, water management, and energy conservation. As a result of an audit, stakeholders may effectively evaluate and improve the effectiveness of risk management, control, and the governance process over the subject matter. The word audit is derived from a Latin word "audire" which means "to hear". During the medieval times when manual book-keeping was prevalent, auditors in Britain used to hear the accounts read out for them and checked that the organization's personnel were not negligent or fraudulent.

14.2. AUDITING GUIDE

The Auditing Guide describes the internal & external audit processes. It covers the planning, conducting and reporting of the results. The objective of an audit is to find improvement in project management, delivery, software development and quality assurance processes.

Although Auditing Guide is primarily intended for project, account and product managers, and for project team members, it is also suitable study material for all the company’s re partners and contractors. There are templates and checklists available to project auditing and they are referred to in the guide. These templates and checklists give detailed information on how to audit customer deliveries, support, development, sales & service, etc.

14.3. OBJECTIVE OF AN AUDIT

The Auditing Guide defines the role of an audit within the Neoxen® Modus methodology. It describes the reasons as well as benefits of the following objectives:

Find improvement areas in

- Project management process
- Delivery process
- Solution development process
- Systems integration process
- Find out the methodology scope of application in projects
- Assist the project manager and the project team to pay attention to the issues that are important from the quality point of view

14.4. AUDIT PROGRAM

Auditing Guide explains how the forthcoming audits are included in the audit program. General audits are planned beforehand for each quarter. During each quarter the quality assessment team suggests potential projects to be audited in the following quarter based on project follow-up, metrics and customer satisfaction. Also, the suggestions from other quality teams and managers are taken into consideration when planning forthcoming audits.

a) The Post-project Audit

The post-project audit gives an overview of the critical incidents during the lifecycle of the project. The objective of the post-project audit is to make an evaluation of the project outcome and development process and make recommendations for the future.

b) The Pre-project Audit

At the end of the project definition phase, a pre-audit insures the definition is complete, the scope is well defined and a risk mitigation plan is in place.

14.5. TYPES OF AUDIT

a) Performance audits

Safety, security, information systems performance, and environmental concerns are increasingly the subject of audits. There are now audit professionals who specialize in security audits and information systems audits. With nonprofit organizations and government agencies, there has been an increasing need for performance audits, examining their success in satisfying mission objectives.

b) Quality audits

Quality audits are performed to verify conformance to standards through review of objective evidence. A system of quality audits may verify the effectiveness of a quality management system. This is part of certifications such as ISO 9001. Quality audits are essential to verify the existence of objective evidence showing conformance to required processes, to assess how successfully processes have been implemented, and to judge the effectiveness of achieving any defined target levels. Quality audits are also necessary to provide evidence concerning reduction and elimination of problem areas, and they are a hands-on management tool for achieving continual improvement in an organization.

To benefit the organization, quality auditing should not only report non-conformance and corrective actions but also highlight areas of good practice and provide evidence of conformance. In this way, other departments may share information and amend their working practices as a result, also enhancing continual improvement.

c) Project audit:

Projects can undergo 2 types of Project audits

- Regular Health Check Audits: The aim of a regular health check audit is to understand the current state of a project in order to increase project success.
- Regulatory Audits: The aim of a regulatory audit is to verify that a project is compliant with regulations and standards. Best practices of NEMEA Compliance Center describe that, the regulatory audit must be accurate, objective, and independent while providing oversight and assurance to the organization.

An operations audit is an examination of the operations of the client's business. In this audit the auditor thoroughly examines the efficiency, effectiveness and economy of the operations with which the management of the entity (client) is achieving its objective. The operational audit goes beyond the internal controls issues since management does not achieve its objectives merely by compliance of satisfactory system of internal controls. Operational audits cover any matters which may be commercially unsound. The objective of operational audit is to examine Three E's, namely:[citation needed] Effectiveness – doing the right things with least wastage of resources. Efficiency – performing work in least possible time. Economy – balance between benefits and costs to run the operations.

14.6. AUDIT PROJECT SELECTION OR

Based on a risk assessment of the organization, internal auditors, management and oversight Boards determine where to focus internal auditing efforts. This focus or prioritization is part of the annual/multi-year Audit Planning. The audit plan is typically proposed by the CAE (sometimes with several options or alternatives) for the review and approval of the Audit Committee or Board of Directors. Internal auditing activity is generally conducted as one or more discrete assignments.

a) Internal audit execution:

A typical internal audit assignment involves the following steps

1. Establish and communicate the scope and objectives for the audit to appropriate management.
2. Develop an understanding of the business area under review. This includes objectives, measurements, and key transaction types. This involves review of documents and interviews. Flowcharts and narratives may be created if necessary.

3. Describe the key risks facing the business activities within the scope of the audit.
4. Identify management practices in the five components of control used to ensure each key risk is properly controlled and monitored. Internal Audit Checklist[10] can be a helpful tool to identify common risks and desired controls in the specific process or industry being audited.
5. Develop and execute a risk-based sampling and testing approach to determine whether the most important management controls are operating as intended.
6. Report issues and challenges identified and negotiate action plans with management to address the problems.
7. Follow-up on reported findings at appropriate intervals. Internal audit departments maintain a follow-up database for this purpose.

Audit assignment length varies based on the complexity of the activity being audited and Internal Audit resources available. Many of the above steps are iterative and may not all occur in the sequence indicated. In addition to assessing business processes, specialists called Information Technology (IT) Auditors review Information technology controls.

b) Internal audit reports

Internal auditors typically issue reports at the end of each audit that summarize their findings, recommendations, and any responses or action plans from management. An audit report may have an executive summary; a body that includes the specific issues or findings identified and related recommendations or action plans; and appendix information such as detailed graphs and charts or process information. Each audit finding within the body of the report may contain five elements, sometimes called the "5 C's":

Condition: What is the particular problem identified?

1. **Criteria:** What is the standard that was not met? The standard may be a company policy or other benchmark.
2. **Cause:** Why did the problem occur?
3. **Consequence:** What is the risk/negative outcome (or opportunity foregone) because of the finding?
4. **Corrective action:** What should management do about the finding? What have they agreed to do and by when?

The recommendations in an internal audit report are designed to help the organization achieve effective and efficient governance, risk and control processes associated with operations objectives, financial and management reporting objectives; and legal/regulatory compliance objectives. Audit findings and recommendations may also relate to particular assertions about transactions, such as whether the transactions audited were valid or authorized, completely processed, accurately valued, processed in the correct time period, and properly disclosed in financial or operational reporting, among other elements. Under the IIA standards, a critical component of the audit process is the preparation of a balanced report that provides executives and the board with the opportunity to evaluate and weigh the issues being reported in the proper context and perspective. In providing perspective, analysis and workable recommendations for business improvements in critical areas, auditors help the organization meet its objectives.

c) Quality of Internal Audit Report

- **Objectivity** - The comments and opinions expressed in the Report should be objective and unbiased.
- **Clarity -** The language used should be simple and straightforward.
- **Accuracy -** The information contained in the report should be accurate.
- **Brevity -** The report should be concise.
- **Timeliness -** The report should be released promptly immediately after the audit is concluded, within a month.

d) Measuring the internal audit function

The measurement of the internal audit function can involve a balanced scorecard approach. Internal audit functions are primarily evaluated based on the quality of counsel and information provided to the Audit Committee and top management. However, this is primarily qualitative and therefore difficult to measure. "Customer surveys" sent to key managers after each audit engagement or report can be used to measure performance, with an annual survey to the Audit Committee. Scoring on dimensions such as professionalism, quality of counsel, timeliness of work product, utility of meetings, and quality of status updates are typical with such surveys. Understanding the expectations of senior management and the audit committee represent important steps in developing a performance measurement process, as well as how such measures help align the audit function with organizational priorities. Independent peer reviews are part of the quality assurance process for many internal audit groups as they are often required by standards.[16] The resulting peer review report is made available to the Audit Committee.

e) Reporting of critical findings

The Chief Audit Executive (CAE) typically reports the most critical issues to the Audit Committee quarterly, along with management's progress towards resolving them. Critical issues typically have a reasonable likelihood of causing substantial financial or reputational damage to the company. For particularly complex issues, the responsible manager may participate in the discussion. Such reporting is critical to ensure the function is respected, that the proper "tone at the top" exists in the organization, and to expedite resolution of such issues. It is a matter of considerable judgment to select appropriate issues for the Audit Committee's attention and to describe them in the proper context.

14.7. ROLE IN INTERNAL CONTROL

Internal auditing activity is primarily directed at evaluating internal control. Under the COSO Framework, internal control is broadly defined as a process, effected by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of the following core objectives for which all businesses strive:

- Effectiveness and efficiency of operations.
- Reliability of financial and management reporting.
- Compliance with laws and regulations.
- Safeguarding of Assets

Management is responsible for internal control, which comprises five critical components: the control environment; risk assessment; risk focused control activities; information and communication; and monitoring activities. Managers establish policies, processes, and practices in these five components of management control to help the organization achieve the four specific objectives listed above. Internal auditors perform audits to evaluate whether the five components of management control are present and operating effectively, and if not, provide recommendations for improvement.

14.8. ROLE IN RISK MANAGEMENT

Internal auditing professional standards require the function to evaluate the effectiveness of the organization's Risk management activities. Risk management is the process by which an organization identifies, analyzes, responds, gathers information about, and monitors strategic risks that could actually or potentially impact the organization's ability to achieve its mission and objectives.

Under the COSO enterprise risk management (ERM) Framework, an organization's strategy, operations, reporting, and compliance objectives all have associated strategic business risks - the negative outcomes resulting from internal and external events that inhibit the organization's ability to achieve its objectives. Management assesses risk as part of the ordinary course of business activities such as strategic planning, marketing planning, capital planning, budgeting, hedging, incentive payout structure, credit/lending practices, mergers and acquisitions, strategic partnerships, legislative changes, conducting business abroad, etc. Sarbanes-Oxley regulations require extensive risk assessment of financial reporting processes. Corporate legal counsel often prepares comprehensive assessments of the current and potential litigation a company

faces. Internal auditors may evaluate each of these activities, or focus on the overarching process used to manage risks entity-wide.

For example, internal auditors can advise management regarding the reporting of forward-looking operating measures to the Board, to help identify emerging risks; or internal auditors can evaluate and report on whether the board and other stakeholders. It can have reasonable assurance the organization's management team has implemented an effective enterprise risk management program. In larger organizations, major strategic initiatives are implemented to achieve objectives and drive changes. As a member of senior management, the Chief Audit Executive (CAE) may participate in status updates on these major initiatives. This places the CAE in the position to report on many of the major risks the organization faces to the Audit Committee, or ensure management's reporting is effective for that purpose. The internal audit function may help the organization address its risk of fraud via a fraud risk assessment, using principles of fraud deterrence. Internal auditors may help companies establish and maintain Enterprise Risk Management processes.

14.9. ROLE IN CORPORATE GOVERNANCE

Internal auditing activity as it relates to corporate governance has in the past been generally informal, accomplished primarily through participation in meetings and discussions with members of the Board of Directors. According to COSO's ERM framework, governance is the policies, processes and structures used by the organization's leadership to direct activities, achieve objectives, and protect the interests of diverse stakeholder groups in a manner consistent with ethical standards. The internal auditor is often considered one of the "four pillars" of corporate governance, the other pillars being the Board of Directors, management, and the external auditor.

A primary focus area of internal auditing as it relates to corporate governance is helping the Audit Committee of the Board of Directors (or equivalent) perform its responsibilities effectively. This may include reporting critical management control issues, suggesting questions or topics for the Audit Committee's meeting agendas, and coordinating with the external auditor and management to ensure the Committee receives effective information. In recent years, the IIA has advocated more formal evaluation of Corporate governance, particularly in the areas of board oversight of enterprise risk, corporate ethics, and fraud.

14.10. REPLACEMENT POLICY

The formal commitment by the owner to a statement that governs how decisions will be made about the circumstances and timing for optimal replacement of assets (i.e., "rules of replacement"). Replacement policies govern the relationship between Potential Failure ("P") and Functional Failure ("F") of an asset.

Goals and Principles

Some of the primary goals of an asset replacement policy are as follows

- To achieve an optimal interval for each asset.
- To develop an appropriate replacement mix based on the type of facility, facility lifecycle and asset behaviour.
- To ensure the lowest possible cost (economies of scale).
- To meet a desired/acceptable level of risk.

The replacement policy should be grounded in the following principles of asset management

- A thorough replacement analysis.
- An understanding of replacement drivers.
- Evaluation of replacement cost.
- Realistic forecasts of future events.
- Defensible cost estimates for the capital projects

14.11. ELEMENTS OF A REPLACEMENT POLICY

A replacement policy should generally contain the following three interrelated facets

a) **Replacement Timing (Mix) -** Different strategies that reflect the different attributes and characteristics of each assets. For example, some assets are set up for RTF whereas other assets are setup for BRP

b) **Replacement Strategies -** Percentage of the whole and internal component rebuild or swap-out.

c) **Replacement Types (Challenger) -** That is, what type of asset (the challenger) with replace the existing asset (the defender). Like-for-like versus upgrade.

d) **Replacement Funding (Reserve) -** That is, how will the owners pay for the project through special assessment, demand loan or reserve transfer.

Classification/Types of Policies (Timing)

All replacement policies can be considered to fall into two broad categories in regards to the timing of the replacement, as follows:

- Preventive Replacement Policy
- Failure Replacement Policy
- Preventive Replacement Policy
- One of a number of different types of asset replacement policies.

Replacement of an asset before Functional Failure ("F") occurs but after Potential Failure ("P") has been detected. It is the equivalent of an optimal interval.

14.12. ATTRIBUTES OF PREVENTIVE REPLACEMENT POLICY

Listed below are some of the key attributes of a preventive replacement policy

a) **Pre-Functional Failure -** The asset is replaced before Functional Failure ("F") has occurred. The actual size of the Pre-F period will depend on the asset in question and procurement lead times.

b) **Deterioration Models -** This approach requires an understanding of deterioration models.

c) **Late-Life Metrics -** Requires and understanding of the late-life metrics of assets.

d) **Lead Times -** This approach requires knowledge of the lead times to asset renewal so that proactive and pre-emptive steps can be taken.

e) **Leading Indicators -** This approach requires knowledge of the leading indicators of functional failure ("F").

f) **Predictive Diagnostics -** Predictive Maintenance (PdM) technologies will need to be employed to track and anticipate P-F Interval.

g) **Monitoring & Diagnostic Technologies** - In order to achieve this optimal interval, the preventive replacement policy attempts to closely monitor and anticipate the P-F interval. In fact, this will require continuous monitoring / commissioning. With detailed operating histories of the assets.

h) **Condition-Based Replacement -** Preventive replacement is a form of condition-based replacement policy.

14.13. FAILURE REPLACEMENT (POLICY)

One of several types of asset replacement policies

Replacement of an asset after it has reached Functional Failure ("F") or is in the process of undergoing functional failure, rather than replacement before failure has occurred.

Listed below are some of the key attributes of the failure replacement approach

- **Leading Indicators -** Telltale signs (leading indicators) of pending failure are ignored.
- **Reactive Funding -** These projects are typically funded by reactive funding.

- **Beyond Economic Repair -** The asset is allowed to deteriorate (either consciously or unintentionally) until it is irreparable and must be replaced.
- **Lag Times -** Management of the renewal project occurs during the lag time period after failure has occurred.

14.14. SELF ASSESSMENT QUESTIONS

1. What is audit? Explain its importance in the project management?
2. Discuss the various types of audit?
3. Explain the role of internal control and risk management in project audit?
4. What is Replacement policy? Explain Elements of a Replacement Policy.

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Chapter - 15
Project Information System

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of project information system.
- To understand the types of project information.
- To know the computerized organization and use of information.
- To understand the organizing information in databases.
- To know the databases and applications programs.

15.1. INTRODUCTION

Construction projects inevitably generate enormous and complex sets of information. Effectively managing this bulk of information to insure its availability and accuracy is an important managerial task. Poor or missing information can readily lead to project delays, uneconomical decisions, or even the complete failure of the desired facility. Pity the owner and project manager who suddenly discover on the expected delivery date that important facility components have not yet been fabricated and cannot be delivered for six months! With better information, the problem could have been identified earlier, so that alternative suppliers might have been located or schedules arranged. Both project design and control are crucially dependent upon accurate and timely information, as well as the ability to use this information effectively. At the same time, too much unorganized information presented to managers can result in confusion and paralysis of decision making.

15.2. TYPES OF INFORMATION

As a project proceeds, the types and extent of the information used by the various organizations involved will change. A listing of the most important information sets would include:

- Cash flow and procurement accounts for each organization
- Intermediate analysis results during planning and design
- Design documents, including drawings and specifications
- Construction schedules and cost estimates
- Quality control and assurance records
- Chronological files of project correspondence and memorandum
- Construction field activity and inspection logs
- Legal contracts and regulatory documents.

Some of these sets of information evolve as the project proceeds. The financial accounts of payments over the entire course of the project is an example of overall growth. The passage of time results in steady additions in these accounts, whereas the addition of a new actor such as a contractor leads to a sudden jump in the number of accounts.

Some information sets are important at one stage of the process but may then be ignored. Common examples include planning or structural analysis databases which are not ordinarily used during construction or operation. However, it may be necessary at later stages in the project to re-do analyses to consider desired changes. In this case, archival information storage and retrieval become important.

Even after the completion of construction, an historical record may be important for use during operation, to assess responsibilities in case of facility failures or for planning similar projects elsewhere.

The control and flow of information is also important for collaborative work environments, where many professionals are working on different aspects of a project and sharing information. Collaborative work environments provide facilities for sharing data files, tracing decisions, and communication via electronic mail or video conferencing. The data stores in these collaborative work environments may become very large.

15.3. ACCURACY AND USE OF INFORMATION

Numerous sources of error are expected for project information. While numerical values are often reported to the nearest cent or values of equivalent precision, it is rare that the actual values are so accurately known. Living with some uncertainty is an inescapable situation, and a prudent manager should have an understanding of the uncertainty in different types of information and the possibility of drawing misleading conclusions.

We have already discussed the uncertainty inherent in making forecasts of project costs and durations sometime in the future. Forecast uncertainty also exists in the short term. For example, consider estimates of

work completed. Every project manager is familiar with situations in which the final few bits of work for a task take an inordinate amount of time. Unforeseen problems, inadequate quality on already completed work, lack of attention, accidents, or postponing the most difficult work problems to the end can all contribute to making the final portion of an activity actually require far more time and effort than expected. The net result is that estimates of the actual proportion of work completed are often inaccurate.

Some inaccuracy in reports and estimates can arise from conscious choices made by workers, foremen or managers. If the value of insuring accuracy is thought to be low or nonexistent, then a rational worker will not expend effort or time to gather or to report information accurately. Many project scheduling systems flounder on exactly this type of non-reporting or mis-reporting. The original schedule can quickly become extremely misleading without accurate updating! Only if all parties concerned have specific mandates or incentives to report accurately will the data be reliable.

Another source of inaccuracy comes from transcription errors of various sorts. Typographical errors, incorrect measurements from reading equipment, or other recording and calculation errors may creep into the sets of information which are used in project management. Despite intensive efforts to check and eliminate such errors, their complete eradication is virtually impossible.

Example of Sources of Delay and Cost Accounts

It is common in construction activity information to make detailed records of costs incurred and work progress. It is less common to keep detailed records of delays and their causes, even though these delays may be the actual cause of increased costs and lower productivity. Paying exclusive attention to cost accounts in such situations may be misleading. For example, suppose that the accounts for equipment and material inventories show cost savings relative to original estimates, whereas the costs associated with particular construction activities show higher than estimated expenditures.

In this situation, it is not necessarily the case that the inventory function is performing well, whereas the field workers are the cause of cost overrun problems. It may be that construction activities are delayed by lack of equipment or materials, thus causing cost increases. Keeping a larger inventory of materials and equipment might increase the inventory account totals, but lead to lower overall costs on the project. Better yet, more closely matching demands and supplies might reduce delay costs without concurrent inventory cost increases. Thus, simply examining cost account information may not lead to a correct diagnosis of a problem or to the correct managerial responses.

15.4. COMPUTERIZED ORGANIZATION AND USE OF INFORMATION

Numerous formal methods and possible organizations exist for the information required for project management. Before discussing the details of computations and information representation, it will be useful to describe a record keeping implementation, including some of the practical concerns in design and implementation. In this section, we shall describe a computer based system to provide construction yard and warehouse management information from the point of view of the system users. In the process, the usefulness of computerized databases can be illustrated. A yard or warehouse is used by most construction firms to store equipment and to provide an inventory of materials and parts needed for projects. Large firms may have several warehouses at different locations so as to reduce transit time between project sites and materials supplies. In addition, local "yards" or "equipment sheds" are commonly provided on the job site. Examples of equipment in a yard would be drills, saws, office trailers, graders, back hoes, concrete pumps and cranes. Material items might include nails, plywood, wire mesh, forming lumber, etc.

In typical construction warehouses, written records are kept by warehouse clerks to record transfer or return of equipment to job sites, dispatch of material to jobs, and maintenance histories of particular pieces of equipment. In turn, these records are used as the basis for billing projects for the use of equipment and materials. For example, a daily charge would be made to a project for using a concrete pump. During the course of a month, the concrete pump might spend several days at different job sites, so each project would be charged for its use. The record keeping system is also used to monitor materials and equipment movements between sites so that equipment can be located.

Organizing this inventory information in a computer program is a practical and desirable innovation. In addition to speeding up billing (and thereby reducing borrowing costs), application programs can readily

provide various reports or views of the basic inventory information described above. Information can be entered directly to the computer program as needed. For example, the transfer record shown in Table 15-1 is based upon an input screen to a computer program which, in turn, had been designed to duplicate the manual form used prior to computerization. Use of the computer also allows some interactive aids in preparing the transfer form. This type of aid follows a simple rule: "Don't make the user provide information that the system already knows." In using the form shown in Table 15-1, a clerk need only enter the code and quantity for an item; the verbal description and unit cost of the item then appear automatically. A copy of the transfer form can be printed locally, while the data is stored in the computer for subsequent processing. As a result, preparing transfer forms and record keeping are rapidly and effectively performed.

More dramatically, the computerized information allows warehouse personnel both to ask questions about equipment management and to readily generate the requisite data for answering such questions. The records of transfers can be readily processed by computer programs to develop bills and other reports. For example, proposals to purchase new pieces of equipment can be rapidly and critically reviewed after summarizing the actual usage of existing equipment.

Ultimately, good organization of information will typically lead to the desire to store new types of data and to provide new views of this information as standard managerial tools. Of course, implementing an information system such as the warehouse inventory database requires considerable care to insure that the resulting program is capable of accomplishing the desired task. In the warehouse inventory system, a variety of details are required to make the computerized system an acceptable alternative to a long standing manual record keeping procedure. Coping with these details makes a big difference in the system's usefulness. For example, changes to the status of equipment are generally made by recording transfers as illustrated in Table 15.1. However, a few status changes are not accomplished by physical movement. One example is a charge for air conditioning in field trailers: even though the air conditioners may be left in the field, the construction project should not be charged for the air conditioner after it has been turned off during the cold weather months. A special status change report may be required for such details. Other details of record keeping require similar special controls.

Even with a capable program, simplicity of design for users is a critical factor affecting the successful implementation of a system. In the warehouse inventory system described above, input forms and initial reports were designed to duplicate the existing manual, paper-based records. As a result, warehouse clerks could readily understand what information was required and its ultimate use. A good rule to follow is the Principle of Least Astonishment: make communications with users as consistent and predictable as possible in designing programs.

Finally, flexibility of systems for changes is an important design and implementation concern. New reports or views of the data are a common requirement as the system is used. For example, the introduction of a new accounting system would require changes in the communications procedure from the warehouse inventory system to record changes and other cost items. In sum, computerizing the warehouse inventory system could save considerable labor, speed up billing, and facilitate better management control. Against these advantages must be placed the cost of introducing computer hardware and software in the warehouse.

15.5. ORGANIZING INFORMATION IN DATABASES

Given the bulk of information associated with construction projects, formal organization of the information is essential so as to avoid chaos. Virtually all major firms in the arena of project management have computer based organization of cost accounts and other data. With the advent of micro-computer database managers, it is possible to develop formal, computerized databases for even small organizations and projects. In this section, we will discuss the characteristics of such formal databases. Equivalent organization of information for manual manipulation is possible but tedious. Computer based information systems also have the significant advantage of rapid retrieval for immediate use and, in most instances, lower overall costs. For example, computerized specifications writing systems have resulted in well documented savings. These systems have records of common specification phrases or paragraphs which can be tailored to specific project applications.

Formally, a database is a collection of stored operational information used by the management and application systems of some particular enterprise.

This stored information has explicit associations or relationships depending upon the content and definition of the stored data, and these associations may themselves be considered to be part of the database. Figure 15-1 illustrates some of the typical elements of a database. The internal model is the actual location and representation of the stored data. At some level of detail, it consists of the strings of "bits" which are stored in a computer's memory, on the tracks of a recording disk, on a tape, or on some other storage device.

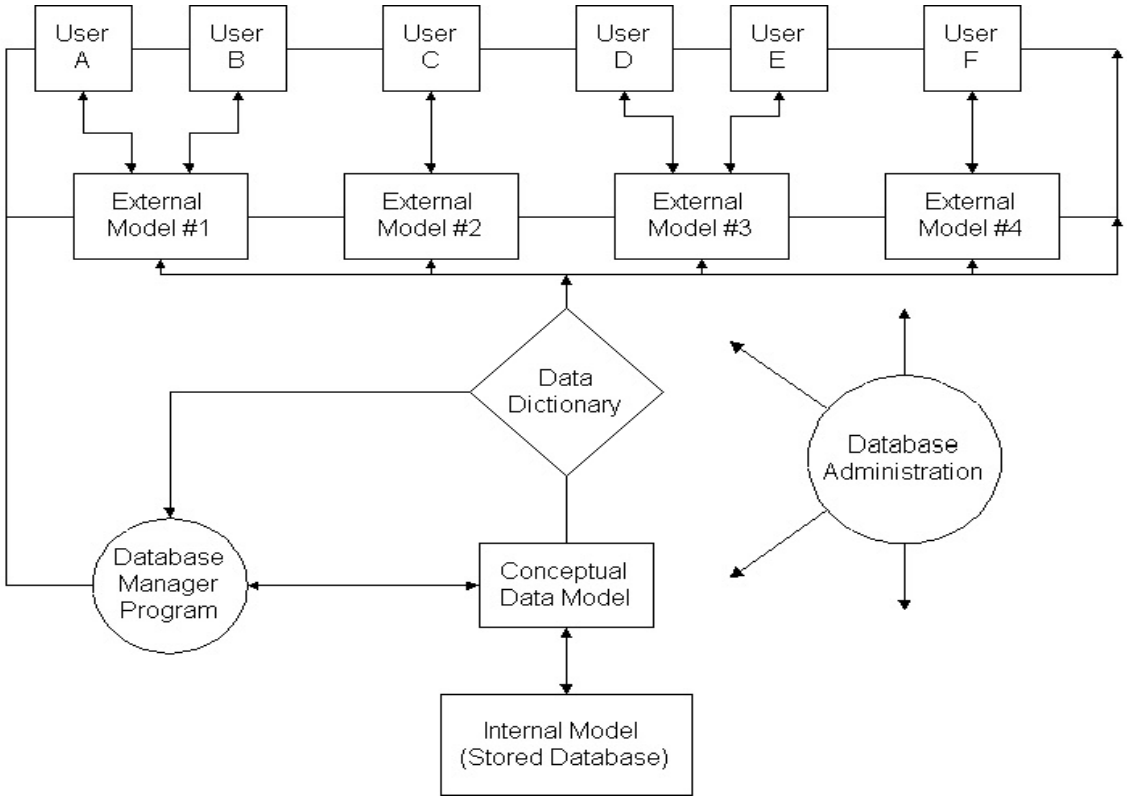

Fig-15-1: Illustration of a Database Management System Architecture

A manager need not be concerned with the details of data storage since this internal representation and manipulation is regulated by the Database Manager Program (DBM). The DBM is the software program that directs the storage, maintenance, manipulation and retrieval of data. Users retrieve or store data by issuing specific requests to the DBM. The objective of introducing a DBM is to free the user from the detail of exactly how data are stored and manipulated. At the same time, many different users with a wide variety of needs can use the same database by calling on the DBM. Usually the DBM will be available to a user by means of a special query language. For example, a manager might ask a DBM to report on all project tasks which are scheduled to be underway on a particular date. The desirable properties of a DBM include the ability to provide the user with ready access to the stored data and to maintain the integrity and security of the data. Numerous commercial DBM exist which provide these capabilities and can be readily adopted to project management applications.

While the actual storage of the information in a database will depend upon the particular machine and storage media employed, a Conceptual Data Model exists which provides the user with an idea or abstract representation of the data organization. (More formally, the overall configuration of the information in the database is called the conceptual schema.) For example, a piece of data might be viewed as a particular value within a record of a data file. In this conceptual model, a data file for an application system consists of a series of records with pre-defined variables within each record. A record is simply a sequence of variable values, which may be text characters or numerals. This data file model is one of the earliest and most important data organization structures. But other views of data organization exist and can be exceedingly useful. The next section describes one such general model, called the relational model.

Continuing with the elements in Figure 15-1, the data dictionary contains the definitions of the information in the database. In some systems, data dictionaries are limited to descriptions of the items in the database. More general systems employ the data dictionary as the information source for anything dealing with the database systems. It documents the design of the database: what data are stored, how the data is related, what are the allowable values for data items, etc. The data dictionary may also contain user authorizations specifying who may have access to particular pieces of information.

Another important element of the data dictionary is a specification of allowable ranges for pieces of data; by prohibiting the input of erroneous data, the accuracy of the database improves. External models are the means by which the users view the database. Of all the information in the database, one particular user's view may be just a subset of the total. A particular view may also require specific translation or manipulation of the information in the database.

For example, the external model for a paycheck writing program might consist solely of a list of employee names and salary totals, even if the underlying database would include employee hours and hourly pay rates. As far as that program is concerned, no other data exists in the database. The DBM provides a means of translating particular external models or views into the overall data model. Different users can view the data in quite distinct fashions, yet the data itself can be centrally stored and need not be copied separately for each user. External models provide the format by which any specific information needed is retrieved.

Finally, the Database Administrator is an individual or group charged with the maintenance and design of the database, including approving access to the stored information. The assignment of the database administrator should not be taken lightly. Especially in large organizations with many users, the database administrator is vital to the success of the database system. For small projects, the database administrator might be an assistant project manager or even the project manager.

15.6. DATABASE MANAGEMENT SYSTEMS

Whichever conceptual model or database management system is adopted, the use of a central database management system has a number of advantages and some costs compared to the commonly employed special purpose data files. A data file consists of a set of records arranged and defined for a single application system. Relational information between items in a record or between records is not explicitly described or available to other application systems. For example, a file of project activity durations and scheduled times might be assembled and manipulated by a project scheduling system. This data file would not necessarily be available to the accounting system or to corporate planners.

A centralized DBM has several advantages over such stand-alone systems

- Reduced redundancy good planning can allow duplicate or similar data stored in different files for different applications to be combined and stored only once.
- Improved availability information may be made available to any application program through the use of the DBM
- Reduced inconsistency if the same data is stored in more than one place, then updating in one place and not everywhere can lead to inconsistencies in the database.
- Enforced data security authorization to use information can be centralized.

For the purpose of project management, the issue of improved availability is particularly important. Most application programs create and own particular data files in the sense that information is difficult to obtain directly for other applications. Common problems in attempting to transfer data between such special purpose files are missing data items, unusable formats, and unknown formats.

As an example, suppose that the Purchasing Department keeps records of equipment rental costs on each project underway. This data is arranged so that payment of invoices can be handled expeditiously and project accounts are properly debited. The records are arranged by individual suppliers for this purpose.

These records might not be particularly useful for the purpose of preparing cost estimates since:

- Some suppliers might not exist in the historical record.

- Finding the lowest cost supplier for particular pieces of equipment would be exceedingly tedious since every record would have to be read to find the desired piece of equipment and the cost.
- No direct way of abstracting the equipment codes and prices might exist.

An alternative arrangement might be to separately record equipment rental costs in (1) the Purchasing Department Records, (2) the Cost Estimating Division, and (3) the Company warehouse. While these multiple databases might each be designed for the individual use, they represent considerable redundancy and could easily result in inconsistencies as prices change over time. With a central DBM, desired views for each of these three users could be developed from a single database of equipment costs.

A manager need not conclude from this discussion that initiating a formal database will be a panacea. Life is never so simple. Installing and maintaining databases is a costly and time consuming endeavor. A single database is particularly vulnerable to equipment failure.

One might also contrast the operation of a formal, computerized database with that of a manual filing system. For the equipment supplier example cited above, an experienced purchasing clerk might be able to immediately find the lowest cost supplier of a particular piece of equipment. Making this identification might well occur in spite of the formal organization of the records by supplier organization. The experienced clerk will have his (or her) own subjective, conceptual model of the available information. This subjective model can be remarkably powerful. Unfortunately, the mass of information required, the continuing introduction of new employees, and the need for consistency on large projects make such manual systems less effective and reliable.

15.7. DATABASES AND APPLICATIONS PROGRAMS

The usefulness of a database organization is particularly evident in integrated design or management environments. In these systems, numerous applications programs share a common store of information. Data is drawn from the central database as needed by individual programs. Information requests are typically performed by including pre-defined function calls to the database management system within an application program. Results from one program are stored in the database and can be used by subsequent programs without specialized translation routines. Additionally, a user interface usually exists by which a project manager can directly make queries to the database. Figure 15.2 illustrates the role of an integrated database in this regard as the central data store.

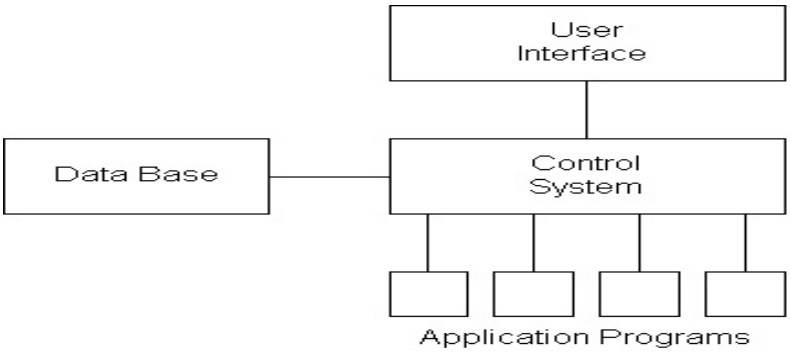

Fig-15.2: Illustration of an Integrated Applications System.

An architectural system for design can provide an example of an integrated system. First, a database can serve the role of storing a library of information on standard architectural features and component properties.

These standard components can be called from the database library and introduced into a new design. The database can also store the description of a new design, such as the number, type and location of individual building components. The design itself can be composed using an interactive graphics program. This program would have the capability to store a new or modified design in the database. A graphics program typically has the capability to compose numerous, two or three dimensional views of a design, to introduce shading (to represent shadows and provide greater realism to a perspective), and to allow editing (including moving, replicating, or sizing individual components). Once a design is completed and its description stored in a database, numerous analysis programs can be applied, such as:

- Structural analysis
- Daylight contour programs to produce plots of available daylight in each room
- A heat loss computation program
- Area, volume and materials quantities calculations.
- Production information can also be obtained from the integrated system, such as:
- Dimensioned plans, sections and elevations.
- Component specifications.
- Construction detail specifications
- Electrical layout
- System isometric drawings
- Bills of quantities and materials.

The advantage of an integrated system of this sort is that each program need only be designed to communicate with a single database. Accomplishing appropriate transformations of data between each pair of programs would be much more difficult. Moreover, as new applications are required, they can be added into an integrated system without extensive modifications to existing programs. For example, a library of specifications language or a program for joint design might be included in the design system described above. Similarly, a construction planning and cost estimating system might also be added. The use of integrated systems with open access to a database is not common for construction activities at the current time. Typically, commercial systems have a closed architecture with simple data files or a "captive," inaccessible database management system.

However, the benefits of an open architecture with an accessible database are considerable as new programs and requirements become available over time.

15.8. INFORMATION TRANSFER AND FLOW

The previous sections outlined the characteristics of a computerized database. In an overabundance of optimism or enthusiasm, it might be tempting to conclude that all information pertaining to a project might be stored in a single database. This has never been achieved and is both unlikely to occur and undesirable in itself. Among the difficulties of such excessive centralization are:

- Existence of multiple firms or agencies involved in any project. Each organization must retain its own records of activities, whether or not other information is centralized. Geographic dispersion of work even within the same firm can also be advantageous. With design offices around the globe, fast track projects can have work underway by different offices 24 hours a day.
- Advantages of distributed processing. Current computer technology suggests that using a number of computers at the various points that work is performed is more cost effective than using a single, centralized mainframe computer.
- Dynamic changes in information needs. As a project evolves, the level of detail and the types of information required will vary greatly.
- Database diseconomies of scale. As any database gets larger, it becomes less and less efficient to find desired information.
- Incompatible user perspectives. Defining a single data organization involves trade-offs between different groups of users and application systems. A good organization for one group may be poor for another.

In addition to these problems, there will always be a set of untidy information which cannot be easily defined or formalized to the extent necessary for storage in a database. While a single database may be undesirable, it is also apparent that it is desirable to structure independent application systems or databases so that

measurement information need only be manually recorded once and communication between the database might exist. Consider the following examples illustrating the desirability of communication between independent application systems or databases. While some progress has occurred, the level of integration and existing mechanisms for information flow in project management is fairly primitive. By and large, information flow relies primarily on talking, written texts of reports and specifications and drawings.

Example of Time Cards

Time card information of labor is used to determine the amount which employees are to be paid and to provide records of work performed by activity. In many firms, the system of payroll accounts and the database of project management accounts (i.e., expenditure by activity) are maintained independently. As a result, the information available from time cards is often recorded twice in mutually incompatible formats. This repetition increases costs and the possibility of transcription errors. The use of a preprocessor system to check for errors and inconsistencies and to format the information from each card for the various systems involved is likely to be a significant improvement (Figure 15.3). Alternatively, a communications facility between two databases of payroll and project management accounts might be developed.

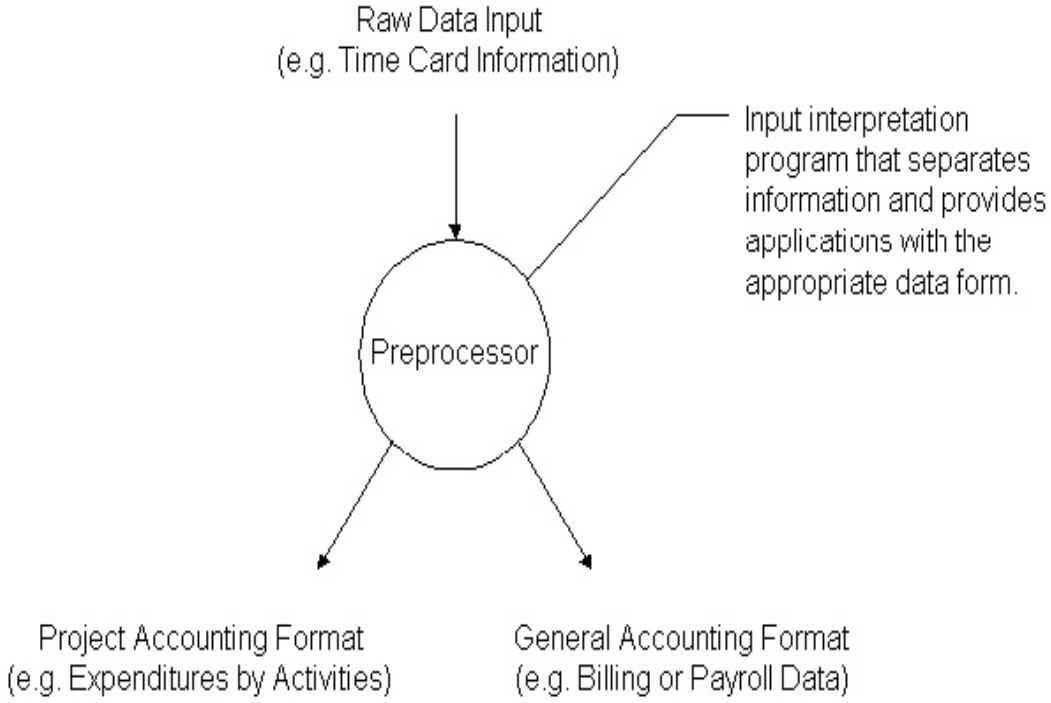

Fig-15.3: Application of an Input Pre-processor.

Example of Final Cost Estimation, Scheduling and Monitoring

Many firms maintain essentially independent systems for final cost estimation and project activity scheduling and monitoring. As a result, the detailed breakdown of the project into specific job related activities must be completely re-done for scheduling and monitoring. By providing a means of rolling-over or transferring the final cost estimate, some of this expensive and time-consuming planning effort could be avoided.

15.9. SELF–ASSESSMENT QUESTIONS

1. What is project information? Explain various types project information?
2. What is Computerized Organizational Information? Explain its uses?
3. Discuss the Databases and Applications Programs in project management?
4. Explain the following:
   a) Organizing Information in Databases
   b) Information Transfer and Flow

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Chapter - 16
Integrating Project Management

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of integrated project management control system.
- To understand the six sigma and project management.
- To know the integration of the two approaches.
- To understand the project transition to operations.

16.1. INTRODUCTION

Manufacturers and transactional firms share a drive to lower costs, reduce cycle time and offer a diverse product mix as they pursue higher profits and an increased market share in a growing global environment. Consumers (those paying for the end product) want products or services that are cheaper, readily available and of a quality that meets their expectations. A variety of systems – such as total quality management (TQM), total quality control and Six Sigma – have been implemented by organizations to help guide the efforts of creating new products, reducing product costs, improving manufacturing or organizational capabilities, realizing new market share or entering new markets. These systems rely on teams of people to identify the voice of the customer (both internal and external), taking into account the organization's competencies. They also require an ongoing portfolio of projects aimed at creating revenue or reducing costs.

While not all organizations implement these systems or keep them in their original form, many of the core ideas are adopted. Some organizations have integrated two or more systems. One melding of systems that hold significant promise is the integration of the Six Sigma methodology with the tools and processes of project management. The Six Sigma methodology DMAIC (Define, Measure, Analyze, Improve, and Control) offers a structured and disciplined process for solving business problems. Six Sigma uses tools designed to identify root causes for the defects in processes that keep an organization from providing its customers with the consistent quality of products the customers require on time and at the most reasonable cost. The Six Sigma work is normally done through cross-function teams that manage the project. Yet the methodology does not address the management of the project itself. Project management's tools and techniques focus on attributes of a project such as development, execution, control and closing. There is an assortment of tools that are used throughout the project to manage the project to completion.

16.2. SIX SIGMA AND PROJECT MANAGEMENT

With Six Sigma's DMAIC process, a problem is first defined and quantified; then measurement data is collected to bound and clarify the problem; analytical tools are deployed to trace the problem to the root cause; a solution for the root cause is identified and implemented; and finally. The improved operations are subjected to ongoing control to prevent recurrence. The Six Sigma toolkit includes a variety of techniques, primarily from statistical data analysis and quality improvement. Design of experiments (DOE), failure mode and effects analysis (FMEA), cause-and-effect diagram (aka fishbone diagram, Ishikawa diagram), process flow diagram and gage repeatability and reproducibility (R&R) studies are among Six Sigma's many tools.

While the methodology of Six Sigma has proven effective in troubleshooting or improving existing processes using the DMAIC approach, there are challenges to confront when using Six Sigma. A company that relies solely on Six Sigma to run its projects may experience issues with control of the project process. A Master Black Belt was interviewed from a firm that utilized a pure Six Sigma system for its projects. The firm found that the majority of its projects were not being completed as the Six Sigma system would suggest. A lack of management support, insufficient resources and failure to understand the voice of customer (VOC) were some of the reported problems. The DMAIC approach focuses on controls for the improvements to the process, not the control of the project management process.

"Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements," according to the Project Management Institute. Work breakdown analysis, schedule development, risk analysis, scope definition, status reporting and cost budgeting are common processes that project managers use to plan, execute, control and close projects. These processes and associated tools work for both transactional projects and manufacturing projects. The project management approach utilizes various tools and processes to complete a process improvement project. The processes identified above are far from an exhaustive list of the processes available in the project management arsenal, but represent those most useful to a process improvement project. The strengths of project management include formal control of change, scope, time and money. These controls are important to any firm trying to improve its bottom line via process improvements.

16.3. THE INTEGRATION OF THE TWO APPROACHES

By taking the process control strength of project management and combining it with the troubleshooting strength of Six Sigma, an organization can create a consistent, controlled and predictable process troubleshooting system. The integration can begin with the development of a project life cycle.

Implementing the Six Sigma methodology for defining the problem adds statistical knowledge of the problem, reducing the chance of an incorrect assessment of the issue as defined by the customer and scope documents. Using Six Sigma tools will reduce the bias that influences perceptions about a particular problem.

Six Sigma tools used for measurement of the problem – gage R&R, FMEA and control plans – can be useful within project management's validation phase of the life cycle. Adding budgeting, scheduling and resource management from project management – throughout the life cycle, will allow management to make informed decisions to move from phase to phase. The tools of both project management and Six Sigma can be placed in this life cycle to plan, act, do and check for a process improvement project. An example of a project life cycle is shown in the table below. This life cycle shows DMAIC activities (in red) assigned to project management phases and controlled by decision points at the bottom of each column. Six Sigma Improve and Control steps are split between design/testing and implementation.

Table-16.1: Example Integration of Project Management System and Six Sigma System

The Project Life Cycle					
Phase I Concept Define	**Phase II Requirements Define**	**Phase III Validation Measure/Analyze Improve/Control**	**Phase IV Implementation Planning Improve/Control**	**Phase V Implementation Improve/Control**	**Phase VI Post Implementation Control**
> VOC - statement of work > Pareto diagrams > Fishbone diagram > FMEA > Process flow > Control plan > Scope definition, objectives > Assumptions > Risk process > Project deliverable checklist	> Requirements writing > Criteria for project completion > Communication plan > Responsibility assignment matrix > Risk process > Change management > Lessons learned > Weekly team meeting	> Cost estimating > Work breakdown structure – Cost budget – Schedule > Gauge R&R > Pareto analysis > FMEA > DOE > Risk process > Change management > Earned value analysis > Lessons learned > Weekly team meeting	> Recommend solutions > Recommend controls of solutions > Design recommended solution > Design controls > Risk process > Change management > Earned value analysis > Lessons learned > Weekly team meeting	> Implement process improvements > Project process monitoring with countermeasures and controls > Purchase capital > Test solution > Risk process > Change management > Earned value analysis > Lessons learned > Weekly team meeting	> Measure for completion of objectives > Repeat at 3 months then again at 6 months > Controls review > Close project > Project book archive > Risk process > Change management > Lessons learned > Weekly team meeting
Senior management approval to continue the project	Stakeholder approval to continue the project	Project Sponsor approval to continue the project	Stakeholder approval to continue the project	Project Sponsor approval to continue the project	Project success or failure

Using Six Sigma tools throughout the project life cycle adds a series of troubleshooting tools and methodology to the project management system. Project management contributes tools to monitor and track the progress of the project and also adds controls to the problem. Examples of problems that might benefit from this integrated approach include a low yield of a production line, a long time to market for a new mutual fund, or a high defect rate for a new software release.

A tool integration problem serves to illustrate the integration of Six Sigma tools and project management. Assume a company operates a website that generates numerous user complaints about the ease of navigation. The consequence is that this site is underutilized. For this problem Six Sigma's Pareto analysis, fishbone diagrams and FMEA can be used to identify the root cause for the issue. Recommended solutions can be generated and the cost can be evaluated. A project management scope, charter and work breakdown structure

can be developed and the project can be executed accordingly. Ultimately, this integration yields a robust troubleshooting methodology with project process management and control.

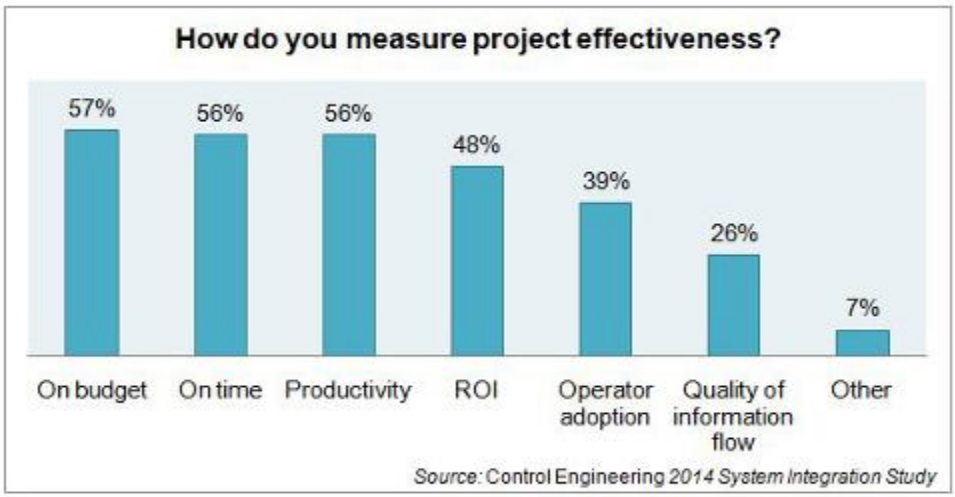
16.4. REFINEMENT OF PROJECT SYSTEMS

As organizations continue to look for ways to improve their systems, cut costs and develop new products for the benefit of profit, project systems will be continually refined. The integration of project management and Six Sigma is a natural fit. This integrated approach will better define ways to accomplish cost reduction, process enhancement, faster implementation and new product development. The integration of the Six Sigma methodology and project management yields an approach that can be used for both transactional and manufacturing organizations to better understand the problems and opportunities that lie ahead.

16.5. SYSTEM INTEGRATION STUDY

In June 2014, Control Engineering surveyed member of their audience who are directly involved in aspects of system integration within their organizations. Respondents include system integrators, those who perform some system integration services in-house, and those who hire system integrators for projects. This study asked key questions on system integration practices, including average project size, devices integrated, preferred qualities of a system integrator, and issues with project schedules and budgets.

Fig-16.2



Control Engineering considers the following five insights to be high-level findings that are impacting the system integration industry today:

1. **Project size:** The average system integration project size among respondents was about $67,000. Third-party system integrators averaged 18 projects per year, while in-house system integrators averaged 17, and those who hire system integrators averaged nine.
2. **Skills for quality work:** Engineering skills were seen as the most helpful by 98% of respondents for system integration services. Other helpful qualities included project management skills and knowledge of industry and national standards.
3. **Role of system integrator:** Nearly 60% of respondents think system integrators should join a project either at project inception or for the entire lifecycle. However, respondents reported that system integrators typically join at the project design or specification phases.
4. **On time, on budget projects:** On average, 69% of respondents' system integration projects during the past year were on time, and another 61% said the project was on budget. If a project was indicated as over budget, 50% of respondents said the overrun was due to administrative issues, such as scope creep, delays in approvals, etc.
5. **Project effectiveness:** Nine out of every 10 respondents rated the automation system integration in their facility or in the facilities where they were involved, as either highly or moderately effective.

16.6. PROJECT TRANSITION TO OPERATIONS

Enterprise projects and programs often have multiple releases to various countries and business units. Project teams run the risk of becoming lost in transition when the initial release is not properly transitioned to an operation support model. In this scenario, the project team continues to work on the next release while struggling with the production support role. The project team ineffectively juggles operational activities with key project deliverables. Without defined operational roles and responsibilities, project teams endanger future releases as well suffer from role confusion.

During a recent project, an IT organization was implementing a new financial accounting package over six months with two planned releases. The first release was implemented to 1/3 of the company and the second release was scoped for the remainder of the company.

The first launch was a challenged launch as the system experienced production support issues and the business partners were not comfortable that the system was stable enough to support the remaining 2/3 of the organization. As the team approached the launch decision for the second release, the business partners and the project team decided to postpone the launch for 30 days.

The key reason wasn't the technical capabilities of the product or outstanding minor production support incidents. During the launch decision meeting, the business partners raised concerns about the instability of the application and the lack of sufficient operational support. After further investigation, the instability was a perception rather than an actual reality. The application response time was acceptable and the Web server never went down. The system functioned as designed however; the perceived instability was directly related to the lack of response from the support team. The key reason contributing to the lack of response was that production support was provided by the existing project team. The project team never transitioned operational support to another team or an individual.

The project team continued to respond to operational issues while trying to deliver the next release of the software implementation. The project issues log was a compilation of operational issues and release specific issues. The project also relied on multiple vendors to manage integration with the software product. The various vendors raised operations issues to multiple points of contact. The end result was confusion. Once the decision to defer the launch was finalized, the project team members became defensive and a bit demoralized by the lack of ownership and the lack of recognition for long hours spent delivering the second phase and production support.

This entire "lost in transition" scenario could have been avoided if the project team included operations support planning and transition early on in the project planning and schedule development. The project team solved the problem by implementing the following six simple steps to improve application governance and improve operational support.

1. **Identify support resources for the application:** Even in resource constrained organizations, it is important to have an individual resource or team responsible for production support. Depending on the volume, the role may be shared or dedicated to production support and application management.
2. **Establish an operations status meeting with business partners and IT stakeholders:** An operations status meeting is similar to a project status meeting except the focus is on the operations of the IT application and the results being delivered to the business. The operations status meeting includes business partners and IT management to jointly review the health and performance of the application.
3. **Establish a production issues and incidents meeting with business subject matter experts and the technical team:** By establishing a separate meeting to review production issues and incidents, the project team can focus on issues relevant to the next release while the operations team focuses on immediate support issues. Failing to separate production issues from project issues will only drain the project team from their intended goals and objectives. The end user becomes confused as they struggle with identifying a single point of contact for assistance.
4. **Establish a change control board to manage ongoing change in the operational environment:** Change management is an ongoing operational process as well as a project management process area. Business needs will change and new reports, fields, interfaces and customizations will be needed. Some

of these enhancements can be bundled with a future software release and others will be made off-cycle based on the request's severity. By establishing a change control board, the business customer will have a method to request changes to the application without deterring the project team from their intended goal. The changes introduced to the change control board should also be vetted and reviewed with the project team to ensure there are no impacts or conflicts.

5. **Communicate the governance model to project stakeholders:** Once the participants are identified for each of the key operational meetings, the operations governance model should be communicated and reviewed by business and IT stakeholders. By presenting a solution on how issues, changes and operational status will be reviewed, the business partners will have greater confidence in the IT manager's role in delivering services and supporting the business.
6. **Provide knowledge transfer between project team and support team:** Another key to a successful operations process is the knowledge transfer provided by the project team to the operational support team. In some cases, project team members will become operational support and in other cases, new operations support teams will be hired independent of the project. The project schedule should include transition documentation tasks to communicate the processes and procedures required to support the application. The processes documentation can include batch schedules, help desk coordination, escalation contacts, known problems and solutions, and disaster recovery procedures.
7. **Readers may be surprised that even a seasoned project team:** It could get "lost in transition", but it often happens when projects are faced with insufficient resources and short timelines. The triple constraint of scope, time and resources is adjusted when the time parameter is fixed. Scope and resource constraints will adjust and unfortunately operations support maybe de-scoped and poorly implemented. By following these six steps, project teams can ensure a better separation of duties between ongoing operations and future application delivery.

16.7. SELF ASSESSMENT QUESTIONS

1. Explain the concept of Integrated Project Management Control System?
2. What is Project Transition to Operations? Discuss?
3. Discuss the approaches of Integrated Project Management Control System?
4. Explain the following:

   a) Six Sigma and Project Management

   b) System Integration Study

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Chapter - 17
Project Quality Management

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of project quality management.
- To understand the components of a project quality plan.
- To understand the concept of quality management.
- To know the various stages of quality management.
- To aware the major principles of TQM.
- To know the benefits and limitations of TQM.

17.1. INTRODUCTION

Every project delivers something at the end of the project execution. When it comes to the project initiation, the project management and the client collaboratively define the objectives and the deliveries of the project together with the completion timelines. During the project execution, there are a number of project deliveries made. All these deliveries should adhere to certain quality standards (industry standards) as well as specific client requirements.

Therefore, each of these deliveries should be validated and verified before delivering to the client. For that, there should be a quality assurance function, which runs from start to the end of the project. When it comes to the quality, not only the quality of the deliveries that matter the most. The processes or activities that produce deliverables should also adhere to certain quality guidelines as well. As a principle, if the processes and activities that produce the deliverables do not adhere to their own quality standards (process quality standards), then there is a high probability that deliverables not meeting the delivery quality standards.

To address all the quality requirements, standards and quality assurance mechanisms in a project, a document called 'project quality plan' is developed by the project team. This plan acts as the quality bible for the project and all the stakeholders of the project should adhere to the project quality plan.

Quality Definition

The first step on the quality management is to define quality, the project manager and the team must identify what quality standards will be used in the project, it will look at what the donor, beneficiaries, the organization and other key stakeholders to come up with a good definition of quality. In some instances the organization or the area of specialization of the project (health, water or education) may have some standard definitions of quality that can be used by the project.

Identifying quality standards is a key component of quality definition that will help identify the key characteristics that will govern project activities and ensure the beneficiaries and donor will accept the project outcomes.

Quality management implies the ability to anticipate situations and prepare actions that will help bring the desired outcomes. The goal is the prevention of defects through the creation of actions that will ensure that the project team understands what is defined as quality.

Sources of Quality Definition

One source for definition of quality comes from the donor; the project must establish conversations with the donor to be familiar with and come to a common understanding of what the donor defines as quality. The donor may have certain standards of what is expected from the project, and how the project delivers the expected benefits to the beneficiaries. This is in line with the project’s ultimate objective that the project outcomes have the ability to satisfy the stated or implied needs.

Another source for quality definition comes from the beneficiaries; the project team must be able to understand how the beneficiaries define quality from their perspective, a perspective that is more focused on fitness for use, the project outcomes must be relevant to the current needs of the beneficiaries and must result in improvements to their lives. The team can create, as part of the baseline data collection, questions that seek to understand how the beneficiaries define the project will meet their needs, and a question that also helps define what project success looks like from the perspective of a beneficiary.

The development organization may have its own quality standards that can reflect technical and managerial nature of the project. The organization may require from the project timely and accurate delivery of project information needed for decision making, or compliance to international or locally recognized quality standards that define specific technical areas of the project, this is quite often in health, water and nutrition projects.

A worldwide recognized standard for project is the Sphere Standard (www.sphereproject.org), used for emergency projects whose aim is to improve the quality of assistance provided to people affected by disasters. This guideline defines the minimum standards for water, sanitation, health, shelter, food security, nutrition, shelter and settlement.

17.2 QUALITY CHARACTERISTICS

All material or services have characteristics that facilitate the identification of its quality. The characteristics are part of the conditions of how the material, equipment and services are able to meet the requirements of the project and are fit for use by the beneficiaries. Quality characteristics relate to the attributes, measures and methods attached to that particular product or service.

Functionality is the degree, by which equipment performs its intended function, this is important especially for clinical equipment, that the operation should be behave as expected.

Performance, its how well a product or service performs the beneficiaries intended use. A water system should be designed to support extreme conditions and require little maintenance to reduce the cost to the community and increase its sustainability.

Reliability, it's the ability of the service or product to perform as intended under normal conditions without unacceptable failures. Material used for blood testing should be able to provide the information in a consistent and dependable manner that will help identify critical diseases. The trust of the beneficiaries depend on the quality of the tests Relevance, it's the characteristic of how a product or service meets the actual needs of the beneficiaries, it should be pertinent, applicable, and appropriate to its intended use or application

Timeliness, how the product or service is delivered in time to solve the problems when its needed and not after, this is a crucial characteristic for health and emergency relief work. Suitability, defines the fitness of its use, it appropriateness and correctness, the agriculture equipment must be designed to operate on the soul conditions the beneficiaries will use it on.

Completeness, the quality that the service is complete and includes all the entire scope of services. Training sessions should be complete and include all the material needed to build a desired skill or knowledge Consistency, services are delivered in the same way for every beneficiary. Clinical tests need to be done using the same procedure for every patient.

Quality characteristics are not limited to the material, equipment or service delivered to the beneficiaries, but also applies to the material, equipment and services the project staff uses to deliver the project outputs. These include the vehicles, computers, various equipment and tools and consulting services the project purchases and uses to carry out its activities.

Quality characteristics must be included in all material, equipment and services the project will purchase, the procurement officers must have a complete description of what is required by the project, otherwise a procurement office may purchase the goods or services based on her or his information of the product.

17.3 QUALITY PLAN

Part of defining quality involves developing a quality plan and a quality checklist that will be used during the project implementation phase. This check list will ensure the project team and other actors are delivering the project outputs according to the quality requirements.

Once the project has defined the quality standards and quality characteristics, it will create a project quality plan that describes all the quality definitions and standards relevant to the project, it will highlight the standards that must be followed to comply to regulatory requirements setup by the donor, the organization and external agencies such a the local government and professional organizations (health, nutrition, etc)

The quality plan also describes the conditions that the services and materials must posses in order to satisfy the needs and expectations of the project stakeholders, it describes the situations or conditions that make an output fall below quality standards, this information is used to gain a common understanding among the project team to help them identify what is above and what is below a quality standard.

The quality plan also includes the procedure to ensure that the quality standards are being followed by all project staff. The plan also includes the steps required to monitor and control quality and the approval process to make changes to the quality standards and the quality plan.

17.4 QUALITY ASSURANCE

Assurance is the activity of providing evidence to create confidence among all stakeholders that the quality-related activities are being performed effectively; and that all planned actions are being done to provide adequate confidence that a product or service will satisfy the stated requirements for quality.

Quality Assurance is a process to provide confirmation based on evidence to ensure to the donor, beneficiaries, organization management and other stakeholders that product meet needs, expectations, and other requirements. It assures the existence and effectiveness of process and procedures tools, and safeguards are in place to make sure that the expected levels of quality will be reached to produce quality outputs.

Quality assurance occurs during the implementation phase of the project and includes the evaluation of the overall performance of the project on a regular basis to provide confidence that the project will satisfy the quality standards defined by the project.

One of the purposes of quality management is to find errors and defects as early in the project as possible. Therefore, a good quality management process will end up taking more effort hours and cost up-front. The goal is to reduce the chances that products or services will be of poor quality after the project has been completed.

Quality assurance is done not only to the products and services delivered by the project but also to the process and procedures used to manage the project, that includes the way the project uses the tools, techniques and methodologies to manage scope, schedule, budget and quality. Quality assurance also includes the project meets any legal or regulatory standards.

17.5 QUALITY AUDITS

Quality audits are structured reviews of the quality management activities that help identify lessons learned that can improve the performance on current or future project activities. Audits are performed by project staff or consultants with expertise in specific areas. The purpose of quality audit is to review how the project is using its internal processes to produce the products and services it will deliver to the beneficiaries. Its goal is to find ways to improve the tools, techniques and processes that create the products and services.

If problems are detected during the quality audits, corrective action will be necessary to the tools, processes and procedures used to ensure quality is reestablished. Part of the audit may include a review of the project staff understanding of the quality parameters or metrics, and skills expertise and knowledge of the people in charge of producing or delivering the products or services.

If corrective actions are needed, these must be approved through the change control processes.

17.6 THE PDCA CYCLE

The most popular tool used to determine quality assurance is the Shewhart Cycle. This cycle for quality assurance consists of four steps: Plan, Do, Check, and Act. These steps are commonly abbreviated as PDCA. The four quality assurance steps within the PDCA model stand for:

- **Plan:** Establish objectives and processes required to deliver the desired results.
- **Do:** Implement the process developed.
- **Check:** Monitor and evaluate the implemented process by testing the results against the predetermined objectives
- **Act:** Apply actions necessary for improvement if the results require changes.

The PDCA is an effective method for monitoring quality assurance because it analyzes existing conditions and methods used to provide the product or service to beneficiaries. The goal is to ensure that excellence is inherent in every component of the process. Quality assurance also helps determine whether the steps used to provide the product or service is appropriate for the time and conditions. In addition, if the PDCA cycle is repeated throughout the lifetime of the project helping improve internal efficiency.

The PDCA cycle is shown below as a never-ending cycle of improvement; this cycle is sometimes referred to as the Shewart/Deming cycle since it originated with Shewart and was subsequently applied to management practices by Deming.

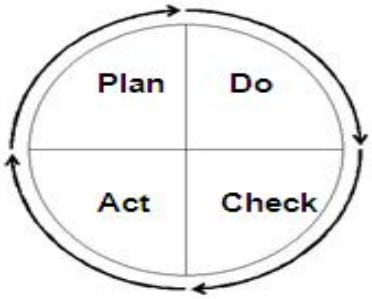

Figure-17.1: The Shewart/Deming Cycle

Quality assurance demands a degree of detail in order to be fully implemented at every step. Planning, for example, could include investigation into the quality of the raw materials used in manufacturing, the actual assembly, or the inspection processes used. The Checking step could include beneficiary feedback or surveys to determine if beneficiary needs are being met or exceeded and why they are or are not. Acting could mean a total revision in the delivery process in order to correct a technical flaw. The goal to exceed stakeholder expectations in a measurable and accountable process is provided by quality assurance.

17.7 ASSURANCE VS. CONTROL

Quality assurance is often confused with quality control; quality control is done at the end of a process or activity to verify that quality standards have been met. Quality control by itself does not provide quality, although it may identify problems and suggest ways to improving it. In contrast, quality assurance is a systematic approach to obtaining quality standards.

Quality assurance is something that must be planned for from the earliest stages of a project, with appropriate measures taken at every stage. Unfortunately far too many development projects are implemented with no quality assurance plan, and these projects often fail to meet quality expectations of the donor and beneficiaries. To avoid problem the project must be able to demonstrate the consistent compliance with the quality requirements for the project.

17.8 QUALITY CONTROL

Quality control is the use of techniques and activities that compare actual quality performance with goals and define appropriate action in response to a shortfall. It is the process that monitors specific project results to determine if they comply with relevant standards and identifies different approaches to eliminate the causes for the unsatisfactory performance.

The goal of quality control is to improve quality and involves monitoring the project outputs to determine if they meet the quality standards or definitions based on the project stakeholder's expectations. Quality control also includes how the project performs in its efforts to manage scope, budget and schedule.

- **Acceptance;** The beneficiaries, the donor or other key project stakeholders accept or reject the product or service delivered. Acceptance occurs after the beneficiaries or donor has had a change to evaluate the product or service
- **Rework:** It is the action taken to bring the rejected product or service into compliance with the requirements, quality specifications or stakeholder expectations. Rework is expensive that is why the project must make every effort to do a good job in quality planning and quality assurance to avoid the need for rework. Rework and all the costs associated with it may not refundable by the donor and the organization may end up covering those costs.
- **Adjustments:** It corrects or take the necessary steps to prevent further quality problems or defects based on quality control measurements. Adjustments are identified to the processes that produce the outputs and the decisions that were taken that lead to the defects and errors. Changes are taken to the Change Control processes of the project.

17.9. QUALITY CONTROL TOOLS

There are a couple of good tools that can be used to control quality on a project, these are cause and effect diagrams, Pareto charts and control charts:

Cause and Effect Diagram, also known as fishbone diagrams or Ishikawa diagrams (named after Kaoru Ishikawa, a Japanese quality control statistician, who developed the concept in the 1960s, and is considered one of the seven basic tools of quality management) It is named fishbone diagram because of their fish-like appearance, it is an analysis tool that provides a systematic way of looking at effects and the causes that create or contribute to those effects. The Ishikawa Diagram is employed by a problem-solving team as a tool for assembling all inputs (as to what are the causes of the problem they're addressing) systematically and graphically, with the inputs usually coming from a brainstorming session. It enables the team to focus on why the problem occurs, and not on the history or symptoms of the problem, or other topics that digress from the intent of the session. It also displays a real-time 'snap-shot' of the collective inputs of the team as it is updated. The possible causes are presented at various levels of detail in connected branches, with the level of detail increasing as the branch goes outward, i.e., an outer branch is a cause of the inner branch it is attached to. Thus, the outermost branches usually indicate the root causes of the problem.

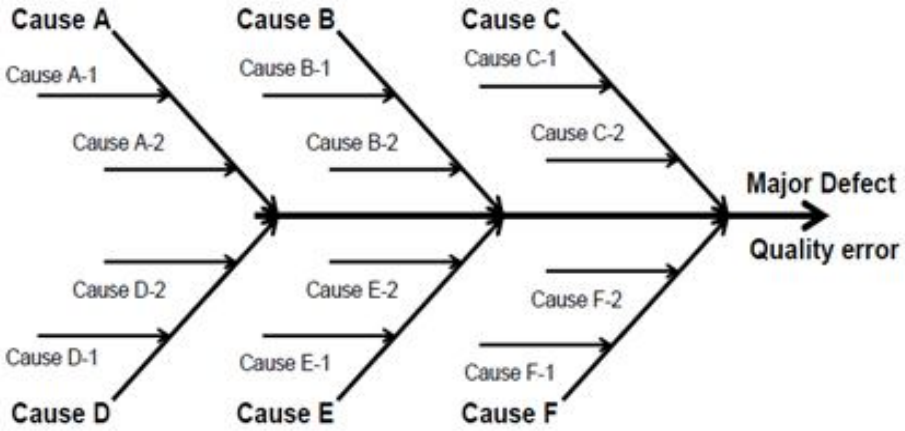

Fig-17.2: Fishbone diagram

Control Charts; is a graphical display of data that illustrates the results of a process over time, the purpose of a control chart is to prevent defects, rather than detect them or reject them, the chart allows the determine whether a process is in control or out of control over specified length of time. Control charts are often used to monitor the production of large quantities of products, but can also be used to monitor the volume and frequency of errors in documents, cost an schedule variances and other items related to project quality management. The figure below illustrates an example of a control chart for the process of controlling the weight of products manufactured by the beneficiaries for sale in international markets. The customer has a limit tolerance for defects; these are the upper and lower control limits in the chart. Random examination of the products reveals data that once charted on the graph identifies the times when the production process created items that were outside the control limits, this helps the project determine actions to help the beneficiaries improve the quality of their work.

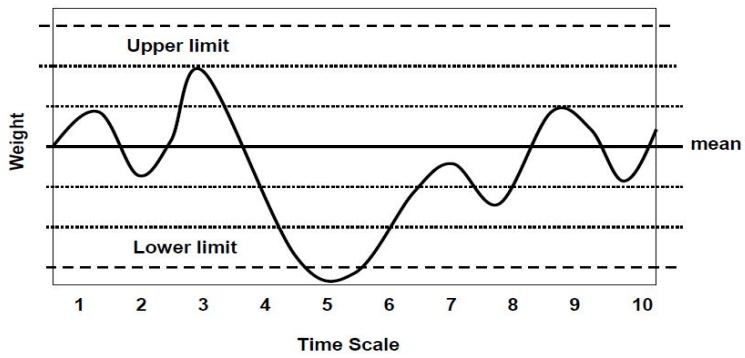

Fig-17.3: Control charts

Control charts can also be used to the project management areas, such as schedule and budget control, to determine whether the costs variances or schedule variances are outside the acceptable limits set by the donor.

17.10 QUALITY IMPROVEMENT

It is the systematic approach to the processes of work that looks to remove waste, loss, rework, frustration, etc. in order to make the processes of work more effective, efficient, and appropriate.

Quality improvement refers to the application of methods and tools to close the gap between current and expected levels of quality by understanding and addressing system deficiencies and strengths to improve, or in some cases, re-design project processes.

A variety of quality improvement approaches exists, ranging from individual performance improvement to redesign of entire project processes. These approaches differ in terms of time, resources, and complexity, but share the same four steps in quality improvement:

Identify what you want to improve; the project using the data found in the quality control process identifies the areas that need improvement.

Analyze the problem or system, the team then investigates the causes for the problem and its implications to the project, the causes may be internal or external to the project.

Develop potential solutions or changes that appear likely to improve the problem or system, the team brainstorms ideas and potential solutions to the problem, taking in consideration its impact to the project schedule and budget. After careful considerations the team decides and chooses the best alternative.

Test and implement the solutions. The team may decide to test the solution on a small scale to verify that it is capable of fixing the problem, it testes for the initial assumptions made about the problem and once it confirms that the solution is a viable alternative, it then proceeds to implement in a full scale the solution.

17.11 COST OF QUALITY

The cost of quality is the sum of costs a project will spend to prevent poor quality and any other costs incurred as a result of outputs of poor quality. Poor quality is the waste, errors, or failure to meet stakeholder needs and project requirements. The costs of poor quality can be broken down into the three categories of prevention, appraisal, and failure costs:

- **Prevention costs:** These are planned costs an organization incurs to ensure that errors are not made at any stage during the delivery process of that product or service to a beneficiary. Examples of prevention costs include quality planning costs, education and training costs, quality administration staff costs, process control costs, market research costs, field testing costs, and preventive maintenance costs. The cost of preventing mistakes are always much less than the costs of inspection and correction.
- **Appraisal costs:** These include the costs of verifying, checking, or evaluating a product or service during the delivery process. Examples of appraisal costs include receiving or incoming inspection costs, internal production audit costs, test and inspection costs, instrument maintenance costs, process measurement and control costs, supplier evaluation costs, and audit report costs.
- **Failure costs:** A project incurs these costs because the product or service did not meet the requirements and had to be fixed or replaced, or the service had to be repeated.

17.12 MATURITY MODELS

Another approach to improve quality is the use of maturity models, which are frameworks for helping organizations and projects improve their processes. The model includes a method for assessing the projects maturity levels as a first step to determine the improvements needed to increase the capacity of the project to deliver the project outputs as promised.

The use of the word "maturity" implies that capabilities must be grown over time in order to produce repeatable success in project management. The Random House College Dictionary defines "maturity" as full development or perfected condition. "Maturity" also indicates understanding or visibility into why success occurs and ways to correct or prevent common problems. "Model" implies change, a progression, or steps in a process.

Project management maturity is the progressive development of an organizations project management approach, methodology, strategy, and decision-making process. The appropriate level of maturity can vary for each organization based on specific goals, strategies, resource capabilities, scope, and needs.

The proper level of maturity to which an organization should strive is determined during a detailed assessment conducted by a professional project management consulting team. The organization has achieved full project management maturity when it has met the requirements and standards for project management effectiveness and it is capable of demonstrating improvements such as on-time project delivery, cost reductions, organizational efficiency, and quality outcomes.

A project quality maturity usually consists of five levels

- **Level 1.** Informal level, there is no defined processes for quality practices or standards. The organization may be in the initial stages of considering how projects should define quality, but most efforts are informal and had-oc.
- **Level 2.** Defined level, the organization has defines some basic quality standards and project quality policies that are being adopted. But not all projects are using it in a consistent manner.
- **Level 3.** Repeatable level, the quality process is well documented and is an organizational standard. All projects are using it and producing consistent and repeatable results.
- **Level 4.** Controlled level, all projects ire required to use quality planning standard processes. The organization has a unit or roles that coordinate quality standards and assurance and quality audits are done on a regular basis.
- **Level 5.** Optimized level, the quality process includes guidelines for feeding improvements back into the process. Metrics are used as key criteria for quality decisions and quality results are predictable.
- The model helps an organization identify were they stand and were they should strive to reach, it is a simple way to determine the level of maturity required for a project or organization, some organizations may be comfortable with achieving a level 3 while others may be encouraged to reach a level 4 due to the need to comply with legal or regulatory standards.

17.13 CONTINUOUS IMPROVEMENT

Quality is not something that is done at the end of a phase or at the end of the project, is a continuous process to ensure quality is performed in all aspects of the project. The goal is to continuously improve based on the lessons learned and new insights provided by the project. To be effective it should happen during all activities of the project.

Continuous improvement, in regard to project quality always focuses on improving stakeholder satisfaction through continuous and incremental improvements to processes, including the removal of any unnecessary activities. By applying a process that continuously improves every element of the project can achieve better results than trying to wait until the end of a phase or a mid term evaluation to start making adjustments and improvements to the work. It requires little effort and by doing small incremental improvements the project can reach significant levels of quality.

To implement continuous improvements, it necessary to have a culture of reflection that allows the project team to learn from mistakes and apply the lesson on the next phase or cycle and not spend time and effort trying to put blame, otherwise, the team will fear reporting any problems with quality and it will be too late to do anything once the donor or the beneficiaries find out.

17.14. TOTAL QUALITY MANAGEMENT:

Total Quality Management (TQM) is a management philosophy which focuses on the work process and people, with the major concern for satisfying customers and improving the organizational performance. It involves the proper coordination of work processes which allows for continuous improvement in all business units with the aim of meeting or surpassing customer's expectations. It emphasizes on totality of quality in all facets of an organization with the aim of reducing waste and rework to reduce cost and increase efficiency in production.

TQM is applicable to any organization irrespective of size, and motives, even the public sector organization are fast adopting the ideology in order to make them effective in meeting public demands. However, the adoption of the ideology by most organization has been hampered due to their non compliance with the

procedures and principles of TQM implementation. While some organization, run TQM like a program which they expect to function and perform the magic all by itself, others have used a half hearted approach to it, by using some bits and pieces of the principles.

The American Society of Quality sees quality as being subjective, with different individuals having their own perception of it. To them, quality can be seen as having two meanings – the characteristics of the product or service ability to satisfy a particular need or a product or service devoid of faults. It can be defined as a state of conformance to valid requirements where valid requirement are defined as conditions that meets the needs of customers, measurable and achievable

Stages of TQM Implementation

Dale et al, ((b) 1994) identified six different levels of TQM implementation, these includes-uncommitted, drifters, tool pushers, improvers' award winners and world class. According to them, these stages do not necessarily represent the stages through which organisations pass on their TQM journey. These levels according to Dale et al are to help organisation in identifying their weaknesses and proffering solutions to them through the use of continuous improvement.

a) Uncommitted: This stage represents organisations that have not started a formal procedure of quality improvement. Organisations in this stage view quality improvement as an added cost and thus have no investment in quality improvement programmes such as training of employees. Organisations in this stage are termed uncommitted because they are not aware of the benefit of

b) Drifters: These are organisations that have engaged in a process of quality improvement for up to three years and have followed the available advice and wisdom of TQM. The management of the organisations in this stage tend to review the performance of the firm based on the implementation of TQM and expect immediate gains from it. These organisations view TQM as a programme rather than a process thus making the policy have a low profile among employees. Organisations which fall within this stage usually have no plan for the deployment of TQM philosophy through out the organisation thus limiting the implementation of TQM to the managers while leaving the shop floor out of the implementation process.

c) Tool pushers: Organisations in this category look at quality improvement programs but in most cases fail to use such tools appropriately. They adopt quality management tools such as quality cycles, quality improvement groups. These organisations often blame the failure of TQM on the tools adopted.

d) Improvers: Organisations in this category have engaged in a process of quality improvement for between five and eight years and during this time made important. They understand that total quality involves long term cultural change and have recognized the importance of cultural change and the importance of quality improvement. This is because the implementation of TQM is dependent on a few managers to sustain the drive and direction of the improvement strategy.

e) Award Winners: These organisations are termed award winners because they have attained a point in their TQM maturity where the kind of culture, values and trust capabilities relationship and employee involvement has become total in nature and encompasses the whole. In these type of organisation every member of staff recognizes the importance of quality and all effort is made to maintain a quality standard. True competition based on product or service quality can only be attained when an organisation has gotten to a stage where it can compete for awards. Organisations in this stage are believed to have manned the process of quality improvement as the organisations have all it takes to achieve greater heights.

f) World class: According to Dale et al these organisations are characterized by the total quality improvement and business strategies to the delight of customers. The organisations that have attained this stage are always in search of opportunities to improve their services to satisfy customers.

17.15. SELF–ASSESSMENT QUESTIONS

1. What is project quality management? Explain the components in project plan?
2. What is quality? Explain the importance quality Management?
3. Discuss the important stages in TQM process?
4. Explain the principles of Total Quality Management?

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Chapter - 18
Project Evaluation

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of project Evaluation
- To know the purpose of project evaluation
- To understand Costs and timing in project evaluation
- To know how does project evaluation link to strategic plans and the budget process

- To familiar with the project evaluation process

18.1. INTRODUCTION

Project evaluation is a methodology for assessing the economic, social, environmental and financial impact of proposed capital projects. All the impacts associated with a capital project are identified and, where possible, costs and benefits valued in monetary terms, so that the projects selected by government will provide the maximum net benefit to the State.

Economic analysis assesses the net worth of a project for the economy. It is usually the major element of a project evaluation because it provides a means to rank projects in terms of the efficient allocation of resources. It provides an initial default ranking for projects which may then be modified by analyses of the social, environmental and budgetary issues associated with these projects. For these reasons, economic analysis is discussed in greater detail in these guidelines than the other analyses. Social and environmental analyses assess the effect of the project on social groups, employment, regional development, etc. and on natural ecosystems, pollution, heritage, rare species etc. respectively. They also identify ways to deal with these issues. The extent to which these analyses form part of a project evaluation depends on the importance of these issues for a particular project.

Design, monitoring and evaluation are all part of results-based project management. The key idea underlying project cycle management, and specifically monitoring and evaluation, is to help those responsible for managing the resources and activities of a project to enhance development results along a continuum, from short-term to long-term. Managing for impact means steering project interventions towards sustainable, longer-term impact along a plausibly linked chain of results: inputs produce outputs that engender outcomes that contribute to impact

18.2. THE PURPOSE OF PROJECT EVALUATION

The purposes of project evaluation are to improve the quality of services, to ensure value for money, and to priorities proposed capital projects.

This is achieved through a structured process which makes it possible to

- Clearly define project objectives, and consider a wide range of options to meet these objectives.
- Link the project to the strategic objectives of the government, the State Capital Works Program and an agency's physical asset strategic plan.
- Carry out economic, social, environmental and budgetary analyses of the project; and
- Identify the net benefit of the project to the community, and the effect on the State Budget.

Project evaluations assist departments to make decisions on proposed capital projects. They provide the means to assess the viability of proposed capital projects, and to rank competing projects in the department's annual capital works program. Project evaluations also facilitate deliberations by the Cabinet Budget Committee during the Budget process. They assist in the selection of projects to be included in the State Capital Works Program.

18.3 TYPES OF EVALUATIONS

All technical cooperation projects are subject to evaluation. Depending on the project evaluation plan, evaluations can take different forms - self-evaluation, internal, independent and external.

a) Self-evaluation is managed and conducted by ILO staff members, including project management, technical specialists and backstoppers.

b) Internal evaluation is managed and conducted by independent ILO officials, i.e., staff members who have not been involved in the design, management or backstopping of the project they are evaluating (e.g., the regional or sectoral evaluation focal person);

c) Independent evaluation is managed by independent ILO officials and conducted and led by external evaluators who have no previous links to the project. Other independent ILO officials may participate as team members in the evaluation.

d) External evaluation is managed from outside the ILO and conducted by external evaluators who have no previous links to the project being evaluated. External evaluations are usually initiated, led and financed by a donor agency. As with any evaluation, project and line management are accountable for follow-up.

18.4. COSTS AND TIMING

Costs

The resources devoted to each evaluation should be commensurate with the size and importance of expenditure involved. As a major purpose of project evaluation is to improve value for money, the cost of project evaluation must be balanced against the benefits of improved decision making. The resources allocated to a project evaluation should be the minimum necessary to inform decision-makers adequately of the worth and impact of the project.

Timing

In view of the substantial financial implications of the capital works program, it is essential that information on the viability of proposed capital projects is available to Treasury and the project team in the development of the project Budget. Project evaluations for major capital projects, to be funded from a department's capital base and to commence in the next financial year, should be completed by the start of the annual Budget process. The evaluations should be completed sufficiently in advance of the Budget process to allow the necessary time for review. This applies especially where there are contentious issues.

Initially, only short-form evaluations are required for new capital initiatives. Projects which the project Budget Committee determines merit further consideration will require a full evaluation to be undertaken. These will be then considered by the committee later in the Budget process. More detailed information on the Budget process itself is outlined in the Treasury Budget Manual. The Budget Division of Treasury can provide the specific dates for the budget process for a particular year.

18.5 NATIONAL OWNERSHIP AND PARTICIPATION

A project can only achieve sustainability if the local partners take ownership for the project during the design and implementation processes and after completion of the project. They should also take an active part in the accompanying learning process, including evaluation. A participatory evaluation involving the local partners and the beneficiaries strengthens their capacities and ownership of the project and thereby increases a project's sustainability. It also assesses how a project is motivating and supporting national constituents and other partners to meet the decent work-related needs of the intended beneficiaries.

Participatory learning is central to good project management (design, implementation, monitoring and evaluation). Information on project activities, including personal accounts of people's experiences, should be collected to facilitate focused management. The project management team and the evaluation manager should ask:

a) Who has a relevant view on what has happened during the course of the project?

b) How can these people be involved in the evaluation?

c) At what level will their contribution be most valuable?

d) Who can benefit from learning from the project?

e) What are the concerns and questions they would like to have addressed?

Project team members, national constituents and other partners should periodically meet and analyze their experiences in order to enhance ownership and make sure the evaluation findings are used to increase the impact and sustainability of the project.

18.6. PROJECT EVALUATION VS STRATEGIC PLANS

The evaluation of capital projects is a key element of a department's financial and service delivery planning, and in the development of the State's Capital Works Program. Project evaluations are used to optimize service delivery strategies and resource utilization within a department, and to do so from a whole of government perspective. Physical asset planning, project evaluation and budgeting are the key elements in determining what assets are needed, which provide the best value for money, and which can and should be funded.

Ensuring that these three elements are linked effectively is important in being able to provide the right infrastructure at the right price and at the right time. These linkages are illustrated in diagram. To achieve this linkage, service delivery strategies and the assets necessary to support them should be identified in a department's corporate plan and its physical asset strategic plan. Information on this aspect of the process is contained in Treasury's Physical Asset Strategic Planning Guidelines.

In line with this overall strategic direction, project proposals are selected and then evaluated in order to priorities them, and to decide whether to include them in the department's proposed capital program. Proposals are then considered in the Budget context and, based on which proposals are approved, the departmental and the State capital programs are developed. These Project Evaluation Guidelines are designed to assist in the evaluation and prioritization part of the process.

18.7. THE PROJECT EVALUATION PROCESS

The project evaluation process involves the identification of service delivery needs, the listing of options (including a "do nothing" option), the gathering of relevant data on these options, detailed analyses of the options, and the selection of a preferred option.

1. Define the objectives and scope of the project

The services to be provided by the project must be assessed and identified in order to clarify the purpose of the project. This purpose can be expressed as an "outcome" (e.g. better recreational access), and as an "output" (e.g. build a new road). These outcomes and outputs should derive from the organisation's corporate and physical asset strategic plans. Any capital proposal should explicitly identify its contribution to a department's service delivery strategies.

The identification of service needs should also be linked to overall government objectives as spelt out in the State strategic planning processes, and in agreed regional strategies. In determining the scope of a capital proposal, consideration should be given to determining what constitutes a discrete project, i.e. avoid excessive aggregation or excessive dis-aggregation of capital works components, and consider the impact on other projects or organisations.

2. Identify and select suitable options

All realistic options should be identified at the early stage in the planning process, including a realistic base case option of "do nothing" or "do without" i.e., maintaining the status quo. Other options can include:

- Refurbishing existing facilities.
- Various options in terms of timing and scale.
- Options to rent, build or purchase.
- Provision of the service or facility by the private sector.
- Maintenance by the private sector.
- Various combinations of capital and recurrent expenditure.
- Various locations or site options.
- Co-operation with other spheres of government.
- Co-location or shared facilities with other agencies.

Options can be generated by asking questions such as

- Could the operation be scaled down or closed?
- Are all elements of the operation justified?
- Could the operation be combined or divided to advantage?
- Can the project be linked to other projects?
- Could the operation be integrated with other functions?

- Is there a role for the private sector?
- Could the operation or part of it be contracted out?
- Are different sizes or qualities of operation feasible?
- How can the design and/or life of the scheme be varied?
- Is there scope to trade-off capital and maintenance costs?
- What interim solutions are available?

Following identification and preliminary assessment of all reasonable options, the most suitable options should be short listed for more detailed assessment.

3. Carry out the project analysis

To ensure that all aspects of a project are assessed adequately, the economic, social, environmental and budgetary impacts should be investigated. The analyses of each of these issues, which often may be interrelated, are then considered together to form the overall analysis of the project. The weight placed on each type of analysis will depend on the nature of the project.

A) Economic analysis

Economic analysis assesses the impact of capital projects on the economy. The costs and benefits of a project are identified, valued (using estimates if necessary), analyzed and ranked according to net economic benefit. The two techniques mainly used for economic analysis are Cost/Benefit Analysis and Cost/Effectiveness Analysis. Cost/Effectiveness Analysis is particularly applicable to projects with strong community or social welfare objectives which may be difficult to value. It expresses the benefits in physical units rather than in monetary units and would apply, for example, where the output of a project cannot be readily assigned a monetary value.

Because of the informational demands of Cost/Benefit Analysis, the project and the benefits have to be of reasonable significance to justify the resources required for it. There are five steps in an economic analysis:

(a) Identify benefits

In identifying benefits consideration should be given to

- Avoided costs — Costs which are unavoidable if nothing is done, but may be avoided if action is taken.
- Cost savings — Verifiable reductions in existing levels of expenditure if a project proceeds.
- Revenues — Revenues which result directly or indirectly from the project; revenue changes which would have occurred regardless of the project must not be included.
- Benefits to consumers, and to the broader community as a whole (externalities); and
- The residual value of the asset (if any).

Multipliers, which measure the secondary or indirect effects of a project on the economy, should not be included as benefits in an economic analysis. The inclusion of multipliers is inappropriate because any construction project will generate activity, directly and indirectly. However, these could also be generated by alternative uses of the funds. Benefits should be valued in monetary terms wherever possible, e.g. by using real or estimated market prices. Often some notional financial measures will be available, but in some cases valuation may be excessively expensive and the results produced may be uncertain. Hence, organisations should use discretion as to the worth of undertaking such valuations.

(b) Identify costs

Evaluations should be based on the additional cost to the State of undertaking the particular project. Costs which would have been incurred anyway should be excluded. The stream of costs should cover the life of the proposed capital item. The degree of accuracy in identifying costs will vary with the significance of the project and the availability of data. Assumptions underlying all capital and recurrent cost estimates should be made explicit in the evaluation, including assumptions regarding, for example, real labour costs, real energy

costs, demand growth or real charges/rates. It is important that estimates of costs be undertaken on a consistent basis to enable meaningful comparisons to be made between competing options and projects. Also valuation of costs should be on the same basis as benefits.

(c) Calculate net benefits

The concept of present value is used to facilitate comparison between projects. For Cost/Benefit Analysis the various future costs and benefits should be expressed in present value terms. For Cost/Effective Analysis, a present value should be provided for costs. Discounting takes account of the fact that initial investment costs are borne up front, while benefits and/or operating costs may extend far into the future. Discounting reflects the concept of the time preference of money which is relevant even in the absence of inflation. The use of real interest rates, i.e., with the effect of inflation removed, for example, reflects this time preference.

As a general rule, costs and benefits should be valued in real terms and the stream of costs and benefits should be discounted. Where nominal costs and benefits are used then this should be stated. Nominal and real values should not be used in the same analysis. The calculation of present value requires the use of a discount rate. A common discount rate is recommended for all departments in the economic evaluation of capital projects in the general Budget sector to facilitate the comparison and ranking of projects within and between portfolios. All departments in the general Budget sector should use a test discount rate of 6% real with appropriate sensitivity testing, e.g. 4% and 8%.

Commercialized entities would normally, subsequent to an economic evaluation, undertake an overall financial evaluation of the project which would use an appropriate commercial rate. The time period the analysis covers should be the expected life of the asset to be created so that immediate costs and benefits, as well as those that occur at varying times in the future, are included in the assessment. In many cases a 20-year time frame will be appropriate. All evaluations should show the Net Present Value or Net Present Value of Costs to assist in ranking projects. A bias towards optimism should be avoided and all scenarios, including pessimistic scenarios, should be considered adequately and presented.

(d) Priorities options

In a Cost/Benefit Analysis, Net Present Value (NPV) is a key decision criterion; this is the difference between the streams of costs and benefits of a project, both discounted to present value. A project is viable if the Net Present Value is greater than zero; i.e., the total discounted value of benefits is greater than the total discounted costs. If projects offer alternative solutions to a single problem, the project with the highest Net Present Value should be selected. For Cost/Effectiveness Analysis, Net Present Value of Cost is the key decision criterion used to rank projects on the basis of cost and to show the lowest cost alternative.

(e) Assess risk and uncertainty

There will always be some degree of uncertainty surrounding the outcome of an evaluation. To estimate the risks associated with this uncertainty, and to determine the sensitivity to adverse movements in particular variables, the projected outcomes should be tested under different scenarios. An assessment should be made of a realistic range for all key variables. NPV calculations should then be performed using different combinations of worst and best case scenarios. The analysis should identify the minimum set of changes in key assumptions that would render the project uneconomic.

Analytical techniques for assessing risk and uncertainty include

- **Sensitivity Analysis:** This illustrates what would happen if a small number of the key variables changed and how these changes would affect the overall cost or benefit of the project.
- **Risk Analysis:** This can be used where there are a limited number of key variables. Risk analysis assigns probabilities to the key variables, weights the key values by their probability of occurrence and uses these data to calculate the net present value of the project.
- **Scenario Planning:** This approach is used if there are many assumptions in the project evaluation, each of which could vary. It is a process of looking at various possible situations or future scenarios.

The analysis should identify

- If there are any significant social impacts from the project.

- If anything can, or should be done in relation to these issues.
- What are the costs and benefits of any such action?

B) Social analysis

An analysis of the social impacts of a capital project provides information, such as distributional effects, which are not included in an economic analysis but may be needed for decision-makers in assessing the desirability of projects. An analysis of the social impacts of a project should be undertaken where it is likely that the project will:

- Result in significant distributional shifts in costs and benefits between and within communities.
- Cause disproportionate disadvantage to a particular sector.
- Provoke appreciable community concern.
- Require changes in government policy and direction.

An analysis of the social impacts of a project should

- Identify any significant social issues or opportunities associated with the project.
- Outline the extent to which they may impact on the project.
- Develop strategies and options to deal with these issues.

The analysis should identify

- If there are any significant environmental issues
- If anything can, or should be done in relation to these issues
- What are the costs and benefits associated with these actions?

C) Environmental analysis

An environmental analysis is required for all capital projects to ensure that they meet the requirements of the Environmental Protection Act 1994 and other relevant legislation acts. The environmental analysis may include a preliminary review to determine the extent and nature of the environmental issues and whether further investigation is needed, followed by a detailed environmental impact statement commensurate with the significance of the environmental issues and the project.

The analysis should assess

- The extent and nature of both on-site and off-site environmental consequences.
- The short- and long-term environmental effects from the project.
- Opportunities to improve environmental benefits from the project (e.g. through the incorporation of conservation initiatives).
- Whether environmental considerations associated with the project are likely to be of significant community concern.

D) Budget analysis

A budget analysis should be provided for the selected options. This should identify outlays and revenues for each year over the three year forward estimates period, and subsequently as appropriate.

The budget analysis of a project should outline

- The outlays, both capital and recurrent.
- The revenues; and
- The funding source, including details of any financial arrangements.

All effects on the State's Budget should be identified. These include

Any budget impacts on other organisations, e.g. inter-departmental/ agency charging. Possible effects on organizations' budgets including capital and recurrent outlays, appropriations from the Consolidated Fund or

Trust Funds, Commonwealth and State grants, borrowings and debt service charges, taxes and fees. Options should be ranked initially on the basis of the economic analysis using Net Present Value or the Net Present Value of Costs as the yardstick. This facilitates comparisons on a consistent basis.

4. Post implementation review

A selection of the major projects undertaken by an organisation should be subject to ex-post evaluations. In addition, major on-going programs which may involve a series of smaller capital projects should be subject to ex-post evaluations. These evaluations would involve:

- A re-examination of the benefits and costs of the selected option to assess whether the anticipated benefits were realized and the forecast costs achieved.
- An assessment of the effectiveness in meeting government priorities and objectives.
- Reconsideration of alternative options (if still applicable); and
- An examination of the project design and implementation to assess the scope for improvement to the adopted option.

18.8 PRINCIPLES OF PROJECT EVALUATION

The ILO adheres to internationally-established good practices in evaluation. This means that project managers and responsible officials should ensure that project evaluations are, and are seen to be, credible and independent, that they contribute to organizational learning and reinforce accountability and transparency.

Gives a list of important principles, some of which are elaborated in the paragraphs below

- Improve performance and contribute to organizational learning:
- Reinforce accountability and transparency;
- Form part of a larger dynamic planning and review process;
- Are oriented by national and ILO longer term priorities and objectives;
- Focus on results and assume that projects are managed for results;
- Provide for the participation of national constituents and other partners;
- Reinforce among our project stakeholders a sense of joint ownership;
- Are supported through a highly credible, independent and transparent process;
- Confine the process to one which is technically and administratively reasonable;
- Are conducted in an ethical way including the responsible handling of confidential information

18.9 ROLES AND RESPONSIBILITIES

A clear division of roles and responsibilities for project evaluations is an important element in ensuring the integrity of the evaluation process to ensure the highest level of independence and credibility of evaluations.

The evaluation manager is responsible for managing all independent and internal evaluations. He/she should be in the sector or region in which the project is being implemented and have knowledge and experience in the management and evaluation of technical cooperation projects. The evaluation manager should have no links to the project decision-making and hence should not be the technical or administrative backstopper of the project. The sector or region decides on the organization of the evaluation management functions. There can be more than one evaluation manager per sector or region.

During project implementation, the evaluation manager ensures that evaluations take place in a timely manner. In preparing for an independent evaluation, the evaluation manager is required to:

- Determine the target audience for the evaluation and the key evaluation questions the evaluation should answer;
- Prepare the draft TOR for the evaluation (final approval is given by the evaluation focal person) and send a copy of the approved TOR to EVAL for information;

- Identify the evaluation consultant(s), and obtain final approval for their recruitment from the evaluation focal person;
- Ensure smooth organization of the evaluation process and proper support to the evaluation team;
- Ensure proper stakeholder involvement in the entire evaluation process;
- Ensure that gender issues are considered throughout the evaluation process;
- Manage the process of preparing the evaluation report (including circulating the draft report and collecting comments);
- Submit the final evaluation report to the evaluation focal person for final review (EVAL provides final approval);
- Send the final reviewed and approved report to PARDEV for submission to the donor and send copies to all other relevant evaluation stakeholders, including the key national partners;
- Ensure proper follow-up on the recommendations and dissemination of lessons learned within the ILO.

18.10. SELF ASSESSMENT QUESTIONS

1. What is project evaluation? Explain its importance?
2. Discuss how does project evaluation link to strategic plans and the budget process?
3. Explain the process of project evaluation?

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Chapter - 19
Project Controlling

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To Know What Is Project Control and its importance
- To Familiar With Project Controlling Techniques.
- To Understand Projects Controlling system and Process

19.1. PROJECT CONTROL

There are many definitions of Project Controls used across industries and indeed across companies within industries. Project controls are the data gathering, management and analytical processes used to predict, understand and constructively influence the time and cost outcomes of a project or program; through the communication of information in formats that assist effective management and decision making. This definition encompasses all stages of a project or program's lifecycle from the initial estimating needed to 'size' a proposed project, through to reflective learning (lessons learned) and the forensic analysis needed to understand the causes of failure (and develop claims).

The limited objective of project control deserves emphasis. Project control procedures are primarily intended to identify deviations from the project plan rather than to suggest possible areas for cost savings. This characteristic reflects the advanced stage at which project control becomes important. The time at which major cost savings can be achieved is during planning and design for the project. During the actual construction, changes are likely to delay the project and lead to inordinate cost increases. As a result, the focus of project control is on fulfilling the original design plans or indicating deviations from these plans, rather than on searching for significant improvements and cost savings. It is only when a rescue operation is required that major changes will normally occurring in the construction plan.

19.2. CHARACTERISTICS OF A PROJECT CONTROL SYSTEM

A Project control system must

- Facilitate detailed planning.
- Be able to measure performance in relation to the plan and quickly report any deviations from the plan.
- Be able to communicate planning and performance information to all parties involved.
- Identify objectives and highlight important operations leading to these objectives.

19.3. ELEMENTS OF CONTROL

- As noted earlier, project management relies heavily on the science of systems. A practical example will help in the understanding of a control system. In a simple machine-to-machine system such as an air conditioner, the input is the electric power and the output is cold air. For this we need three essential control tools:
- A monitoring mechanism, in this case, a thermostat;
- A comparative device, e.g., the thermostat signal with a set point or objective; and
- A preset formula and a means for sending a corrective signal.

The preset formula and corrective signal in its simplest form is on-off. Obviously, other more sophisticated formulae and signals are possible. This can be seen in a man-to-machine system such as an automobile where graduated control is exercised by the gas and brake pedals. Project Management is a man-to-man system. In this case the input is essentially design information and resources of materials and labor. The output is a completed facility. The processing is done by designers, draftsmen, skilled labor, etc., who transform the raw data through drawings to contracts to construction and finally to project start-up. Control is exercised through monitoring, reporting and forecasting the output, comparing this to the project objectives and sending corrective signals to the input of data and resources. Thus the output is made to conform closely to the objectives. This cycle is illustrated in Fig. 17.1.

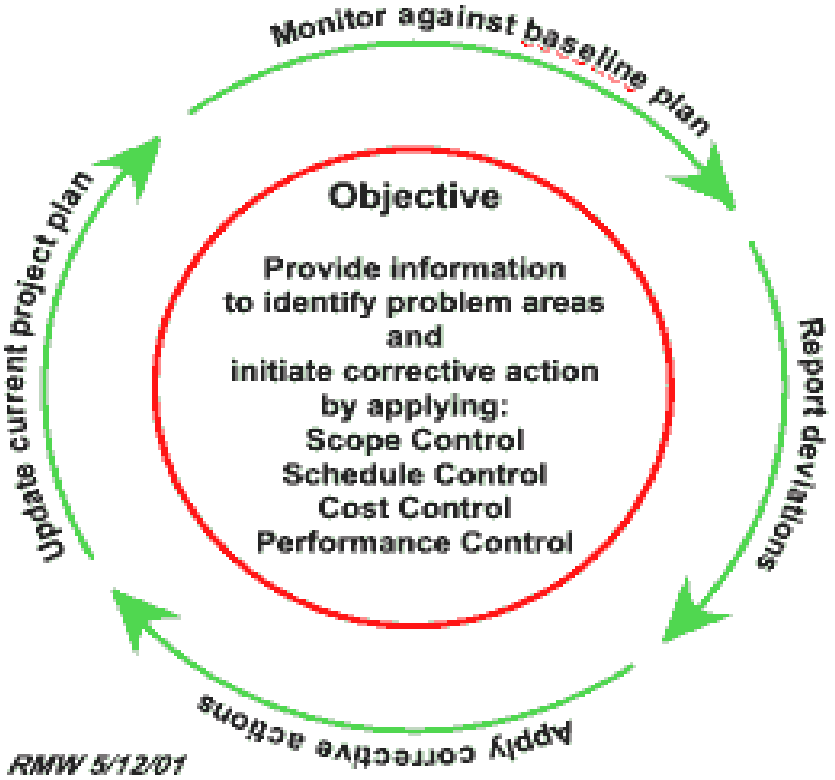


Fig-19.1: Elements of the project control cycle.

Modern computers allow us to use a wide variety of control functions using almost any conceivable control formulae. Actually, the real process is continuous and rather more complex. The cycle of monitoring, comparing and correcting never ceases until a project is completed.

19.4. IMPORTANCE OF PROJECT CONTROL

The successful performance of a project depends on appropriate planning. The PMBOK Guide defines the use of 21 processes that relate to planning out of the 39 processes for project management, (Globerson & Zwikeal 2002). The execution of a project is based on a robust project plan and can only be achieved through an effective schedule control methodology. The development of a suitable Project Control system is an important part of the project management effort (Shtub, Bard & Globerson 2005). Furthermore, it is widely recognised that planning and monitoring plays a major role as the cause of project failures. Despite the continuous evolution in the project management field, it appears evident that the traditional approach still shows a lack of utilisation of Project Controls and there have been a number of articles published to support the importance of control in the achievement of project objectives. It has been proved time and again that Project performance can be improved if dedicated Project Controls systems are in place

19.5. PROBLEMS THAT MAY ARISE DURING PROJECT CONTROL

In construction, no project, almost, is executed as planned. Control needs to be carried out due to the dynamic nature of the construction process. Controlling after project finish is trivial and updates are usually done periodically. Controlling can be done for project schedule and/or project cost. As the construction stage of project starts, the project mostly will face delays and/or cost over runs. The following is a list of the factors that may cause such problems:

- Change in activity durations and quantities.
- Sudden changes of the availability of resources.
- Change orders.
- Accidents.
- Procurement delays

19.6. MONITORING AND CONTROLLING

- Measuring the ongoing project activities ('where we are').
- Monitoring the project variables (cost, effort, scope, etc.) against the project management plan and the project performance baseline (where we should be).
- Identify corrective actions to address issues and risks properly (How can we get on track again).
- Influencing the factors that could circumvent integrated change control so only approved changes are implemented.
- In multi-phase projects, the monitoring and control process also provides feedback between project phases, in order to implement corrective or preventive actions to bring the project into compliance with the project management plan.
- Project maintenance is an ongoing process, and it includes 1 Continuing support of end-users 2 Correction of errors 3 Updates of the software over time.

Fig-19.2: Monitoring and controlling cycle.

In this stage, auditors should pay attention to how effectively and quickly user problems are resolved.

Over the course of any construction project, the work scope may change. Change is a normal and expected part of the construction process. Changes can be the result of necessary design modifications, differing site conditions, material availability, contractor-requested changes, value engineering and impacts from third parties, to name a few. Beyond executing the change in the field, the change normally needs to be documented to show what was actually constructed. This is referred to as change management.

Hence, the owner usually requires a final record to show all changes or, more specifically, any change that modifies the tangible portions of the finished work. The record is made on the contract documents – usually, but not necessarily limited to, the design drawings. The end product of this effort is what the industry terms as-built drawings, or more simply, “as built.” The requirement for providing them is a norm in construction contracts. Construction document management is a highly important task undertaken with the aid an online or desktop software system, or maintained through physical documentation. The increasing legality pertaining to the construction industries maintenance of correct documentation has caused the increase in the need for document management systems.

When changes are introduced to the project, the viability of the project has to be re-assessed. It is important not to lose sight of the initial goals and targets of the projects. When the changes accumulate, the forecasted result may not justify the original proposed investment in the project. Successful project management identifies these components, and tracks and monitors progress so as to stay within time and budget frames already outlined at the commencement of the project.

19.7. PROJECT CONTROL SYSTEMS

Project controlling should be established as an independent function in project management. It implements verification and controlling function during the processing of a project in order to reinforce the defined performance and formal goals. The tasks of project controlling are also:

- The creation of infrastructure for the supply of the right information and its update.
- The establishment of a way to communicate disparities of project parameters.
- The development of project information technology based on an intranet or the determination of a project key performance indicator system (KPI).
- divergence analyses and generation of proposals for potential project regulations
- The establishment of methods to accomplish an appropriate project structure, project workflow organization, project control and governance.
- Creation of transparency among the project parameter.

Fulfillment and implementation of these tasks can be achieved by applying specific methods and instruments of project controlling. The following methods of project controlling can be applied:

- Investment analysis
- Cost–benefit analysis
- Value benefit analysis
- Expert surveys
- Simulation calculations
- Risk-profile analysis
- Surcharge calculations
- Milestone trend analysis
- Cost trend analysis
- Target/actual-comparison

Project control is that element of a project that keeps it on-track, on-time and within budget. Project control begins early in the project with planning and ends late in the project with post-implementation review, having a thorough involvement of each step in the process. Projects may be audited or reviewed while the project is in progress. Formal audits are generally risk or compliance-based and management will direct the objectives of the audit. An examination may include a comparison of approved project management processes with how the project is actually being managed.

Each project should be assessed for the appropriate level of control needed: too much control is too time consuming, too little control is very risky. If project control is not implemented correctly, the cost to the business should be clarified in terms of errors and fixes.

Control systems are needed for cost, risk, quality, communication, time, change, procurement, and human resources. In addition, auditors should consider how important the projects are to the financial statements, how reliant the stakeholders are on controls, and how many controls exist. Auditors should review the development process and procedures for how they are implemented. The process of development and the quality of the final product may also be assessed if needed or requested. A business may want the auditing firm to be involved throughout the process to catch problems earlier on so that they can be fixed more easily. An auditor can serve as a controls consultant as part of the development team or as an independent auditor as part of an audit.

Businesses sometimes use formal systems development processes. These help assure that systems are developed successfully. A formal process is more effective in creating strong controls, and auditors should

review this process to confirm that it is well designed and is followed in practice. A good formal systems development plan outlines:

- A strategy to align development with the organization's broader objectives
- Standards for new systems
- Project management policies for timing and budgeting
- Procedures describing the process
- Evaluation of quality of change

19.8. PROJECT CONTROL PROCESS

Generally project planning and controlling process is different from organization to organization and every organization has its own system of planning and controlling process, the process of planning controlling which commonly implemented by large organizations discussed here under.

Stage One – Baseline Performance Measurement

Prior to commencing planning for a specific project, a company must first measure its current performance as a point of comparison for the future performance of any project undertaken. The measurement of existing energy consumption is typically undertaken by engineers who collect data which are then converted into simple metrics. However, engineers may not know the usage patterns, so they normally have to work with other staff members to find out usage patterns.

Table-19.3: Planning and Control Cycle for Energy Efficiency projects

Stage	Title	Description
One	Baseline Performance Measurement	Collate what you have, i.e. form monthly statements.
Two	Project Identification & Feasibility	In the first instance apply Rule 1 and 2 in house, and make these the project.
Three	Planning and Budgeting	
Four	Enactment	In this stage the plan is carried out. Control systems are used to monitor and control the project's progress to ensure expenditure is within the budget and outcomes are satisfactory.
Five	Evaluation	Following completion, the actual project results are compared with the expected project results detailed in the budget. The extents to which the budget is exceeded and to which project goals are met are two measures used in evaluating project success.
Six	Feedback and Learning	Organizations gain valuable lessons from the overall results of a project, as well as any feedback provided by personnel involved in the project. They use this as guidance for selecting, planning and controlling future projects.

For example, a business wanting to implement a company-wide, energy efficient project must first measure its current energy usage, energy costs, and energy wastage. This requires communication between various departments of the company, and a good understanding of what assets the organization is using, and how they are used.

The maintenance staff can measure current energy usage and identify the main activities and assets which use the most energy; the accounting department can calculate energy costs from energy bills and work with engineers to develop more detailed information about energy use; and engineers can measure the current energy waste. Combining all this information, the company can measure its current performance at the present time as a baseline for evaluating a new project.

Stage Two - Project Identification and Feasibility

Management will initially assess how practical a given project will be in terms of potential benefits and costs. The Feasibility Stage requires management to perform the following key tasks:

- Identification of what physical and human resources are need for each project
- A basic forecast or budget outlining potential costs and benefits, as well as a rough estimate of the project cash inflows and outflows.
- It is prudent to include the key people who will be affected by a project at the feasibility stage. This will allow them to feel involved, and to point out any challenges to the project idea.

Preparation of a formal feasibility report which contains enough information to allow decision makers to decide whether the project is 'feasible', and to allow different projects to be compared in order to identify the best projects.

Comparison of all the projects available, and the selection of the best projects. Usually the more expensive the project, the greater the level of responsibility of the decision makers. The largest projects require approval from the board of directors, whilst some projects can be implemented by lower level managers without formal approval. It is also prudent to begin negotiations early with key personnel across the organisation regarding who will have responsibility for doing the work involved in the project. It is imperative to explain to the key departments the impact of the proposed project on existing operations. Employees must be aware of the benefits that will arise from the project, as compensation for any loss of work, their time, or expenses they may incur. This will ensure that goals are aligned across the organisation when proceeding with the project enactment (Stage 3). Although management accountants are involved in this process in many organisations, in some organizations the tasks are completed by other professionals.

Returning to the lighting upgrade example, the parties involved in the implementation of a lighting project would typically be engineers, maintenance staff, the finance/accounting department and senior management. In the Feasibility phase, discussions between these parties would revolve around the feasibility of the project scale (engineering and maintenance), personnel requirements (senior management), and expenses and costs (finance department). Overall, a consensus among involved parties is necessary to proceed with more detailed budgeting and project enactment.

Stage Three-Planning and Budgeting

The planning and budgeting stage incorporates the information collected from the Feasibility Stage, namely the information gathered from consultations with key parties. The opportunity costs and benefits are then quantified and budgeted in terms of cash inflows and outflows, in order to confirm the economic feasibility of the project (i.e. profitability). Budget preparation typically involves the following steps:

- Detailed planning of the project, including a forecast of key physical and human resources needed.
- Identification of who will be responsible for doing what activities. Estimates of the cost of the physical and human resources needed.
- Identification of key benefits which are expected to arise from the project.

In the Budgeting Stage, the decision to undertake the project is re-evaluated based on the budgets prepared. The decision to continue with the project will depend on whether the projects have more benefits than costs. The cost benefit analysis is usually quantified by accountants, and used to estimate the payback period, the net present value, and the accounting rate of return. Building on the lighting upgrade example, an analysis of the energy savings arising from the replacement of light globes would be a prime cash inflow relevant to the analysis, while initial outlay costs relating to the purchase and installation new light globes would comprise a major cash outflow. A basic consultation with maintenance staff about energy savings and suppliers about initial outlay costs provide an accurate estimate of the potential cash flows associated with undertaking the project. In some cases, as energy efficient lights last so much longer than traditional light fittings, the maintenance savings are greater than the savings of energy.

Stage Four- Enactment

The Enactment Stage is concerned firstly with the implementation of the project, and secondly, systems of control (management control systems) used to monitor and control activities to ensure the project meets budgetary estimates and is completed within the budgeted timeframe. This stage also entails the collection of information which informs management about potential areas of improvement, for example additional resource controls and monitoring requirements.

In the lighting project example, fiscal controls and active monitoring are a necessity in attempting to manage unnecessary spending and wastage. Unnecessary spending may arise from the over allocation of staff during the installation phase while energy wastage can result when new light globes are not properly maintained. These issues can be addressed by appropriately budgeting for the number of required staff in addition to scheduling maintenance jobs and monitoring staff to ensure these tasks are properly undertaken. The control of the project may simply involve having an independent staff member walk around the site to check and see if the lights have been upgraded. Also, maintenance staff may have to provide documentation that the old light fittings were disposed of in an environmentally safe manner. There also needs to be a system in place to identify and prevent cases of theft, such as a physical check by an independent staff member to see if the bulbs have been upgraded, and safe storage of the new globes.

Stage Five-Evaluation

Once complete, the project is evaluated in terms of its outcomes relative to the expected results established in the budgeting and baseline performance stage. A qualitative comparison of the expected and actual incomes yields a variance which highlights the effectiveness of the project. In the Evaluation Stage, actual expenditure is compared to budgeted expenditure. If actual exceeds budgeted, then an unfavourable variance has occurred. An unfavourable variance could be the result of waste or inefficient use of resources. Alternatively, an unfavourable variance could be due to miscalculations in the budget of the actual resources required. This provides information useful for the Feedback and Learning stage.

An unfavourable variance in the lighting project may relate to actual labour hours exceeding budgeted labour hours. This may be due to the workers' lack of technical knowledge required to install light fittings, or due to unanticipated work required to ensure the safety of procedures. Alternatively, the budgeted values may be over or underestimated due to inaccuracies in its calculation which may need to be addressed in subsequent projects. Overall, the outcomes are then assessed and utilized in the final stage (Feedback and Learning) in order to improve future decision making. For many energy saving projects, it may not be easy to measure the exact amount of energy saved, so accountants may need to work with operating staff and engineers to calculate the savings from these projects.

Stage Six - Feedback and Learning

The information gathered in Enactment and Evaluation Stages is utilized through Feedback and Learning. This stage is used to collate feedback gathered from the current project in order to accurately assess future projects. Information to facilitate learning procedures may also come from general feedback obtained by interviewing personnel involved in the project or, more generally, from examining the source of variances between budgeted and actual results which may result from inaccuracies in calculation or wastage. In the case of lighting projects, many firms have found that the projects are so successful that they automatically approved a full lighting upgrade at all sites.

19.9 PROJECT CTRL TECHNIQUES

The Top 7 Project Management Techniques Every Project Manager Needs to Employ According to project management experts, nearly every kind of project can be handled using one of just seven recognized methodologies. From the extremely simple to the simply extreme, each of these project management techniques will be useful to project managers at all stages of their careers.

1. Traditional Project Management

In many situations, the classic approach to project management remains the most appropriate. This simple method requires little more than an assessment of the tasks required to complete a project and a process to monitor their completion. During the course of the project, managers provide coaching, feedback, and assessment of team members, on the way to an agreed outcome. This kind of simple project management

strategy works best with small groups when members do not necessarily need to wait on each other's completed tasks to move forward.

2. Waterfall Project Management
Taking traditional project management to the next level, the waterfall approach assumes that individual team members rely on each other to complete tasks in sequence. As contributions to the common goal build, they enable more team members to take on larger tasks. In some cases, teams can actually get larger over the course of the project as more and more opportunities to complete tasks are created. Many waterfall style projects can be tracked using Gantt charts that symbolize project timelines and dependencies.

3. Rational Unified Process
Named for the company where it was first developed, the Rational Unified Process matches the iterative style of software development projects. RUP style projects work well with cyclical projects that integrate feedback from end users for future production cycles. Although RUP projects can often resemble waterfall projects, RUP places more emphasis on the "transition" phase at the end of a cycle, where products enter the hands of end users for evaluation and future evolution.

4. PERT Project Management
Challenges of the Cold War spurred defense contractors to collaborate with the armed forces on a new model for large-scale project management. Dubbed the Program Evaluation and Review Technique, this style of project management works very well for one-time manufacturing or development processes that may evolve or expand over time. Using this technique, project managers differentiate between events (that measure progress) and activities (that get things done). Carefully estimating the amount of time between events forms the basis of both timelines and budgets. Project managers track their progress using a PERT chart.

5. Critical Path Project Management
Popular among scientists and manufacturers since its development in the 1950s, critical path project management relies heavily on task duration estimates and dependencies. Based on similar principles as the PERT method, Critical Path focuses on speeding up tasks through measurement and prioritization. By analyzing the amount of time it should take to complete a task, project managers can develop a clear picture of the overall timeframe for a project. By charting paths between tasks that rely on the completion of earlier tasks, managers can compress a project into the shortest possible amount of time.

6. Critical Chain Project Management
An evolution of both PERT and Critical Path methodologies, the Critical Chain method helps project managers reshape their teams and goals around budgets and other constraints. Instead of using Critical Path projections to determine the shortest possible project length, project managers can use the data to model potential cost savings and benefits of changing or eliminating project elements. Critical Chain management styles have become popular among managers in highly competitive industries, such as auto manufacturing and consumer electronics.

7. Extreme Project Management
Internet distribution changed project management for many companies, especially firms that focus on developing web-enabled software. Extreme project management techniques speed up the iterative cycles of Rational project management into weekly or daily processes. In some instances, project managers assign a name or number to the product at the end of each cycle, regardless of its completeness or functionality. "Nightly builds" and regular updates are hallmarks of extreme projects, which often handle user requests as prompts for future cycles. Agile programming and Scrum programming are two examples of extreme project management techniques.

19.10. HOW TO SET YOUR PROJECT CONTROLS IN 10 SIMPLE STEPS

Setting smart, effective project controls begins well before the execution stage of your project. Monitoring and control go hand in hand with each other for every stage of your project. Controls and monitoring should be solidified by using each of the following steps:

1) **Determining the scope of the project:** Explaining and communicating every aspect of the project to all members of the team.

2) **Team structure and assigning tasks:** Determining who is best suited for each required task, how many members are assigned to each team, and planning on how to monitor progress.

3) **Predetermined risk factors:** knowing which risks are worth taking, and which are guaranteed to sabotage project success. Setting a risk management plan to mitigate risks before they can become real project threats will save you a boundless amount of pain when risks are managed,

4) **Adaptability contingencies:** Both internal and external factors can demand that a project must change its course. Plan for the unexpected, but possible factors that would demand change to your project process, and set contingencies to adapt to change.

5) **Monitoring of project status:** Set a schedule and determine a method (i.e. whether in person regular meetings, or the submission of written reports) for monitoring how well or poorly your project is progressing. Also, if the project is moving along ahead of schedule, investigate and find what is facilitating the rapid progress. Apply the factors to future projects. The same rings true in the opposite scenario, when your status is behind schedule. You will then know what to monitor for and avoid in future projects, saving valued time and money.

6) **Plans for effective communication:** Obviously your lines of communication should be efficient and transparent, but pay equal care to your plans for communicating with both customers and project stakeholders alike.

7) **Deadlines and budgeting:** Set in place a plan for establishing the initial project costs, keeping track of changes to the budget by regular communication with the accounting department, and ensuring that deadlines are met. Also, develop a contingency plan for if and when a deadline is not met, how to avoid future deadline failures.

8) **Analysis/evaluation:** Set a system for evaluating and analyzing how well each element of the project planning and execution is contributing to the overall project success within the scope of the project. Is anything missing? Do you need to allocate more resources or reassign personnel? A system should be in place to solve questions (and all others) like these during both execution and planning.

9) **Corrective contingencies:** Following step 8, if there are indicators that corrections should be made to the project or, that you discovered that some of your bases are not covered, plan not only for a system to implement changes, but also for contingencies in case the corrections also include their own set of complications. You cannot predict the future, but you can imagine it and set plans to do your best to control the future.

10) **Planning for project presentation:** Determine the people that will be responsible for presenting the final product, the required supplies if any, and whom to present to also, plan for how to address handling status.to remind you, each of the preceding controls needs to have a dedicated monitor every step of the way. Without sufficient monitoring you really do not have much control at all. In the contemporary competitive project management marketplace, the necessity for project control in every facet of a project, from conception to delivery, is important now more than ever before.So, now that you know how to set your project controls when performing project management, what should you expect to gain from implementing the controls? Next, we will go over the features of proper project control.

19.11. PROJECT CRASHING AND CONTROL

a) Time-Cost Relationship of An Activity

The time required for the performance of an activity is estimated according to the quantity of resources. Except for fixed duration activities such as crop duration, gestation period etc it is possible to mange the duration of an activity by varying the quantity of resource. If cost is not a constraint, putting more resources to the activity duration could reduce be reduced. This in other word means time and cost of a project are inversely related. The relationship between cost of an activity and its duration may take the form of the curve as depicted in figure 17.4

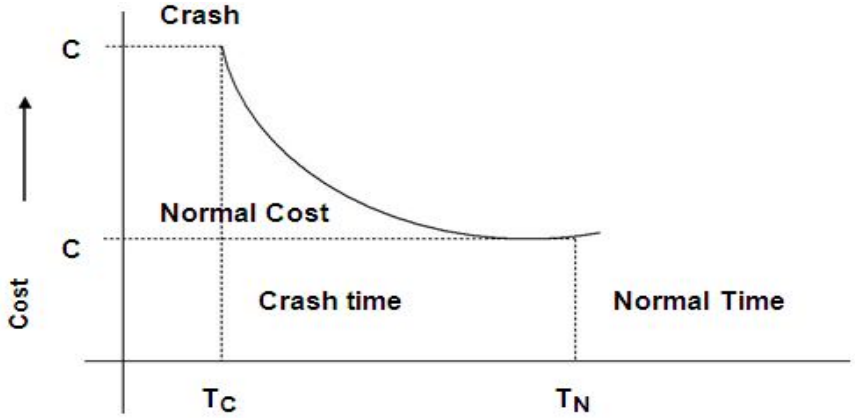


Fig-19.4: Time-Cost relationship

The time for the Activity Duration ⟶ *time* and the minimum time for the activity is called *crash time*. The costs associated with these times are called respectively the *normal cost* and the *crash cost.* Although it is possible to estimate the time and cost associated with the normal and crash conditions for each activity it is difficult to estimate the time and cost at any intermediate stage between these two points. To overcome this difficulty, it is assumed that the relationship between the time and cost as linear in the range between normal and crash situations.

b) Project Crashing

Project crashing is an exercise carried out to reduce the time of a project by investing more money. This becomes necessary when the dead line has to be met. For crashing only the critical are considered since duration of the project could be reduced by crashing these activities only. It is possible that when a project is crashed another non-critical activity may become critical and in the next cycle this has to be considered for further crashing. The steps involved in

c) Crashing are as under.

a. Identify critical path and critical activity
b. Compute crash cost slope i.e. (Crash cost – Normal cost) / (Normal Time – Crash Time)
c. Select the activity with the least cost slope i.e. minimum crash cost per time.
d. Check for the critical path.

As the project shortening (crashing) continues, a point is reached at which no further crashing is possible. At this point, some activities might not have reached their crash points. If these activities are crashed further, costs are increased with no saving in project duration.

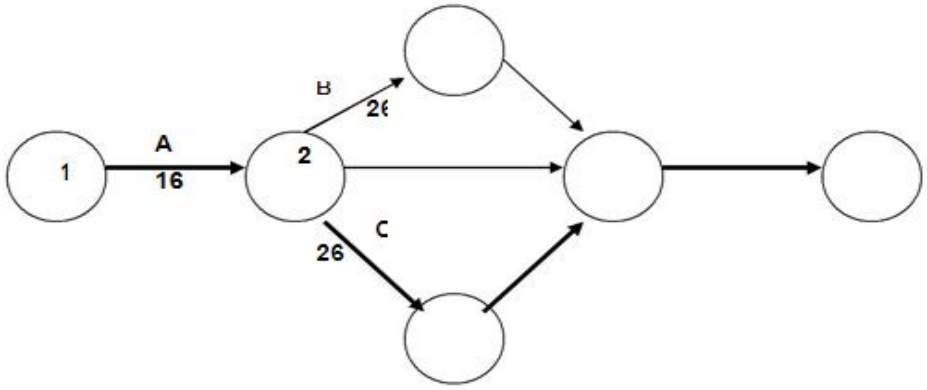
d) Project Crashing Example

The principles of project crashing are illustrated with the help of the example. Activity table of the project and the network diagram are shown in Table17.5 and Figure 17.6.respectively. Table 17.7 presents the normal and crash parameters.

Project: Development of Agro-Technology Demonstration Blocks

Table-19.5: Activity Table

Sr. No	Activity	Symbol	Preceding activity	Duration (Weeks)
1	Leveling the land	A	-	16
2	Stone pitching	B	A	26
3	Raising seedling	C	A	26
4	Establishment of irrigation system	D	A	30
5	Development of drainage system	E	C	28
6	Making pits and transplantation	F	B	27
7	Erection of fencing	G	D,E,F	18



Network diagram-19.6

Table-19.7: Normal and Crash parameters

Activity	Time in weeks		Cost in Rs.	Reduction	Increase in time	Cost slope in cost	(Rs./week)
	Normal	Crash	Normal	Cost			
A	16	11	36000	38000	5	2000	400
B	26	18	27000	33000	8	6000	750
C	26	21	8000	8900	5	900	180
D	30	23	135000	138570	7	3570	510
E	28	20	20000	22400	8	2400	300
F	27	23	12000	13700	4	1700	425
G	18	12	35000	36500	6	1500	2500
Total			273000	291070	43	18070	

The above project has a duration (Critical path length) of 88 weeks, normal cost Rs273000 and crash cost of Rs. 291070. For crashing, the critical activities in the project A,C,E and G are to be considered first. Activity C has the least cost slope i.e. Rs180/ week and can be crashed first from 26 to 21 weeks. After this crashing the project duration is reduced to 83 weeks (Activity C from 26 to 21 weeks) and the cost has increased from Rs.2,73,000 to Rs.2,73,900. The revised PERT network of the project after crashing is as in figure.17.5

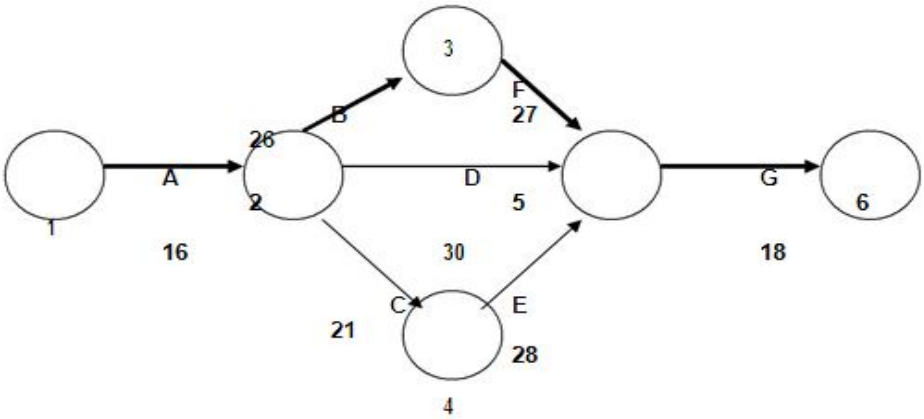


Figure-19.8: The network diagram after crashing activity C

In the redrawn network the new critical path is A,B,F and G. These activities are to e considered for further crashing. Among these activity G having least cost can be crashed from 18 weeks to 12. The project cost would be increased from 2,73900 to Rs 275000. After crashing the network diagram is to be drawn and the procedures could continue till a stage is reached when no further crashing is possible. The crashing result for the project is summarized in Table 17.9

Table-17.9: Summery of crashing exercise

Crashed	Crashed	Crashed	Project duration in weeks			Project cost in Rs.		
			Before	After	Cumulative	Before	After	Cumulative
activity	Time	Time	crashing	crashing		crashing	crashing	
	(Weeks)	(Weeks)			Reduction			increase
Normal			88	-	-	273000	-	-
C	5	5	88	87	1	273000	273900	900
G	6	6	87	81	7	273900	275400	2400
A	5	5	81	76	12	275400	277400	4400
F	4	4	76	72	16	277400	279100	6100
E	8	8	72	72	16	279100	281500	8500
B	8	8	72	64	24	281500	287500	14500

It may be noted from the above table that even though the activity C is crashed by 5 weeks i.e. from 26 to 21 weeks, the critical path length has not reduced to the same extent. It has reduced by only one week i.e. from 88 to 87 weeks. This in other words the crashing of 5 weeks in the activity C has resulted only one week reduction in the project time. This happen only when the difference between the critical path and the other paths are less than the crashed period (In the example Critical path was 88 weeks and the next path length was 87. This difference of one week which is less than the crashed period of 5 weeks). Cases where the network has two or more critical paths crashing one activity may not result in any reduction of project duration as in case of crashing activity. For example after crashing activity F the project will have two critical paths i.e. A-B-F-G and A-C-E-G. Further crashing of activity E would not result in reduction of project duration. Because the path A-B-F-G would still remain as critical path. The project in example could be crashed to the maximum of 24 weeks by incurring additional expenditure of Rs.14500.

Crashing of project indicates the time-cost trade-off implication. The decision on the extent to which the project is to be crashed depends on the managerial decision based on paucity / availability of fund.

19.12 REDRAWING NETWORK

So far the discussions were on the use of PERT/CPM in planning and scheduling a project. This unit considers the third aspect, viz. the use of this method during project execution.

No management technique, however elegant and sophisticated, can take away the responsibility of management to exercise control through making decisions. Management techniques will, however, by providing the relevant information, enable management to take better-informed decisions and thereby exercise a finer degree of control than would be possible otherwise.

A project being a dynamic entity must respond to changing conditions if it is to be completed successfully. Further projects are always executed in an environment of endless change, and there is therefore the need for continuous reassessment and reappraisal of the project. The original plan and schedule cannot therefore be executed to the last detail because of a host of influencing factors, of which the following are a few.

- Changes in the date for completion
- Changes in activity durations
- Changes in resource availability
- Changes in activity relationship
- Failure of suppliers to deliver on time
- Unexpected environmental conditions (strikes, weather, etc.)

It is, therefore, necessary to have some procedure whereby the progress of work is checked at regular intervals against the plan, discrepancies highlighted and the necessary corrective active action taken to ensure that objectives are achieved. This is the function of project control.

Measurement of the actual achievement and comparison with the original plan is therefore an essential feature of an effective control system. The sequence of instruction, execution, measurement, feedback and. correction is fundamental to control theory.

The management of the project is therefore a continuous process involving both planning and control. While the planning can be done at leisure, the control phase is carried out under continuous pressure.

The continuous recycling of information helps comparing with the original. Plan and in cases of deviation (in majority of the cases deviations do, occur as it is very rare that plan targets are fulfilled exactly) it becomes necessary to reschedule the plan. This involves considerable work even in smaller projects. In the case of large projects involving several activities, a computer becomes an invaluable tool.

Project control in action: The steps involved in project control are

- Fixing up the review period
- Obtaining progress information
- Comparing actual progress with the schedule
- Taking appropriate corrective action when required.

1. Fixing up the review period: How often the project is to be reviewed depends upon a large number of factors and there can be no standard rule or practice about this. The frequency of reviewing however will depend upon the type of project, its overall duration and the degree of uncertainty involved. For the average project, a fortnightly review should be sufficient in the normal course but in the case of rapidly changing projects, higher frequency of reviewing is necessary to have close control. Projects of the same overall duration using 3 time estimates (PERT system) for activities require greater frequency of reviewing than those using single time estimates (CPM system) for activities. The interval between reviews may change depending on the management needs.

2. Obtaining progress information: For obtaining progress, a form shown below is normally used. The basic information required refers to activities just started, activities completed, and progress on current activities. While the information regarding first two can be given precisely, the last may best be quantified by estimating the completion date.

Table-19.10: Progress Report

		Project				**For delayed activity**		
Activity	**Duration**	**Scheduled date**		**Actual date**		**Expected date**		**Remarks**
		Start	Finish	Start	Finish	Start	Finish	

Comparing actual progress with the schedule: The actual progress is transferred either on to the network or to the scheduling table so that it can be compared with the schedule to identify deviations.

3. Taking appropriate corrective action when required: Obtaining progress information and identification of deviations alone are of little value without effective follow up. If a delay occurs in a non-critical activity, corrective action will usually be limited to rescheduling the following activities. If a delay occurs in one of the critical activities, corrective action would include adding additional resources from non-critical to critical jobs, rescheduling of series operations in parallel etc. If the time cannot be made up by any of these methods, completion of the project will be delayed.

Based on the corrective action taken, fresh schedules are prepared for the following week/fortnight and the control cycle consisting of execution, measurement, feedback correction and instruction repeats itself.

4. Frequency of updating: There is no standard practice regarding the frequency of updating. Updating may be undertaken at regular intervals or whenever the situation warrants it. Updating should be done whenever major changes occur that will affect project completion date or cause a shift in the critical path, or when the impact of changes on the schedule cannot be readily noticed by inspecting the network.

19.13. SELF ASSESSMENT QUESTIONS

1. What Is Project Controlling? Explain Its Need and Importance?
2. Discuss the Process of Project Controlling?
3. Explain the Elements and Characteristics of Project Controlling?
4. Discuss the Problems of Project Controlling? Discuss the Suitable Measures to Overcome These Problems?

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Chapter - 20
Project Ethics

LEARNING OBJECTIVES

After reading this chapter, you will be able to

- To understand the concept of Originate the Ethics.
- To understand the Different vaue system.
- To understand the Code of Ethics in Project Management.
- To know the various Ethical Problems in Project Management.

20.1 WHAT AND WHERE DO ETHICS ORIGINATE

"The behaviours classified as good or bad, right or wrong are not due to goodness or badness, or a good or bad character, or a knowledge of right and wrong: they are due to contingencies involving a great variety of reinforcers, including the generalised verbal reinforcers of 'Good!' 'Bad!' 'Right!' Wrong!'". These reinforcers are provided throughout the formative or growth years of most people, usually our parents and immediate family or social group. In this manner we build our value system. Ethics refers to moral values that are sound, actions that are morally required permissible, policies and laws that are desirable.

Values are something that we learn as we grow up and then we adapt or refine them as we mature. They are the basis for decisions we make and are of particular interest because they represent controls on the decisions we make. These two themes are explored in the sections below.

20.2 THE VALUE LEARNING PROCESS

Lawrence Kohlberg, an educational psychologist, has traced what he believes to be six sequential stages of ethical reasoning through which each person progresses as part of their normal mental development. The child moves from an unquestioning dependence on external rules and controls to an increasingly sophisticated set of internalized standards, as follows;

a) Simple obedience to rules and authority to avoid punishment

b) Conformity to group behaviour to obtain rewards and exchange favours

c) Good-boy (or Good-girl) orientation, conformity to avoid dislike and rejection by others

d) Duty orientation, conformity to avoid censure by authority, disruption of order, and resulting guilt

e) Legalistic orientation, recognition of the values of contracts, some arbitrariness in rule formation to maintain common good

f) Conscience or principle orientation, primary allegiance to principles of choice, which can overrule law in cases where the law is judged to be more harm than good.

Developing to level four or five enables us to live harmoniously in small groups. (Wilson is referring here to our ancestral development into small hunter - gathering groups about 10 000 years ago).

Stage six represents behaviours associated with modern social living. The individual selects principles against which the group and law are judged. Precepts chosen by intuition based on emotion are primarily biological in origin and are likely to do no more than reinforce the primitive (hunter – gatherer group based) social arrangements.

20.3 VALUES AND CONTROL

"Once we have identified the contingencies that control the behaviour called good or bad, and right and wrong, the distinction between facts and how people feel about facts is clear". The contingencies Skinner is talking about are events that reinforce or punish certain behaviours. He goes on to make the point that these contingencies may be due to good or bad luck rather than be administered by people; in addition they may not be appropriate. As Skinner says indolence may be rewarded and hard work through bad fortune, be punished!

Returning to control, Skinner gives an example of a person who drives a car well.

They do this because of contingencies of reinforcement that have shaped this behaviour. These reinforcing contingencies drive us to a norm of behaviour, something acceptable by all those in our group and a set of rules supporting them. An example is 'Thou shalt not steal' one of the Ten Commandments in the Bible. In some cases the contingency is immediately related to the rule and reinforces it. In others it is not apparent and so we develop other rules and contingencies to drive the desired behaviour.

To explain rules to support desired behaviour consider the rule on a construction site requiring that all workers wear hard hats. The immediate contingency associated with not wearing a hard hat is injury when struck by a falling object. But because this is not a common event secondary reinforcement is needed. So a rule is made that failure to wear a hard hat will result in immediate disciplinary action and possible dismissal. Similar approaches are used to reinforce behaviours that 'are for the good of others' and not simply of self interest.

Skinner goes on to explain that where a person does not develop a value system in the way most people do, it may result in significantly different behaviour. What Skinner says is that values are a form of social control on the individual. Where these are evaded the individual may ask "Why should I behave for the good of others" and express other such sentiments. Skinner points out that if a person overcomes the contingencies that induce behaviour 'for the good of others' the only remaining contingencies are personal reinforcers, and the individual turns to immediate gratification. This state is described as 'valueless' (As in lacking externally derived values) and symptoms may include use of drugs.

When valueless situations are identified, controls are re-actively strengthened by sharpening the reinforcers. For instance laziness can be overcome by paying people more, crime reduced through stronger law enforcement. Skinner then points out that such action may succeed but does not address the root cause of the behaviour. The underlying problem is that organised control 'for the good of others' will continue to compete with personal reinforcers, and different kinds of organised control with one another.

20.4 DIFFERENT VALUE SYSTEMS

Having established that values come from the group around the individual, it is useful here to look at one description of different group values systems. It deals with the decision making process.

The problem is one of getting people over 'there' to do things the 'way we do things around here'. Methods used to attempt this include the appointment of appropriate staff to command the 'outpost', another is to try to change values. Neither method has been particularly successful. Belbin identifies four distinct types of culture; Authoritarian, Kinship, Consensus and Bribe cultures. All, he says, are resistant to foreign influence.

Belbin goes on to say that the Organisation itself can override the values of its members. An organisation can destroy the ideals which created a following in the first place. Alternatively a well designed organisation can foster new working values that have a positive effect on behaviour. In short each person holds a set of values derived from their family and personal life, the society they have grown up in, and the working environment around them. These value systems are not necessarily aligned with one another.

20.5 EVOLUTION OF VALUES IN ORGANISATIONS

Within organisations certain rules of behaviour evolve over time as the leaders of the organisation decide on solutions to certain problem types and these solutions work. Over a period of time these decisions become an underlying assumption behind subsequent decisions. As an example, in the engineering field, "it would be inconceivable to deliberately design something that is unsafe; it is a taken-for-granted assumption that things should be safe".

These basic assumptions are very difficult to change. When something new arises that challenges these and people are forced to re-examine their basic assumptions they experience large amounts of anxiety. Instead of tolerating the anxiety levels people try to perceive the events around them as congruent with the assumptions to the extent of distorting their view of what is going on around them. In other words they may deny the validity of new date bearing on the particular issue or problem. A further result of the presence of these basic assumptions is that individuals who do not strongly subscribe to them within the group risk being ejected from the group.

Conclusions on Values

1) The main points that have emerged areValues are learned from the group we are part of, they may differ between different groups
2) Values are a form of control of individual behaviour
3) Group values reinforce actions taken for 'the good of others' and compete with values of immediate self interest

20.6 DECISIONS IN ORGANISATIONS

Herbert Simon tells us that decisions are a description of a future state of affairs that may be true or false, but essentially seek to be based on facts. However because decisions involve choices they unavoidably have an ethical component. To illustrate this point consider a local authority decision to build a new recreational park. They have an aim in doing this that may be to improve public health or wellbeing, for instance. The

factual part of the decision is that a new park will facilitate better health or wellbeing. The ethical dimension is in the word better, what and how does one decide if something is 'better'?

The factual part of the decision may not turn out to be true. In terms of decision making the 'fact' may be something that has to be proved and might eventually turn out to be untrue in the final analysis. However for the decision maker it remains the fact and the quantitative goal of the decision. The fact is that a park will probably result in healthier people. The decision maker has a goal of improving the physical health of the population and this is a reasonable way of achieving it.

The ethical dimension is the decision to devote city resources to building the park.

To evaluate this aspect of the decision rationally, Simon tells us 'the values taken as organisational objectives must be definite, so that their degree of realisation in any situation can be assessed, and it must be possible to form judgments as to the probability that particular actions will implement these objectives'.

It is possible to validate the factual aspect of the decision by evaluating the degree to which it agrees with observed results (the facts themselves), the value dimension cannot be so evaluated, and its validity is a matter of human direction. In this example the fact is that a recreation facility may give rise to better wellbeing and health, the ethical aspect comes from the organisation goal stating that improving public health is something that ought to be done. The ethical aspect is thus sometimes not apparent in the actual decision making process because it is driving the decision at a systemic level. This point is perhaps clarified through the example of the Space Shuttle Main Engine Development Project. The budget constraints placed on the Shuttle program caused a re-think on how the engineering development was to be undertaken. In particular, the testing of parts and sub assemblies in new technology development presented a cost challenge. There were two testing philosophies within the aerospace community at that time, 'all-up' was one and 'component' was the second. All-up testing is a top down method that requires an entire system to be built and then tested as a whole. This is an 'all or nothing' approach to testing. Either the entire design works or it fails. Its advantage is that it is possible to produce a finished system in relatively short time frames compared to alternative ways of doing things.

All-up testing was a low cost approach that had evolved within the Department of Defence (DoD) establishment. The systems engineers in the DoD were accustomed to building large scale complex technical systems under conditions where there was a trade off between cost and reliability. The kinds of systems they built were unmanned missiles and early warning radar systems. Test flights were conducted on firing ranges and if the device failed and was lost no human lives were endangered.

The component testing approach is bottom up, each part and the material it is made of is specified and tested, then the sub assemblies are tested and re-designed if need be. Parallel development of alternative designs takes place to address risks of one line of development reaching a 'dead end'. This approach offers lower cost re-design of the final product but it is an expensive and time consuming approach. This is the more common approach in aviation, it provides greater chance of success at the test flight stage where the life of a test pilot is at risk.

The component testing philosophy arose from the German rocket team (under Werner von Braun) and also the flight test engineers who were civil organisations. These two groups built systems that flew with a human payload and so reliability was of paramount importance. Because of the budget constraints placed on NASA by Congress a senior level decision was made to adopt the lower cost 'all-up' approach to testing. Note that the value system of the engineers who had developed this approach did not include concern for safety to the same extent as the latter group who built manned vehicles. What this top level decision meant for the engineers on the project was that each engineer in the organisation had to make judgmental decisions about the suitability of components, without the freedom to test the component in the traditional engineering fashion. This was an organisation constraint placed on the freedom of each engineer to perform their job.

20.7 PROFESSIONS – A GUIDE TO CODES OF ETHICS

A profession is an occupation requiring advanced education, training and involving intellectual skills.11 Examples are doctors, lawyers and engineers. Professionals provide a service to the population as a whole but the average recipient of that service has little opportunity to judge the qualifications of the professional.

Users of professional services therefore rely on professional membership as a way of determining qualification for the work to be done.

The question of trust arises here.12 There are two types of trust questions that are relevant, "Can you do the job?" and 'Will you take care of my interests in a predictable way?". The field of trust is a new development in project management research. All recognised professions have five attributes, these are

1. A unique body of knowledge
2. Standards of entry
3. A code of ethics
4. Service orientation to the profession
5. A sanctioning organization

Ethics is not however one 'compartment' within this framework that can be safely ignored most of the time. The intention of this section is to focus on that compartment; however the purpose of this reader is to show that Ethics is a pervasive factor throughout the entirety of a profession. This theme is elaborated on below.

20.8 PROJECT MANAGEMENT PROFESSION

This section examines each of the five attributes of a profession with reference to PMI, the American professional organisation. There are several other organisations that also promote professionalism in this field however PMI is globally the most widespread and accessible.

As an aside in this discussion, it is noteworthy that the ethics development team have recommended to the board of PMI that the standard be revisited every five years 'for consistency and to adjust to new trends'. Presumably values change with time.

The body of knowledge provides users of the profession with an outline of what they can expect from the professional by way of service. From an ethical viewpoint the professional is a knowledge expert in that profession, they are relied upon in this capacity. To do this the professional must be competent in the knowledge areas of the profession.

Standards of entry provide a route for members of the public to work towards admission to the profession. In the case of PMI this standard is demonstrated through the successful completion of the Project Management Professional (PMP) exam. It should be noted by aspirants that this is not a test of knowledge about the content of the body of knowledge text, 'A Guide to the Project Management Body of Knowledge', but a test of the knowledge areas outlined within that text.

The PMI code of ethics (October 2006 version) is reproduced in the appendix of this reader. Relating to this paper is the observation that the code is based on a set of values and these four values; Responsibility, Respect, Fairness, and Honesty are the four major headings of the code PMI encourages a service orientation through its requirement for ongoing professional development. To retain the PMP status holders have to submit evidence of professional development, this can take the form of attendance or delivery of training, writing of articles, or devoting voluntary service to the community, and particularly to promoting the profession to the public.

The purpose of ethical standards is to make explicit appropriate behaviour and provide a basis for self policing of unethical behaviour. This activity is performed through the use of sanction by a professional body. PMI have such a mechanism for reporting and conducting hearings on unethical conduct.

20.9 A CODE OF ETHICS ROLE

Hopefully the above explanation of its role, with the abbreviated example from PMI in the appendix gives readers some idea of how important the code of ethics of a profession is.

Codes present the moral responsibilities of professionals and as such stress not only the responsibilities of its members but the freedom to exercise those responsibilities. Eight roles are fulfilled by a code of ethics

1. Serving and protecting the public

2. Providing guidance
3. Offering inspiration
4. Establishing shared standards
5. Supporting responsible professionals
6. Contributing to education
7. Deterring wrongdoing
8. Strengthening a professions image

Codes are not a substitute for individual responsibility, but they are a framework for dialog about moral issues and cast a light on the dilemmas confronting engineers and project managers.14 The code of ethics of a profession is derived from ordinary morality relating to how to serve the public good.

20.10 KEY PRINCIPLES IN ETHICS CODES

This section relates particularly to engineering and technology project managers. There are three key elements summarised in the statement 'professionals are competent, responsible, and strive to avoid potential for harm and opt for doing good. Competency means having enough knowledge about the subject and the task and technology to perform and also know what areas are not known or understood. So competency includes knowledge and acknowledgement of ones limits. An incompetent may still 'do' the same things but without being fully informed of what they should be doing(Such a case of incompetence may be intentional or unintentional)

Professional responsibility is to communicate what one knows, not to communicate is to is to abdicate ones proper and unique role. This means that the professional has to take part in the organisation decision making process and by so doing, through the use of expert power, become responsible for those decisions.

The final element, to do no harm, relates to safety and more recently the natural environment. This places the onus on the professional to identify and articulate the risks involved in and arising from what is being undertaken. The communication of that knowledge should take place in the decision making process. To remain silent about risks or worrisome data relating to risks is an abdication of ones role as a knowledge expert inside an organisation.

20.11 OBLIGATIONS AND ORGANISATIONS

The question now arises for professionals, to whom do they owe their loyalties, their employer or the profession that defines their role and standing in society. Loyalty can mean two things, 'Agency' loyalty and 'attitude' loyalty. Agency loyalty is acting to fulfil ones contractual duties to an employer. Attitude loyalty is defined by emotions, attitude and ones sense of personal identity.

Where a professional code of ethics, asserts that the members must place priority on the interests of their employer or client, is this the overriding 'value'. In the case of engineers there is an overriding obligation to 'hold paramount the safety, health, and welfare of the public', this probably applies to other technical professionals as well.

The subject of rights is a large one. Here two will be highlighted in the context of the professional at work. The first right is to the provision by ones employer of the freedom to perform ones duties as one sees fit. This has two aspects; freedom from interference and second the provision of suitable facilities and equipment. The second right is the right of conscientious refusal, that is the right to refuse to engage in unethical behaviour. Here there is scope for conflict between this right and the obligations to ones employer. Such situations can arise where there is no agreement that a project or procedure is unethical. It is universally agreed that in cases where payment of bribes for instance, or falsifying documents, is concerned one has a right to refuse. But some situations, involving safety or the environment for example, are less clear cut. In these latter cases some degree of judgment is needed.

20.12 ETHICS AND MODERN ORGANISATIONS

The working decisions made by project and technical professionals are mainly within the context of organisations of which they are a part. As a result the goals and the internal environment of the organisation

impact directly on decision making. As Simon makes clear "The individual can be rational in term of the organisations goals only to the extent that he is able to pursue a certain course of action, and is correctly informed about the conditions surrounding his actions. Within the boundaries laid down by these factors his choices are rational, - goal-oriented" Simon previously states "The task of administration is to so design this environment that the individual will approach as close as practicable to rationality (Judged in terms of the organisation's goals) in his decisions".

Simon also makes the important point that decisions made in modern organisations are rarely attributable to one person. The process can in fact be quite complex. Consider a large technical system. The needs are specified by the senior representatives of the user community. The solution framework is then sketched out by an architect, (A generalist of some sort), once this is agreed to any number of specialists apply their minds to more detailed design of each component. These then have to be reviewed and integrated into the whole. The final design is agreed with the user group, budgets are set and work begins, along with a whole new set of technical decisions.

The point being made here is that each professional applies his or her mind to the problems that they are an expert about. Their solution space is constrained by the opinions of other experts of different areas that have a bearing on their own domain. The decisions become sub-optimal trade-off choices, what is most practical, or flexible, or meets the situation as understood by the decision maker. As mentioned in section 3.3 above, each professional has a duty to ensure they have communicated to other professionals what they know to be pertinent. This duty can only be completely performed if the organisation and its processes are designed to allow it.

The burden of ethical decision making is therefore in part contingent on the organisation and its design. Returning to Pinkus et al 21, the organisation has to ensure that the collective body of knowledge of all its professionals contain the requisite knowledge to undertake the work of the organisation. The organisation has to be competent in all the requisite knowledge areas.

On top of competence the organisation must also exhibit responsibility. 22 That is the organisation must listen to and consider reported concerns. Finally there is the matter of doing no harm. 23 Individual technologists cannot comprehend the totality of risks inherent in a modern technical system. Only an organisational level analysis of risk can do this. From this viewpoint it is the organisation that has an obligation to assess the risks and take action where appropriate to reduce them. By contrast an un-ethical organisation fails to assess risks or ignores the potential for harm.

20.13 GENERAL ETHICAL PROBLEMS IN THE PROJECT MANAGEMENT

The main ethical issues that might be approached into a project management are

- **Fraud in science:** the deliberated action of fabrication, falsification, plagiarism or illicit alienation of the scientific research;
- **Data fabrication:** registration and data presentation from imagination that are not obtained by using research methods;
- **Falsification:** falsify the research materials, equipment, processes or results; data or results omission of the kind to misinterpret the research results;
- **Plagiarism:** ideas, methods, procedures, technology, results and papers belonging to other person appropriation, indifferent of the way that have been obtained, presented as personal creation;
- **Conflict of interests:** situation of incompatibility in which a person is having a personal interest that influences the impartiality and the objectivity of its activities in evaluation,monitoring, realisation and reporting the research and development activities.
- In addition, in any project approach the project manager has to provide all required information to the research team before the project starts.

In the same way that the professional has a duty to be competent, responsible and do no harm, organisations also have to meet these criteria to be ethical. In addition the organisation has to ensure that professional staff within its ranks is able to make appropriate decisions with access to appropriate information.

20.14 CODE OF ETHICS

These obligations are based on moral principles and procedures gathered in the Code of ethics and professional deontology of the research-development personnel (www.legestart.ro/). According to the law the right behaviour in the research and development excludes:

- Hiding or eliminating the unwanted results;
- Fabrication of results;
- Replacing the results with fictitious data;
- Deliberated distorted interpretation of the results and conclusions deformation;
- Plagiarism of the results or other authors publications;
- Deliberated distorted results of other authors;
- Unfair attribution of the paternity of a paper;
- Introduction of false information in the applications for grants;
- Hiding conflict of interests;
- Research funds embezzlement;
- Poor data storage and retention;
- Lack of information of research team before project start up regarding salary wrights,
- Responsibility, co-authors, intellectual wrights on the research results, financing sources andassociations;
- Lack of objectivity in evaluation and inobservance of confidentiality conditions;
- The repeated publication or financing of the same results as scientific news.

The Code of Ethics for Engineers (http://www.niee.org/) specifies that it is required honesty, equity, impartiality and dedication to health protection, safety and public welfare to any researcher. In the USA, the dishonesty issues practiced by the researchers are usually found in seven areas: plagiarism, fabrication and falsification, nonpublication of data, faulty datagathering procedures, poor data storage and retention, misleading authorship, and sneaky publication practices. „Three frames of reference for engineering ethics are discussed—individual, professional and social—which can be further broken down into "microethics" concerned with individuals and the internal relations of the engineering profession and "macroethics" referring to the collective social responsibility of the engineering profession and to societal decisions about technology"

Several cases of dishonesty could be listed in every research centre or university and most of them are found in the students' research papers. They probably have not studied the ethical principles and behaviour rules.

20.15. SELF ASSESSMENT QUESTIONS

1. Define Value system? Explain the values prevailing in the modern organisations?
2. Discuss the role of Code of Ethic in the Project Management?
3. Explain the General ethical problems and how to manage these problems in the Project Management .Discuss?

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Sample Case studies

CASE STUDY - 1

Rapid prototyping has been a constant growing and evolving fi eld since the late1980s. As technology improved, so did the opportunities in new markets. Theidea quickly evolved from its grassroots beginning to many smallcompaniescompeting for a bigger share of the growing market.Frank Billings was just another name in what was at that time a niche market.As a student in engineering school, he followed the development of the newprototyping techniques and realized their potential in the marketplace. His dreamjob was to work for a rapid prototype equipment manufacturer. There were onlya few start - up companies in rapid prototypemachinedevelopment, however, andnone could pay the average engineer wage.Like most engineering school graduates overloaded with school loans, hecouldn ' t wait for his dream job to come along, so he went for a job at CocableCompany. Cocable designed and manufactured specialty cable and cable - relatedproducts. It had nothing to do with rapid prototyping, but it paid well.He worked hard at Cocable and earned enough to pay down his debts. Heproved to be an excellent engineer, earning a great reputation at Cocable andmaking many contacts along the way. In those three years at Cocable, however,he never stopped thinking about rapid prototype machines. He spent his free timecoming up with a rapid prototype machine design, always dreaming of having hisown company. Three years in, he was ready. He quit Cocable and started his ownrapid prototype (RP) design business. Heperfected his own RP machine designand was ready to prove himself in the growing field.

Like every start - up business in a new fi eld, fi nding customers is tough. In the RPfi eld, there are two types of work. The fi rst includes owning an RP machine anddoing prototypes per order. The second is selling RP machines to businesses thatwant the machine to do in - house RP. The latter option is far more profi table sincethe machines are more expensive than each prototype they produce. Frank wouldhave been happy with either type of business, since at the time, he wasn ' t doingmuch business at all.All those years making contacts at Cocable Company proved to be worth thetime and effort. He had stayed in touch with these contacts and through them washappy to learn thaCocable had just been hired by GE to design and manufacturecable installations on their newest jet engine. Part of the wiring installation thatCocable had been hired to design included junction boxes and switch covers.The installation would be no simple task as these " boxes " are made of specialtymaterials with complex shapes and multiple designs, all needed for application.They had to be perfect from the start since airplane engines have no room forerror. This was a huge job and the timeline was tight. Rapid prototypes were anabsolute necessity for this job. Frank ' s knowledge of Cocable ' s needs made himperfect for the RP job. Cocable wanted full access to rapid prototyping so theydecided to contract Frank to custom build four RP machines to their specifications.Frank could not be happier. The RP machine specs were given to Frank and he went to work.

After three months of all - night work sessions, the machines were built to specification and ready for delivery toCocable. Frank ' s daring steps into a new fi eldwere fully rewarded, he thought.Everyone was ready for a test run, after the first machine was delivered toCocable. The CAD model was loaded and it was time to hit the " Start " button.Beep, beep, beep." That ' s not good, " said Frank.He felt embarrassed that the machine failed in front of everyone. He was sure themachine ran fi ne before it was delivered. He couldn ' t allow his fi rst major deal tofail in any way.The machine was checked over for shipping damages. The connections weredouble - checked. Everything appeared intact.Frank sat down to review the CAD model and discovered the problem. Themodel was 62 inches long. This was an issue, considering the RP machines weredesigned for a maximum of 55 inches.The original Cocable specs for Frank ' s RP machines were for a maximumlength of 48 inches. Frank optimized his machines for a length of 48 inches, butto be on the safe side, the machines were capable of 55 - inch designs.

Sixty - twoinches went outside that range. A machine that could make prototypes that longwould require completely different processors, actuators, and adhesion processes.This would be a major redesign of the RP machines. This would take time and a lot of money.Cocable claims that the original specs for a maximum of 48 inches camefrom GE. GE claims that it never gave Cocable a maximum length. The firstdesign that GE requested from Cocable was 62 inches long and that had beenweeks before. Cocable should have double - checked their RP specs.Nobody wants to take the blame for specifying the prototype design sizes andFrank ' s first major product is now going nowhere. Everyone is dissatisfied and twothings are for sure: (1) The entire project is running late, and (2) it will be way overbudget.

DISCUSSION ITEMS

6. What have you learned about the issue in the case?
7. Who do you think should pay for the changes?
8. What could have been done to make sure that the project scope was correct?

CASE STUDY - 2

Mike Bitka, one of the three owners of BC Company, and George Slicker, thecompany CEO, met on a regular basis to discuss the company business. Usuallyvery calm, Mike was nervous at this recent meeting.Mike: I had a chance to talk to the other owners of the company last week aboutthe Court House project, the one that was recently closed. They wanted me todiscuss it with you so that we could improve our Best Known Methods (BKM)to prevent any similar disaster in the future. For the beginning, let me say thattwo months before the ending of the Court House project, we estimated to loseapproximately $ 500,000 on a $ 1.5 million project. So from your point of view,what do you see as being the mistakes we should never repeat again?George: I will be very brief. First, the major mistake was to hire Pete Tramp as themanager. He didn ' t have much experience in managing projects. Becausethe job market was very tight we hired him to estimate the Court House project.He did the bid and got the job. Apparently, the bid estimate was below the costof that project, and I have to admit that Steve Johnson of E - contractors, anotherbidder, warned me that our bid was very low. But, I did not react.Mike: Did anybody in the company check Pete ' s estimate?George: No. According to our BKM, our estimating department should haveverifi ed Pete ' s estimate. But, they were too busy working on another twoprojects and did not have time to verify his estimate.Mike: Couldn ' t our estimators rearrange their work schedule to make time toverify this important estimate?George: I can ' t say for sure, I only can assume. But if our estimators wantedto have this project ' s estimate verifi ed, they could ' ve applied a method welearned in a project for Intel. It is called " shadow estimating. " When you wantto verify an estimate for a project, you hire anestimating consultant, ask him todevelop an estimate for the project, but don ' t show him the estimate beingverifi ed. Of course, the consultant ' s estimate is assumed to be accurate. Then,the two estimates are compared, and if the difference is zero or close, the estimatebeing verifi ed is considered good. The larger the difference, the weakerthe estimate being verifi ed. The downside is that you have to pay the consultant.

DISCUSSION ITEMS

1. How would you rearrange the work of the BC Company ' s estimating department to make it possible for the department to verify Pete ' s bid estimate?
2. What are the pros and cons of the shadow estimating approach?
3. How could the earned value reporting have helped detect problems with the estimate of the Court House project earlier?
4. How could the periodic project audits, if the BC Company used them, have helped detect the estimate problem in the Court House project earlier?
5. If you were in charge in BC Company, would you consider hiring a professional estimating company to develop a bid estimate for this project?

CASE STUDY - 3

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ABOUT THE BOOK

The book Project Management is designed to meet the requirements of Management and Engineering students of various universities across the country. In keeping with the increasing focus on creating and growing a new venture, the understanding of the process of developing and operating new projects. The book has been developed to provide an in depth knowledge of the project planning, scheduling and project evaluation as a mechanism for creating new projects and affecting national economy.

The book is presented in a simple and lucid language to enable easy understanding. This text book is being supported by illustrative examples in addition, end of every chapter exercises including review questions will help the readers to test their knowledge pertaining to the particular chapter.

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