

INTRODUCTION TO PROJECT MANAGEMENT

Broad Contents

- Management
- Key management concepts
- Functions of management
- Comparison of 20th and 21st century organizations

1.1 What is Management?

Managing is an art of getting things done through and with people in formally organized groups.

Management is the process of designing and maintaining an environment in which individuals, working together in groups, efficiently accomplish selected aims towards any project. It is the art of creating an environment in which people can perform as individuals and yet cooperate towards the attainment of group goals.

1.1.1 Management as a Process:

According to this, management is the process of using organizational resources to achieve the organization's goals through **planning, organizing, leading, and controlling**. It is thus, a set of activities directed at an organization's resources with the aim of achieving organizational goals in an **efficient** and **effective** manner.

1.1.2 Management as People:

This refers to a group of people who engage in "Process of Management".

1.2 Key Management Concepts:

- **Project Organization:** It comprises of people working together and coordinating their actions to achieve specific goals.
- **Goal:** A desired future condition that the organization seeks to achieve.
- **Resource:** An asset, competency, process, skill, or knowledge controlled by organization.

Various types of resources that an organization possesses are as follows:

- People
- Information
- Machinery
- Financial capital
- Raw Materials

A resource is strength, if it provides an organization with a competitive advantage. On the contrary, a resource is a weakness; if it is something the organization does poorly or does not have capacity to do. Organizational resources include: Human, Physical, Financial, Technological, and Information.

1.3 Evolution of Management Concept in Modern Era:

- a) **Frederick Taylor – Father of Scientific Management** was a Mechanical Engineer. He invented high speed steel cutting tools. He got the opportunity to know first hand problems and attitudes of the workers. Based on these he identified that in order to improve the quality of management, the major concern was to *increase efficiency in production, lower cost, raise profits through higher productivity, and also increase the pays/salaries of the workforce.*

His message of management was to give people their best opportunities to be productive, and in turn reward workers for their individual productivity. This increase in labor productivity is not possible without the following:

- Providing ample rewards
- Adequate trainings
- Continuous managerial support

Thus, Fredrick Taylor concluded that *“low productivity in any project is matter of ignorance on part of labor and management”*.

- b) **Henry L. Gantt** stressed the importance of *“developing understanding of systems both for labor as well as management.”* He emphasized that in all problems of management, human element is the most important one.

Gantt gave graphic methods of describing project plans in order to have better managerial control. He highlighted the importance of time and cost in planning and controlling projects. He made the famous **Gantt chart** which is the forerunner of PERT.

1.4 Key Aspects of the Management Process:

The key aspects of the Management Process can be explained with the help of the following diagram:

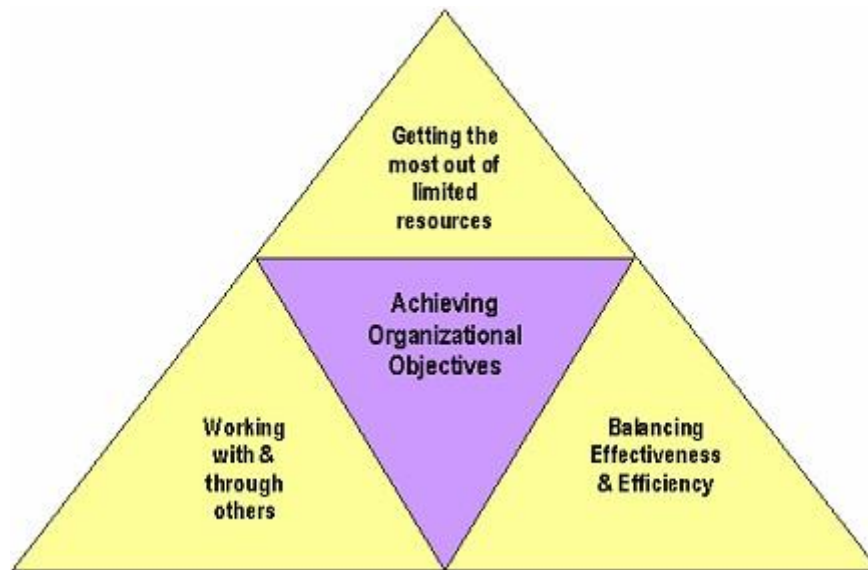


Figure 1.1: Management Process Aspects

1.5 Functions of Management:

The process of management consists of four basic managerial functions. These are:

a) **Planning:**

Planning is the process of setting objectives in any project and then determining what should be done to accomplish them. It is a capstone activity of management. Managers at every level do planning. Planning activities determine an organization's objective and based on these helps it in establishing appropriate strategies for achieving them. These strategies provide the organization with the direction and serves to obtain a match between the external environment and internal capabilities. The strategies are intended to achieve a sustained competitive advantage over the competitors.

b) Organizing:

Organizing is the process of assigning tasks, allocating resources, and arranging coordinated activities to implement plans. It involves establishing intentional structure of roles for people to fill in organizations.

c) Leading:

Leading is the process of arousing enthusiasm and directing human resource efforts toward project and organizational goals. It involves influencing people so that they contribute towards organizational and group goals. Leadership predominantly is concerned with the interpersonal aspect of managing.

In projects most important problems arise from people in terms of their desires, attitudes, and behavior (as individuals as well as in groups). Thus, effective project managers also need to be effective leaders.

Leadership implies follower-ship and people tend to follow those who offer means of satisfying their own needs, wishes, and desires.

d) Controlling

Controlling is the process of measuring performance and taking actions to ensure desired results in any project. It involves measuring and correcting individual as well as organizational performance to ensure that events conform to plans.

Controlling facilitates accomplishment of plans. There are three basic elements that are involved in controlling. These are:

1. Management should establish standards of performance.
2. Performance should be assessed periodically and information should be updated that indicates deviation between actual versus the established standards.
3. Actions should be taken to correct performance that does not conform to the standards.

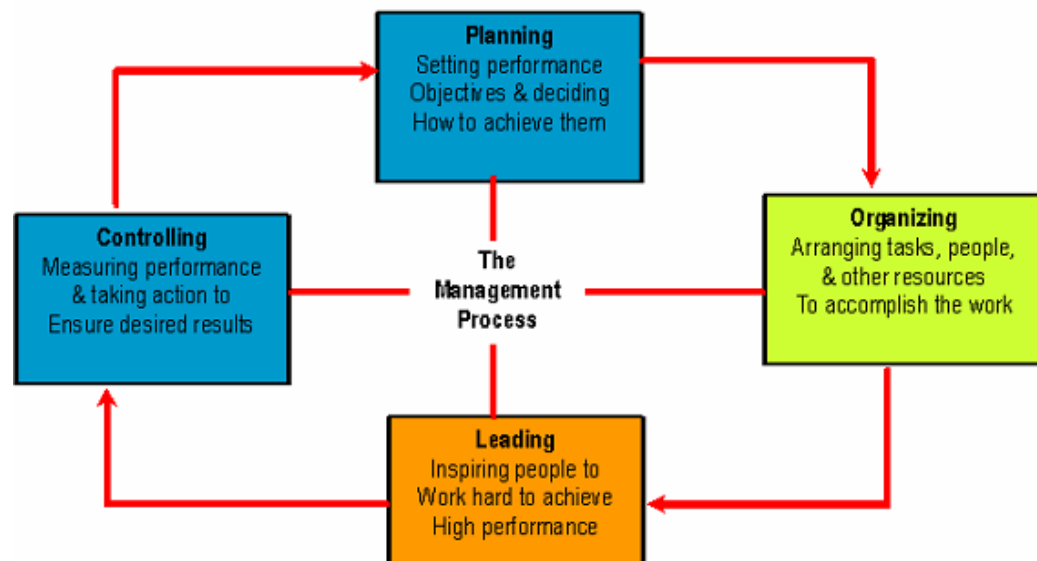
1.6 Management Functions: Planning, Organizing, Leading & Controlling:

Figure 1.2: Management Functions

1.7 Managerial Functions in Organizations Undertaking Projects:

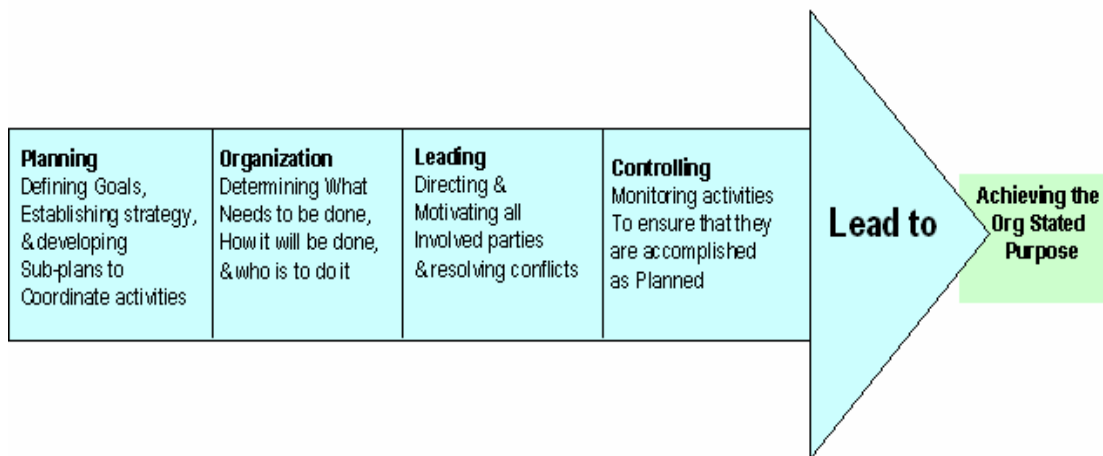


Figure 1.3: Managerial Functions

Organizations are arranged in ways that try to maximize *synergy*, i.e. *the ability of the whole to equal more than the sum of its parts*. This means that an organization ought to be able to achieve its goals more effectively and efficiently than would be possible if the parts operated separately. Organizations comprise of various levels. These are depicted in the following figure:



Figure 1.4: Various organizational levels



Figure 1.5: A model for organizational environment

1.8 Comparison of 20th And 21st Century Organizations:

20 th Century Organizations	21 st Century Organizations
<u>Structure</u> • Bureaucratic • Multi-leveled • Organized with the expectation that senior management will manage • Characterized by policies and procedures that create many complicated internal interdependencies	<u>Structure</u> • Not bureaucratic, with fewer rules and employees • Limited to fewer levels • Organized with the expectation that management will lead, and lower-level employees will manage. • Characterized by policies and procedures that produce the minimal internal interdependence needed to serve customers.
<u>Systems</u> • Depend on few performance information systems. • Distribute performance data to executives only • Offer management training and support systems to senior people only	<u>Systems</u> • Depend on many performance information system, providing data on customers especially • Distribute performance data widely • Offer management training and support systems to many people
<u>Culture</u> • Inwardly focused • Centralized • Slow to make decisions • Political • Risk averse	<u>Culture</u> • Externally oriented • Empowering • Quick to make decisions • Open and candid • More risk tolerant

1.9 Economic And Social Forces Driving Need For Major Changes in Organizations:

This is illustrated in the following figure:

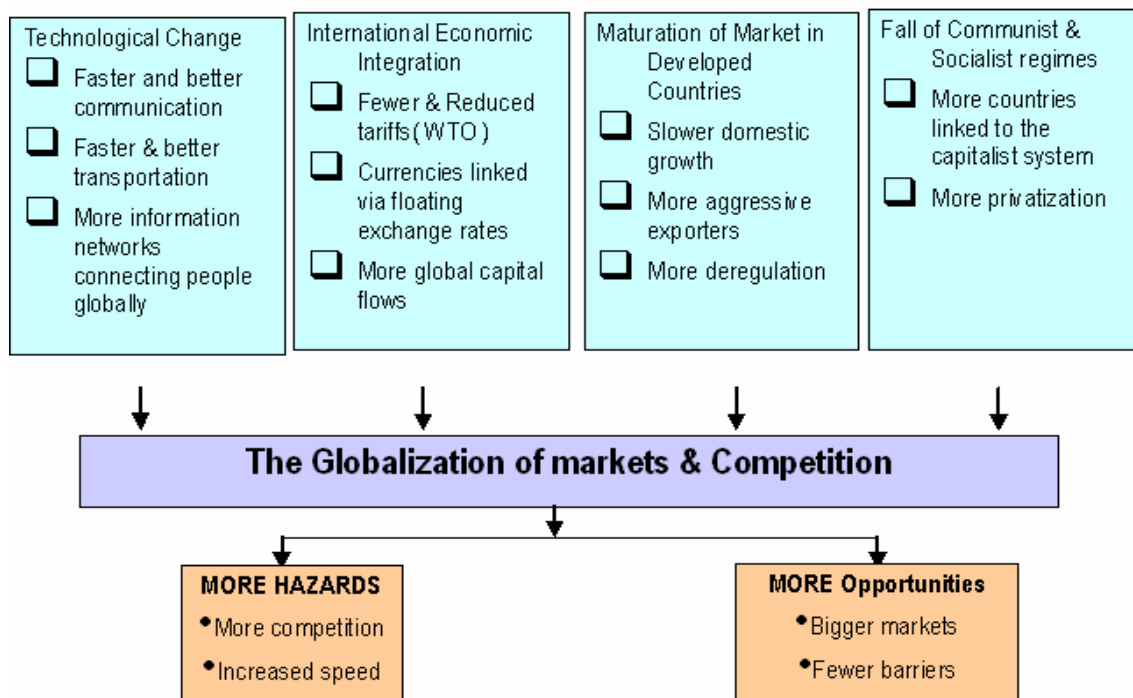


Figure 1.6: Economic and Social changes driving change

In order to have large scale changes in organizations, there are some distinctive transformation processes. These are as follows:

- Reengineering
- Restructuring
- Quality programs
- Mergers and acquisitions
- Strategic changes
- Cultural changes

1.10 Paradigm Shifts:

From

Industrial Society
Forced Technology
National Economy
Short Term
Centralization
Institutional Help
Representative Democracy Hierarchies
North
Either/OR

To

Information Society
High Tech/High Touch
World Economy
Long Term
Decentralization
Self-Help
Participatory Democracy
South
Multiple Option

CONCEPTS, DEFINITIONS AND NATURE OF PROJECTS

Broad Contents

What is a project?
Why projects?
Attributes of a project
Characteristics of projects
Project environment
Project participants
Projects and strategic planning
Examples of projects
Project types

2.1 What is a Project?

J. M. Juran defined that “*a project is a problem scheduled for solution.*” Problem refers to the gap between where you are and where you want to be, with an obstacle that prevents easy movement to close the gap.

Projects are a group of activities that have to be performed with limited resources to yield specific objectives, in a specific time, and in a specific locality. Thus, **a project is a temporary endeavour employed to create a unique product, service or results.** Projects are an investment on which resources are used to create assets that will produce benefits over an expanded period of time. It is a unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of *time, cost and resources*.

2.1.1 Short Range Projects:

They are completed within one year, and are focused towards achieving the tactical objectives. They are less rigorous; require less or no risk. They are not cross functional. These projects require limited Project Management tools, and have low level of sophistication. It is easy to obtain approval, funding and organizational support for short range projects. For example, reduce defect in shop number two from 6 to 4 percent.

2.1.2 Long Range Projects:

These projects involve higher risk and a proper feasibility analysis is essential before starting such projects. They are most often cross functional. Their major impact is over long period of time, on internal as well as external organization. Large numbers of resources are required to undertake long range projects and they require breakthrough initiatives from the members.

2.2 Why Projects are initiated?

Projects are initiated in the following scenarios:

- When starting a new business.
- In order to develop/ modify a product or service.
- For relocating and/or closing a facility.
- For regulatory mandate.
- For some community issues.
- In order to re-engineer the process so as to reduce complaints, reduce cycle time, and eliminate errors.
- For implementing a new system or process.
- To introduce new equipment, tools or techniques.

2.3 Attributes of a Project:

Projects focus on a single goal as compared to a program. They have customers who are affected by the end results. They have to be completed within specified time frame (completion date), within budget (limited resources including, people, money, machines) and should be according to the specifications (with a certain level of functionality and quality).

In brief projects are:

- Directed towards achieving a specific result.
- Coordination of undertaking of interrelated activities.
- Of limited duration, a beginning and an end.
- Prone to risks, that is, every project has a certain amount of risk.

2.4 Characteristics of Projects:

- As already mentioned projects are temporary with a definite beginning and a definite end.
- They also have temporary opportunities and temporary teams.
- Projects are terminated when the objectives are achieved, or conversely, if the objectives cannot be met.
- Most of the projects last for several years. However, they have a finite duration.
- They involve multiple resources (human and non-human) and require close coordination.
- They are composed of interdependent activities.
- At the end of the project, a unique product, service or result is created. Some degree of customization is also a characteristic of projects.
- Projects encompass complex activities that are not simple, and may require repetitive acts.
- They also include some connected activities. Some order and sequence is required in project activities. The output from one activity is an input to another.
- Project Management lives in the world of conflict. The management has to compete with functional departments for “resources and personnel”.
- There exists a constant conflict for project resources and for leadership roles in solving project problems.
- In every project, clients want changes, and the parent organization aims at maximization of profits.
- There can be two bosses at a time and that too with different priorities and objectives.

2.5 Project Environment:

All projects are planned and implemented in a social, economic, environmental, political and international context.

- **Cultural and Social Environment** is that how a project affects the people and how they affect the project. This requires understanding of economic, demographic, ethical, ethnic, religious and cultural sensitivity issues.
- **International and Political Environment** refers to the knowledge of international, national, regional or local laws and customs, time zone differences, teleconferencing facilities, level of use of technology, national holidays, travel means and logistic requirements.
- **Physical Environment** is the knowledge about local ecology and physical geography that could affect the project, or be affected by the project.

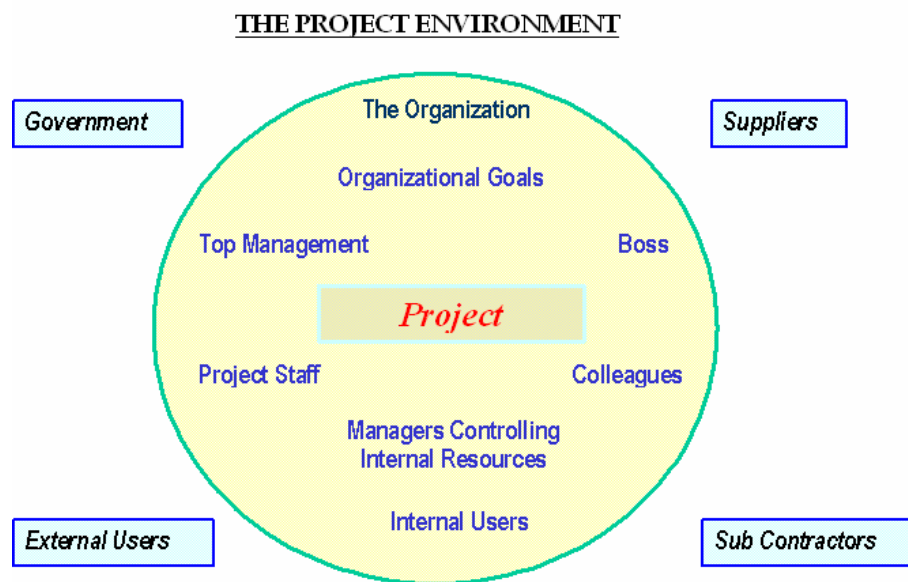


Figure 2.1: Project Environment

2.6 Project Participants:

2.6.1 Stakeholders:

Stakeholders are the ones who have a share, or an interest in an enterprise. Stakeholders in a company may include shareholders, directors, management, suppliers, government, employees, customers, and the community. Stakeholders are influenced by the outcomes and objectives. They have varying level of responsibility and authority. Thus, they should not be ignored. A project manager should try to manage and fulfill the expectations of the stakeholders. There are both positive and negative stakeholders. In some cases, stake holder's roles and responsibilities are overlapping. For example, an engineering firm also provides financing.

Project stakeholders are individuals and organizations that are actively involved in the project, or whose interests may be affected as a result of project execution or project completion. They may also exert influence over the project's objectives and outcomes. The project management team must identify the stakeholders, determine their requirements and expectations, and, to the extent possible, manage their influence in relation to the requirements to ensure a successful project.

As already mentioned, stakeholders have varying levels of responsibility and authority when participating on a project and these can change over the course of the project's life cycle. Their responsibility and authority range from occasional contributions in surveys and focus groups to full project sponsorship, which includes providing financial and political support. Stakeholders who ignore this responsibility can have a damaging impact on the project objectives. Likewise, project managers who ignore stakeholders can expect a damaging impact on project outcomes.

Sometimes, stakeholder identification can be difficult. For example, some would argue that an assembly-line worker, whose future employment depends on the outcome of a new product-design project, is a stakeholder. Failure to identify a key stakeholder can cause major problems for a project.

Stakeholders may have a positive or negative influence on a project. Positive stakeholders are those who would normally benefit from a successful outcome from the project, while negative stakeholders are those who see negative outcomes from the project's success. For example, business leaders from a community that will benefit from an industrial expansion project may be positive stakeholders because they see economic benefit to the community from the project's success. Conversely, environmental groups could be negative stakeholders if they view the project as doing harm to the environment. In the case of positive stakeholders, their interests are best served by helping the project succeed, for example, helping the project obtain the needed permits to proceed. The negative stakeholders' interests would be better served by impeding the project's progress by demanding more extensive environmental reviews. Negative stakeholders are often overlooked by the project team at the risk of failing to bring their projects to a successful end.

2.6.2 Key Stakeholders:

Key stakeholders include the following:

a) Project Manager:

The person, who is responsible for managing the project.

b) Customers, End Users:

The person or organization that will use the project's product. These may be multiple layers of customers. For example, the customer for a new pharmaceutical product can include the doctors who prescribe it, the patient who take it and the insurers who pay for it. In some application areas, customers and user are synonymous, while in others, customer refers to the entity acquiring the project's product and users are those who will directly utilizes the project's product.

c) Performing Organization:

The enterprise whose employees are most directly involved in doing the work of project.

d) Project Management Working on the Project:

The members of the team who are directly involved in project management activities.

e) Project Team Members:

The group that is performing the work of the project. It includes the members who are directly involved in the project activities.

f) Sponsors:

The person or group that provides financial resources, in cash, or kind, for the project.

g) Influencers:

People or groups that are not directly related to the acquisition or use of the project's product, but due to an individual's position in the customer organization or performing organization, can influence, positively or negatively, the course of the project.

h) Project Management Organization:

If it exists in performing organization, the Project Management Organization can be a stakeholder if it has direct responsibility for the outcomes of the project.

2.6.3 Project Stakeholders:

In addition to these key stakeholders, there are many different names and categories of *project stakeholders*, influencing internal or external, owners and investors, sellers and contractors, team members and their families, government agencies and media outlets, individual citizens, temporary or permanent lobbying organizations, and society-at-large. The naming or grouping of stakeholders is primarily an aid to identifying which individuals and organizations view themselves as stakeholders. Project Managers must manage stakeholder expectations, which can be difficult because stakeholders often have very different or conflicting objectives.

For example:

- The manager of a department that has requested a new management information system may desire low cost, the system architect may emphasize technical excellence, and the programming contractor may be most interested in maximizing its profit.
- The vice president of research at an electronics firm may define new product success as state-of-the-art technology, the vice president of manufacturing may define it as world-class practices, and the vice president of marketing may be primarily concerned with the number of new features.
- The owner of a real estate development project may be focused on timely performance, the local governing body may desire to maximize tax revenue, an environmental group may wish to minimize adverse environmental impacts, and nearby residents may hope to relocate the project.

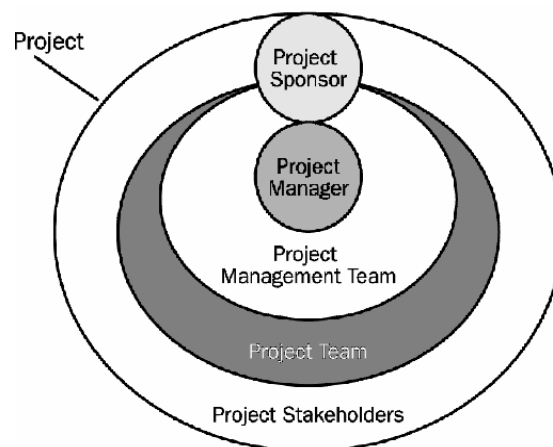


Figure 2.2: Stakeholders and Projects

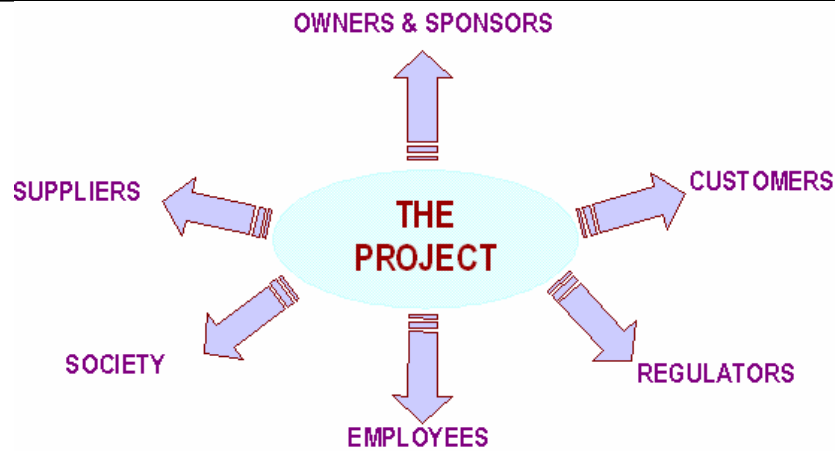


Figure 2.3: Relevant Stakeholders

2.7 Projects and Strategic Planning:

Projects are the means of achieving organization's strategic plans. Following are the strategic considerations that have to be kept in mind while planning for projects:

- The market demand (e.g. a new refinery).
- Organizational needs (e.g. a university offers new courses for revenue generation).
- Customer's requests (e.g. an Internet Service Provider ISP provider lunches DSL).
- Technological demand (e.g. new video games, new cell phones with advance features).
- Legal requirements (e.g. child labor control project, toxic waste disposal center).

2.8 Sub Projects:

Projects are frequently divided into more manageable components or sub projects. Individual sub projects are also a project and are managed as such. They can be sub contracted or out sourced.

2.9 The Triple Constraint of Project Management:

Meeting stakeholder needs and expectations involves balancing competing demands among cost, quality, scope, and time.

$$Q = f(T, C, S)$$

- Where Q is Quality, S is Scope and T is Time.
- Project quality is affected by balancing these three factors.
- Projects fail when:
 - a) Estimates are faulty
 - b) Time, talent and resources are insufficient or incorrectly applied



Figure 2.4: Overview of Project Management

Figure 2.4 is a pictorial representation of project management. The objective of the figure is to show that project management is designed to manage or control company resources on a given activity, within time, within cost, and within performance expectations. Time, cost, and performance are the constraints on the project. If the project is to be accomplished for an outside customer, then the project has a fourth constraint: that is good customer relations.

2.10 Examples of Projects:

- Designing and implementing an auto tax filing system in a revenue collection organization.
- Hosting a web site of your department.
- Executing an environmental clean-up of a contaminated site.
- Holding a University alumni reunion.
- Provision of clean water to Pakistani nation by 2008.
- Developing a new product or service.
- Effecting a change in structure, staffing, or style of an organization.
- Developing or acquiring a new or modified information system.

2.11 Operations and Projects:

Operations are ongoing and repetitive activities conducted by the staff. Some of these include:

- Financial management and control
- Continuous manufacturing
- Product distribution

Projects are temporary and unique, and are performed by teams that have:

- Clearly defined team and individual roles
- Open and effective communication systems
- Visible rewards for good performance, and have constant pressure to improve poor performance

Common Characteristics between operations and projects are as follows:

- They are both performed by people
- They are constrained by limited resources
- Both are planned, executed, and controlled

2.12 Project Types:

Project End Requirements

Project Methods		Well Defined	Poorly Defined
	Well Defined	Type I Construction	Type III Software
	Poorly Defined	Type II Product Development, Space	Type IV OD, Vision, Training Assessment

Figure 2.5: Project Types

- **Type I Projects – Large Engineering Projects:**
They have well defined project methods and end project requirements, such as construction projects.
- **Type II Projects – Product Development Projects, Early Space Projects:**
They have poorly defined project methods but have well defined project end requirements.
- **Type III Projects – Software Development Projects:**
In these, the shape of end product proceeds. They have well defined project methods, but poorly defined project end requirements.
- **Type IV Projects – Organizational Development Projects, Vision Definition, Assessment of Impact of Trainings:**
They have both poorly defined project methods as well as project end requirements.

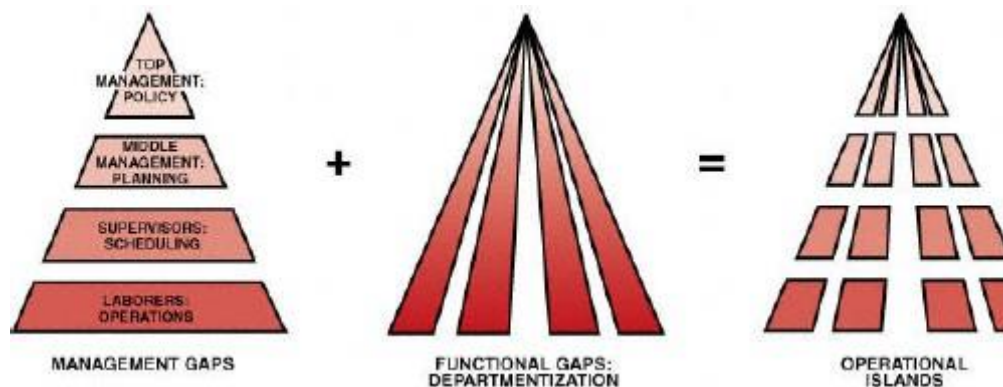


Figure 2.6: Why are systems necessary?

Figure 2.6 shows how many companies are structured. There are always "class or prestige" gaps between various levels of management. There are also functional gaps between working units of the organization. If we superimpose the management gaps on top of the functional gaps, we find that companies are made up of small operational islands that refuse to communicate with one another for fear that giving up information may strengthen their opponents.

The project manager's responsibility is to get these islands to communicate cross-functionally toward common goals and objectives.

Projects fill an essential need in society. Indeed, projects are the major mode in which change is accomplished. It is the mode in which corporate strategy is implemented, business change is

addressed, productive teams and their necessary competencies are dealt with, quality of deliverables, and tracking pre-established metrics for management's decision making, as well as closing out a project and creating lessons learned are performed.

This discipline changes over time but the basic business premise never changes:

Accomplish the right thing right the first time within justifiable time, resources, and budget.
Projects are the means for responding to, if not proactively anticipating, the environment and opportunities of the future.

CONCEPTS OF PROJECT MANAGEMENT

Broad Contents

- Project Management
- *Efficiency* and *effectiveness* in projects
- The project management system
- Project manager

3.1 What is Project Management?

Project Management is the discipline of organizing and managing resources in such a way that these resources deliver all the work required to complete a project within defined scope, time, and cost constraints. It is important to note here that a project is a temporary and one-time endeavor undertaken to create a unique product or service that brings about beneficial change or added value. This property of being a temporary and one-time undertaking contrasts with processes, or operations, which are permanent or semi-permanent ongoing functional work to create the same product or service over and over again. The management of these two systems is often very different and requires varying technical skills and philosophy, hence requiring the development of project management.

Thus, in this regard, the first challenge of project management is ensuring that a project is delivered within the defined constraints. The second, more ambitious, challenge is the optimized allocation and integration of the inputs needed to meet those pre-defined objectives. The project, therefore, is a carefully selected set of activities chosen to use resources (money, people, materials, energy, space, provisions, communication, quality, risks, etc.) in order to meet the objectives established by the organization.

Management in any project is concerned with productivity. This refers to efficiency and effectiveness. These can be explained as follows:

Efficiency: In order to be efficient, management is concerned with minimizing resource costs. Efficiency is “doing things right”.

Effectiveness: In order to be effective, management is concerned with getting activities completed. Effectiveness is “doing right things”.

Thus, efficiency is concerned with means and effectiveness with ends. They are interrelated. It is easier to be effective if one ignores efficiency. For example, some organizations are reasonably effective, but are extremely inefficient. They get their jobs done, but at a very high cost.

For the management of any project, it is important not only to get the activities completed (effectiveness), but also to do so as efficiently as possible. Can organizations be efficient and yet not effective? Yes, by doing wrong things well.

The following figure (figure 3.1) shows management seeking efficiency and effectiveness.

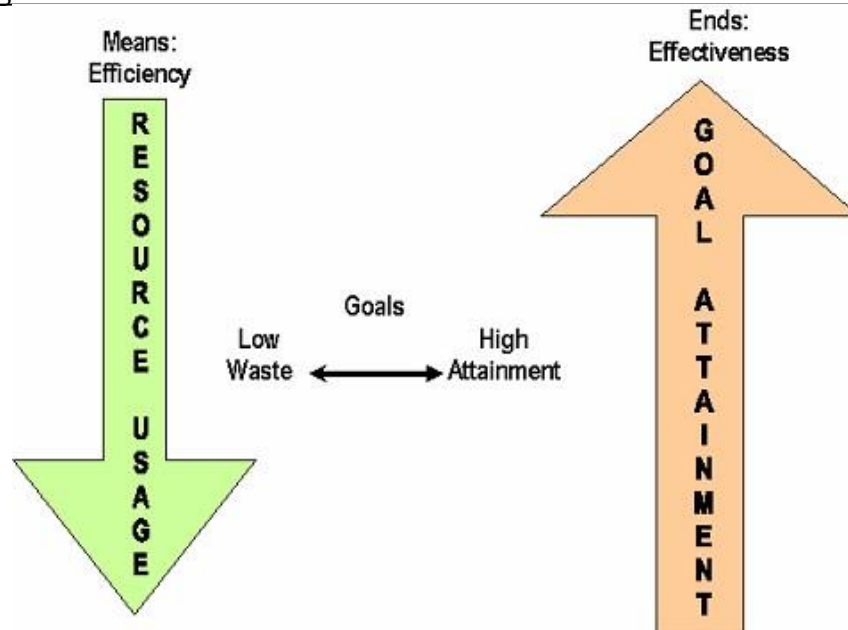


Figure 3.1: Efficiency and Effectiveness

3.2 THE PROJECT MANAGEMENT SYSTEM

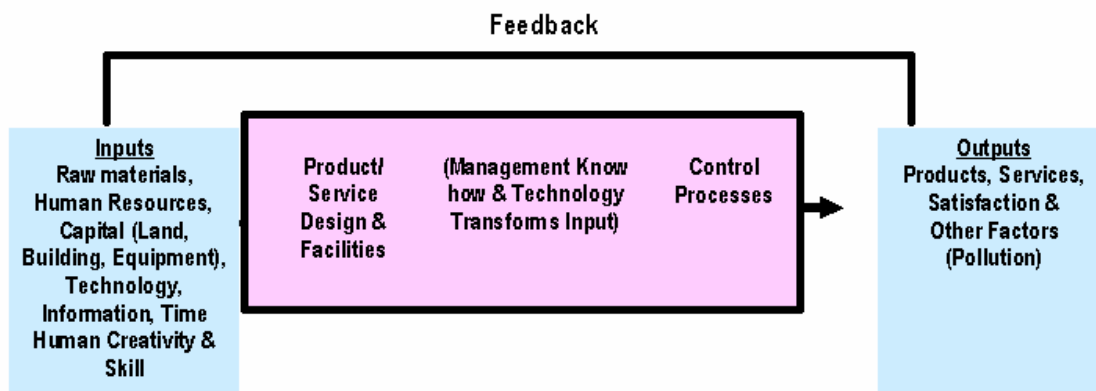


Figure 3.2: Project Management System

Because of the interrelatedness of these driving forces, some people contend that the only true driving force is survival. This is illustrated in Figure 3.3 below. When the company recognizes that survival of the firm is at stake, the implementation of project management becomes easier. The speed by which companies reach some degree of maturity in project management is most often based upon how important they perceive the driving forces to be.

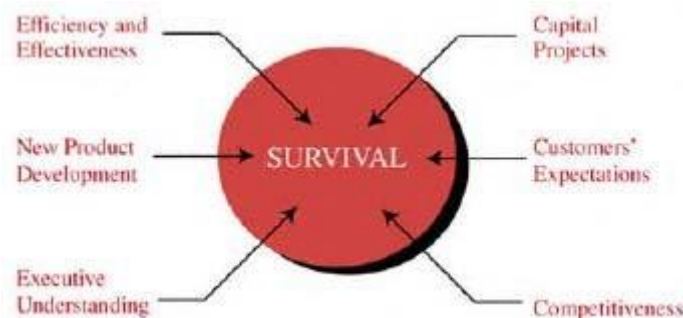


Figure 3.3: Components of survival

3.3 Who is a Project Manager?

A project manager is a professional in the field of project management. They have the responsibility of the planning and execution of any project. A project manager's central duty is to ensure the success of a project by minimizing risk throughout the lifetime of the project. This is done through a variety of methods, both formal and informal. A project manager usually has to ask penetrating questions, detect unstated assumptions, and resolve interpersonal conflicts, as well as use more systematic management skills.

In whatever field, a successful project manager must be able to envisage the entire project from start to finish and should have the ability to ensure that this vision is realized.

3.3.1 Types of Project Managers:

Project managers cannot perform their tasks well unless they have understanding of and are responsive to many elements of the external environment, including; economic, technological social, political and ethical factors that effect their areas of operations. The various types of project managers are follows:

Line managers are responsible for activities making direct contributions to production of organization's basic goods or services.

Staff managers use special technical expertise to advise and support the efforts of line workers.

Functional managers are responsible for only one area of activity, i.e. finance, marketing, production, personnel, accounting, or sales.

General Managers are responsible for complex organizational unit that include many areas of functional activity.

An administrator is someone who administers work in any kind of organization.

3.3.2 Activities of Project Managers:

Following are the four major activities that are undertaken by the project managers:

1. **Traditional management:** This includes decision making, planning, and controlling
2. **Communication:** This refers to exchanging routine information and processing paperwork.
3. **Human Resource Management (HRM):** It involves motivating, disciplining, managing conflict, staffing, and training.
4. **Networking:** It includes socializing, and interacting with outsiders.

An average manager spends:

- 32% of time in traditional management activities
- 29% in communicating
- 20% in HRM activities
- 19% in networking

Today's business environment is moving away from the conventional practices and with this; the role of the Project Managers is also witnessing rapid changes.

3.3.3 Success for Project Managers:

There are three general preconditions for achieving lasting success as Project Manager. These include:

- **Ability (A)**
- **Motivation to manage (M)**
- **Opportunity (O)**

Together, they constitute the basic formula for managerial success (S):

$$S = A \times M \times O$$

3.3.4 Ten Facts of Project Managerial Life:

- i) Project Managers work long hours. Number of hours worked tends to increase as one climbs the managerial ladder.
- ii) Project Managers are busy. Typical manager's day is made up of hundreds of brief incidents or episodes. Activity rates tend to decrease as rank increases.
- iii) Project Manager's work is fragmented. Given managers high activity level, they have little time to devote to any single activity. Interruptions and discontinuity are the rule.
- iv) Project Manager's job is varied. They engage in variety of activities (paperwork, phone calls, scheduled and unscheduled meetings, and inspection tours/visits). They interact with variety of people, and deal with variety of content areas.
- v) Project Managers are "homebodies". They spend most of their time pursuing activities within their own organizations. As managerial rank increases, they spend proportionately more time outside their work areas and organizations.
- vi) Project Manager's work is primarily oral. At all levels, they spend most of the time communicating verbally by personal contacts/ telephone etc.
- vii) Project Managers use a lot of contacts. Consistent with their high level of verbal communication, managers continually exchange information with superiors, peers, subordinates, and outsiders on ongoing basis.
- viii) Project Managers are not reflective planners. Typical manager is too busy to find uninterrupted blocks of time for reflective planning.
- ix) Information is the basic ingredient of Project Manager's work. Managers spend most of their time obtaining, interpreting, and giving information.
- x) Project Managers do not know how they spend their time. Managers consistently overestimate the time they spend on production, reading and writing, phone calls, thinking, and calculating and consistently underestimate time spent on meetings as well as on informal discussions.

3.3.5 Managerial Skills:

A skill is an ability or proficiency in performing a particular task. Skills reflect the ability to translate actions into results. They are of the following types:

- **Technical Skill** is the knowledge of and proficiency in activities involving methods, processes, and procedures.
- **Human Skill** is the ability to work with people; cooperative effort; it is teamwork; feel secure and free to express their opinions.
- **Conceptual Skill** is the ability to see "big picture" in order to recognize significant elements in a situation, and to understand relationships among elements.
- **Design Skill** is the ability to solve problems in ways that will benefit enterprise.

3.4 Tomorrow's Management Today

- Average company will be smaller, employing fewer people.
- Traditional organizational structures will become more team-based and without boundaries.
- Employees will be empowered to make decisions.
- Flatter organizations will be the norm.
- Work will be organized around teams and processes.
- Bases of power will change.
- Knowledge-based organizations will exist.
- Stress will be on vision and values.
- Managers will be change agents.
- Leadership will be more important.

PROJECT MANAGEMENT METHODOLOGIES AND ORGANIZATIONAL STRUCTURES

Broad Contents

Project driven versus non–project driven organizations
Project management methodologies
Systems, programs, and projects
Categories of projects
Product versus Project Management
Maturity and excellence
Informal Project Management
Organizational structures
Selecting the organizational form

4.1 Project driven versus Non – project driven organizations:

On the micro level, virtually all organizations are marketing, engineering, or manufacturing driven. But on the macro level, organizations are either project- or non–project driven. In a project driven organization, such as construction or aerospace, all work is characterized through projects, with each project as a separate cost center having its own profit-and-loss statement. The total profit to the corporation is simply the summation of the profits on all projects. In a project driven organization, everything centers on the projects. In the non–project driven organization, such as low technology manufacturing, profit and loss is measured on vertical or functional lines. In this type of organization, projects exist merely to support the product lines or functional lines. Priority resources are assigned to the revenue-producing functional line activities rather than the projects.

Project management in a non–project driven organization is generally more difficult for these reasons:

- Projects may be few and far between.
- Not all projects have the same project management requirements, and therefore, they cannot be managed identically. This difficulty results from poor understanding of project management and a reluctance of companies to invest in proper training.
- Executives do not have sufficient time to manage projects themselves, yet refuse to delegate authority.
- Projects tend to be delayed because approvals most often follow the vertical chain of command. As a result, project work stays too long in functional departments.
- Because project staffing is on a "local" basis, only a portion of the organization understands project management and sees the system in action.
- There exists heavy dependence on subcontractors and outside agencies for project management expertise.

Non–project driven organizations may also have a steady stream of projects, all of which are usually designed to enhance manufacturing operations. Some projects may be customer-requested, such as:

- The introduction of statistical dimensioning concepts to improve process control.
- The introduction of process changes to enhance the final product.
- The introduction of process change concepts to enhance product reliability.

If these changes are not identified as specific projects, the result can be:

- Poorly defined responsibility areas within the organization.
- Poor communications, both internal and external to the organization.
- Slow implementation.
- Lack of a cost tracking system for implementation.
- Poorly defined performance criteria.

Figure 4.1 below shows the tip-of-the-iceberg syndrome, which can occur in all types of organizations but is most common in non-project driven organizations.

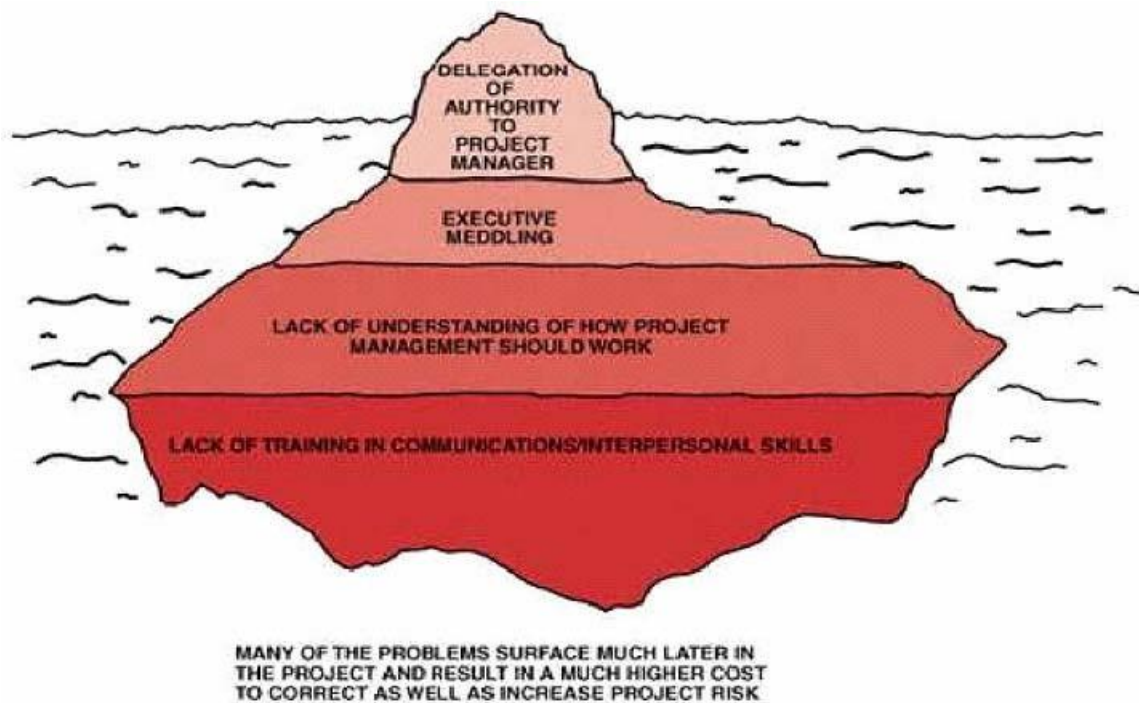


Figure 4.1: The tip-of-the-iceberg syndrome for matrix implementations.

On the surface, all we see is a lack of authority for the project manager. But beneath the surface we see the causes; there is excessive meddling due to lack of understanding of project management, which, in turn, resulted from an inability to recognize the need for proper training. In the previous sections we stated that project management could be handled on either a formal or an informal basis. Informal project management most often appears in non-project driven organizations. It is doubtful that informal project management would work in a project driven organization where the project manager has profit and loss responsibility.

In reality, most firms that believed that they were non-project driven were actually hybrids. Hybrid organizations are typically non-project driven firms with one or two divisions that are project driven.

Historically, hybrids have functioned as though they were non-project driven, as shown in Figure 4.2, but today they are functioning like project driven firms.

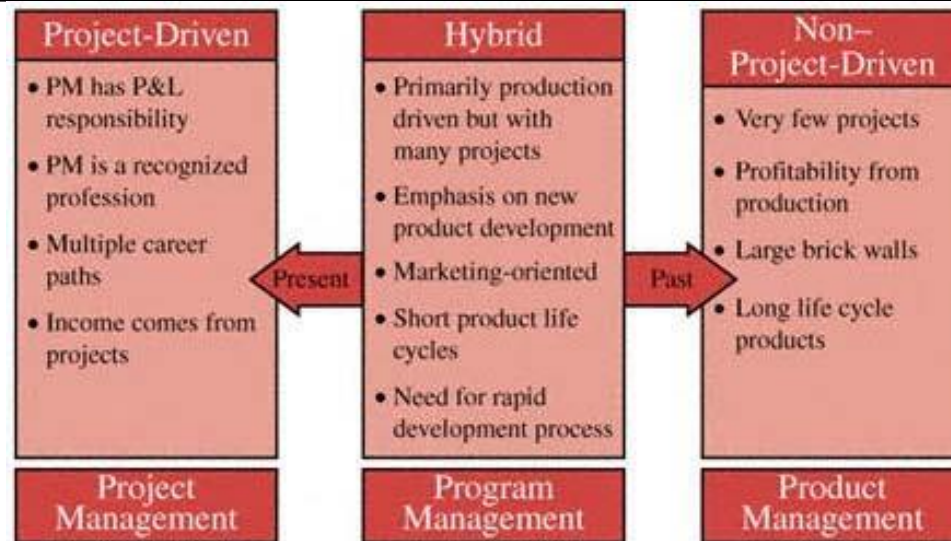


Figure 4.2: Project driven versus non-project driven organizations

4.2 Project Management Methodologies:

Earlier there were no allies or alternative management techniques that were promoting the use of project management. The recession of 1989–1993 finally saw the growth of project management in the non-project driven sector. This recession was characterized by layoffs in the white collar/management ranks. Allies for project management were appearing and emphasis was being placed upon long-term solutions to problems. Project management was now here to stay. The allies for project management began surfacing in 1985 and continued throughout the recession of 1989–1993.

- **1985:** Companies recognized that they must compete on the basis of quality as well as cost. There existed a new appreciation for **Total Quality Management (TQM)**. Companies began using the principles of project management for the implementation of TQM. The first ally for project management surfaced with the "marriage" of project management and TQM.
- **1990:** During the recession of 1989–1993, companies recognized the importance of schedule compression and being the first to market. Advocates of concurrent engineering began promoting the use of project management to obtain better scheduling techniques. Another ally for project management was born.

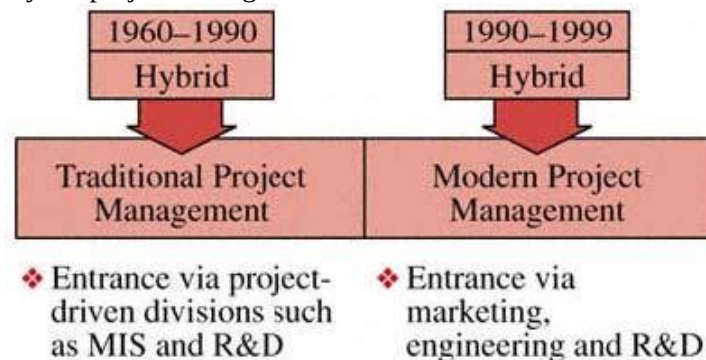


Figure 4.3: From hybrid to project-driven.

- **1991–1992:** Executives realized that project management works best if decision-making and authority are decentralized. They further recognized that control could still be achieved at the top by functioning as project sponsors.

- **1993:** As the recession of 1989–1993 came to an end, companies began "re-engineering" the organization, which really amounted to elimination of organizational "fat." The organization was now a "lean and mean" machine. People were asked to do more work in less time and with fewer people; executives recognized that being able to do this was a benefit of project management.

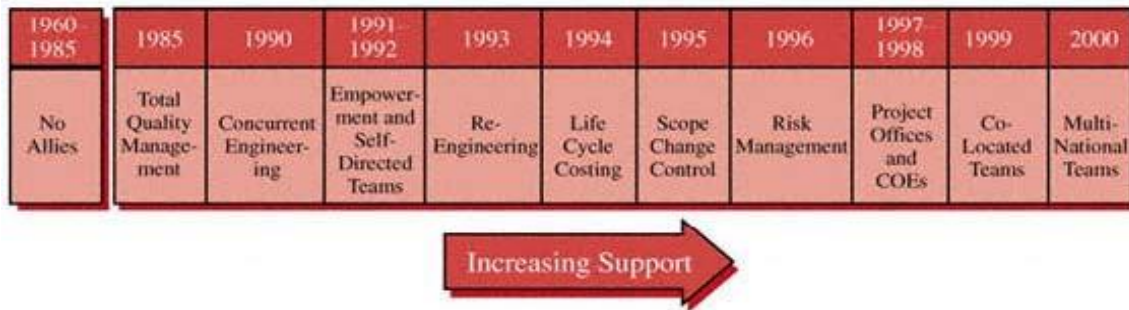


Figure 4.4: New processes supporting project management.

- **1994:** Companies recognized that a good project cost control system (i.e., horizontal accounting) allows for improved estimating and a firmer grasp of the real cost of doing work and developing products.
- **1995:** Companies recognized that very few projects were completed within the framework of the original objectives without scope changes. Methodologies were created for effective change management.
- **1996:** Companies recognized that risk management involves more than padding an estimate or a schedule. Risk management plans were now included in the project plans.
- **1997-1998:** The recognition of project management as a professional career path mandates the consolidation of project management knowledge and a centrally located project management group.

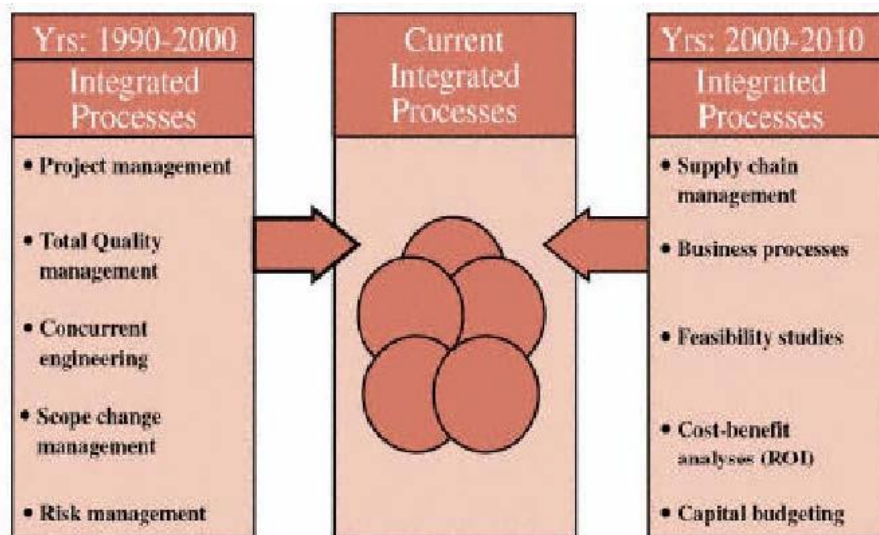


Figure 4.5: Integrated Processes (Past, present, and future)

- **1999:** Companies that recognized the importance of concurrent engineering and rapid product development found that it was best to have dedicated resources for the duration of the project. The cost of over management may be negligible compared to risks of under management. More and more organizations could be expected to use collocated teams all housed together.

- **2000:** Mergers and acquisitions were creating more multinational companies. It was believed that multinational project management will become the major challenge for the next decade.

The reason for the early resistance to project management was that the necessity for project management was customer-driven rather than internally driven, despite the existence of allies. Project management was being implemented, at least partially, simply to placate customer demands. By 1995, however, project management had become internally driven and a necessity for survival. Project management benchmarking was commonplace, and companies recognized the importance of achieving excellence in project management.

As project management continues to grow and mature, more allies will appear. In the twenty-first century, second and third world nations will come to recognize the benefits and importance of project management. Worldwide standards for project management will occur.

4.3 Systems, Programs, and Projects:

4.3.1 Systems:

In the preceding sections the word "systems" has been used rather loosely. The exact definition of a system depends on the users, environment, and ultimate goal. Modern business practitioners define a system as:

A group of elements, either human or nonhuman, that is organized and arranged in such a way that the elements can act as a whole toward achieving some common goal, objective, or end.

Systems are collections of interacting subsystems that either span or interconnect all schools of management. Systems, if properly organized, can provide a synergistic output. Systems are characterized by their boundaries or interface conditions. For example, if the business firm system were completely isolated from the environmental system, then a **close** system would exist, in which case management would have complete control over all system components. If the business system does in fact react with the environment, then the system is referred to as **open**. All social systems, for example, are categorized as open systems. Open systems must have permeable boundaries.

4.3.2 Programs:

Programs can be explained as the necessary first-level elements of a system. Two representative definitions of programs are given below:

- **Air Force Definition:** The integrated, time-phased tasks necessary to accomplish a particular purpose.
- **NASA Definition:** A relative series of undertakings that continue over a period of time (normally years) and that are designed to accomplish a broad, scientific or technical goal in the NASA long range plan (lunar and planetary exploration, manned spacecraft systems). Programs can be regarded as subsystems. However, programs are generally defined as time-phased efforts, whereas systems exist on a continuous basis.

4.3.3 Projects:

Projects are also time-phased efforts (much shorter than programs) and are the first level of breakdown of a program. A typical definition would be:

- **NASA/Air Force Definition:** A project is within a program as an undertaking that has a scheduled beginning and end, and that normally involves some primary

purpose. The majority of the industrial sector, on the other hand, prefers to describe efforts as projects, headed by a project manager. Whether we call our undertaking project management or program management is inconsequential because the same policies, procedures, and guidelines that regulate programs most often apply to projects also. For the remainder of this text, programs and projects will be discussed interchangeably. However, the reader should be aware that projects are normally the first-level subdivision of a program.

4.4 Categories of Projects:

Once a group of tasks is selected and considered to be a project, the next step is to define the kinds of project units. There are four categories of projects:

1. **Individual projects:** These are short-duration projects normally assigned to a single individual who may be acting as both a project manager and a functional manager.
2. **Staff projects:** These are projects that can be accomplished by one organizational unit, say a department.
3. **Special projects:** Very often special projects occur that require certain primary functions and/or authority to be assigned temporarily to other individuals or units. This works best for short-duration projects. Long-term projects can lead to severe conflicts under this arrangement.
4. **Matrix or Aggregate projects:** These require input from a large number of functional units and usually control vast resources. Each of these categories of projects can require different responsibilities, job descriptions, policies, and procedures. Project management may now be defined as the process of achieving project objectives through the traditional organizational structure and over the specialties of the individuals concerned. Project management is applicable for any ad hoc (unique, one-time, one-of-a-kind) undertaking concerned with a specific end objective. In order to complete a task, a project manager must:
 - Set objectives
 - Establish plans
 - Organize resources
 - Provide staffing
 - Set up controls
 - Issue directives
 - Motivate personnel
 - Apply innovation for alternative actions
 - Remain flexible

The type of project will often dictate which of these functions a project manager will be required to perform.

4.5 Product versus Project Management:

For all practical purposes, there is no basic difference between program management and project management. Project management and product management are similar, with one major exception: *the project manager focuses on the end date of his project, whereas the product manager is not willing to admit that his product line will ever end.* The product manager wants his product to be as long-lived and profitable as possible. Even when the demand for the product diminishes, the product manager will always look for spin-offs to keep his product alive. When the project is in the Research and Development (R & D) phase, a project manager is involved. Once the product is developed and introduced into the marketplace, control is taken

over by the product manager. In some situations, the project manager can become the product manager. Both product and project management can, and do, exist concurrently within companies.

4.6 Maturity and Excellence:

Some people think that maturity and excellence in project management are the same. Unfortunately, this is not the case. Consider the following definition:

Maturity in project management is the implementation of a standard methodology and accompanying processes, in such a way that ensures a high likelihood of repeated successes.

This definition is supported by the life-cycle phases. Maturity implies that the proper foundation of tools, techniques, processes, and even culture, exists. When projects come to an end, there is usually a debriefing with senior management to discuss how well the methodology was used and to recommend changes. This debriefing looks at "key performance indicators," and allows the organization to maximize what it does right and to correct what it did wrong.

The definition of excellence can be stated as:

Organizations excellence creates an environment in which there exists a continuous stream of successfully managed projects and where success is measured by what is in the best interest of both the company and the project (i.e. the customer)

Excellence goes well beyond maturity. You must have maturity to achieve excellence. It may take two years or more to reach some initial levels of maturity. Excellence, if achievable at all, may take an additional five years or more.

4.7 Informal Project Management:

Companies today are managing projects more on an informal basis than on a formal one. Informal project management does have some degree of formality but emphasizes managing the project with a minimum amount of paperwork. A reasonable amount of formality still exists. Furthermore, informal project management is based upon guidelines rather than the policies and procedures that are the basis for formal project management. This was shown previously to be a characteristic of a good project management methodology. Informal project management mandates:

- Effective communications
- Effective cooperation
- Effective teamwork
- Trust

These four elements are absolutely essential for informal project management to work effectively.

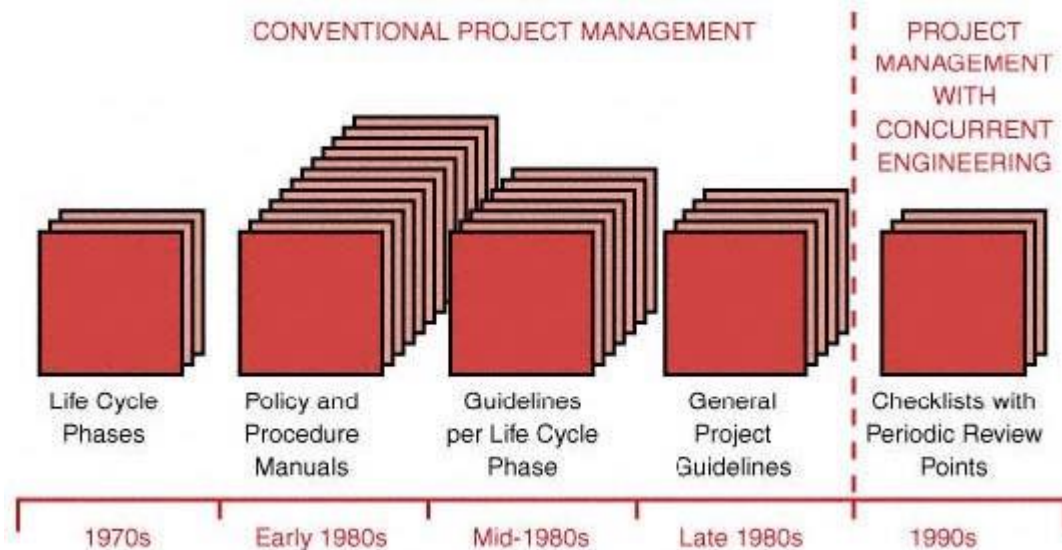


Figure 4.6: Evolution of policies, procedures, and guidelines.

Not all companies have the luxury of using informal project management. Customers often have a strong voice in whether formal or informal project management will be used.

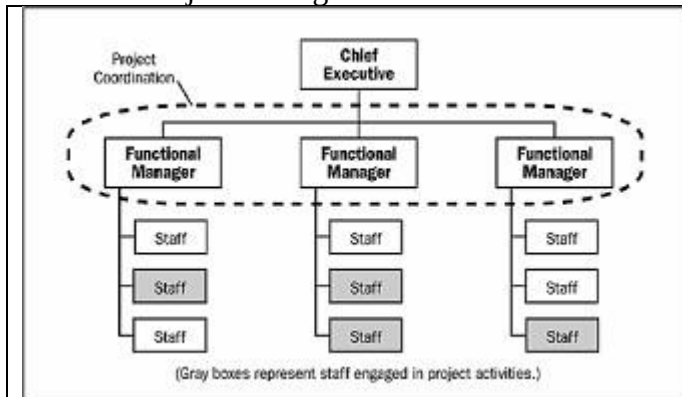
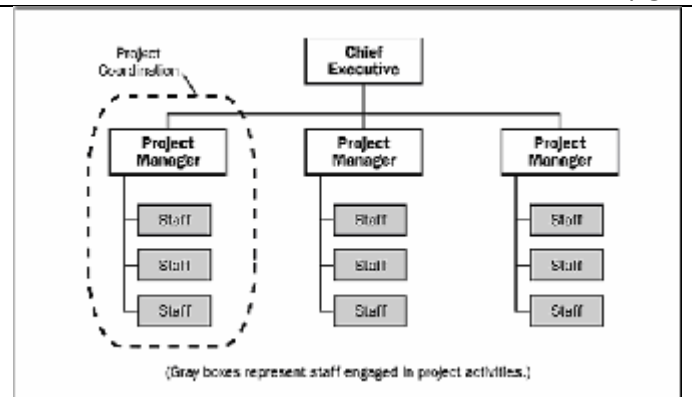
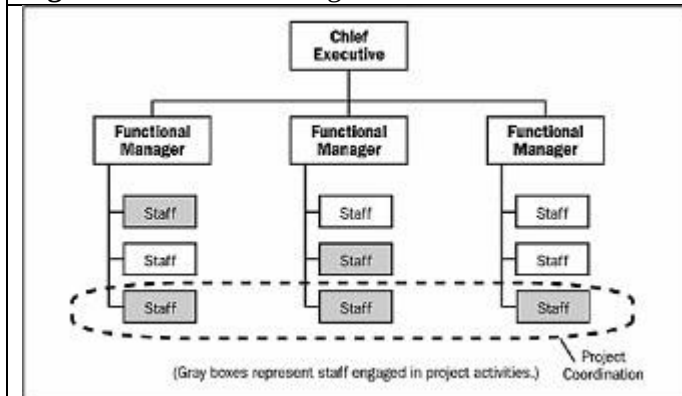
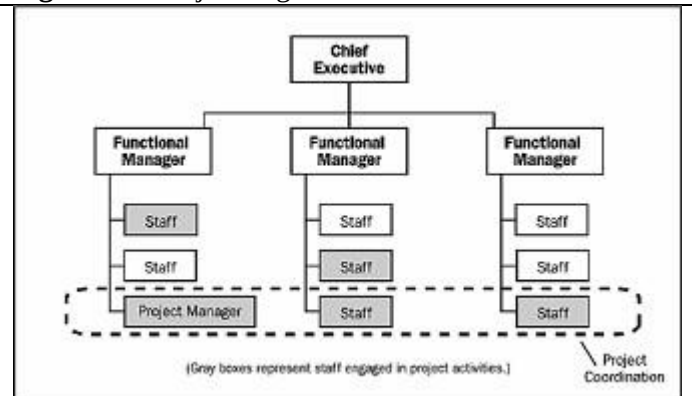
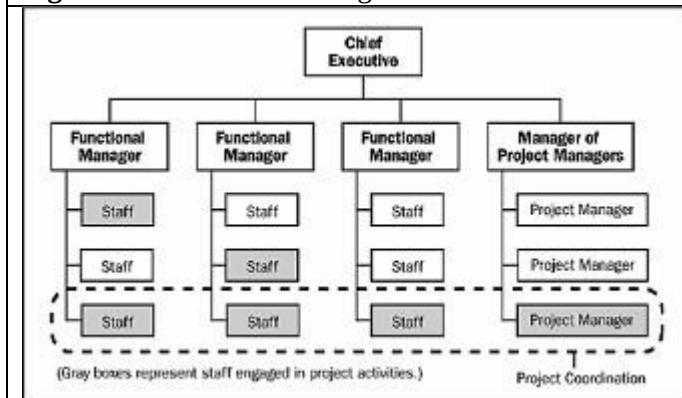
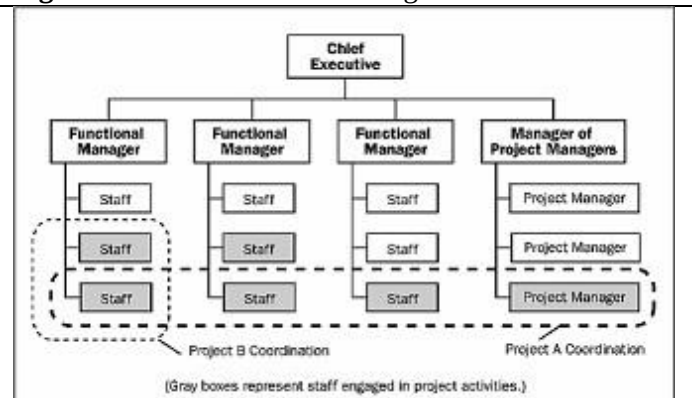
4.8 Organizational Structures:

During the past thirty years there has been a so-called hidden revolution in the introduction and development of new organizational structures. Management has come to realize that organizations must be dynamic in nature; that is, they must be capable of rapid restructuring, if environmental conditions so dictate. These environmental factors evolved from the increasing competitiveness of the market, changes in technology, and a requirement for better control of resources for multiproduct firms. More than thirty years ago, Wallace identified four major factors that caused the onset of the organizational revolution:

- The technology revolution (complexity and variety of products, new materials and processes, and the effects of massive research).
- Competition and the profit squeeze (saturated markets, inflation of wage and material costs, and production efficiency).
- The high cost of marketing.
- The unpredictability of consumer demands (due to high income, wide range of choices available, and shifting tastes).

Much has been written about how to identify and interpret those signs that indicate that a new organizational form may be necessary. According to Grinnell and Apple, there are five general indications that the traditional structure may not be adequate for managing projects:

- Management is satisfied with its technical skills, but projects are not meeting time, cost, and other project requirements.
- There is a high commitment to getting project work done, but great fluctuations in how well performance specifications are met.
- Highly talented specialists involved in the project feel exploited and misused.
- Particular technical groups or individuals constantly blame each other for failure to meet specifications or delivery dates.
- Projects are on time and to specifications, but groups and individuals are not satisfied with the achievement.

**Figure 4.7: Functional Organization****Figure 4.8: Project Organization****Figure 4.9: Weak Matrix Organization****Figure 4.10: Balanced Matrix Organization****Figure 4.11: Strong Matrix Organization****Figure 4.12: Composite Organization**

Unfortunately, many companies do not realize the necessity for organizational change until it is too late. Management continually looks externally (i.e., to the environment) rather than internally for solutions to problems. A typical example would be that new product costs are continually rising while the product life cycle may be decreasing. Should emphasis be placed on lowering costs or developing new products?

For each of the organizational structures described in the following sections, advantages and disadvantages are listed. Many of the disadvantages stem from possible conflicts arising from problems in authority, responsibility, and accountability. The reader should identify these conflicts as such.

4.8.1 Traditional (Classical) Organization:

The traditional management structure has survived for more than two centuries. However, recent business developments, such as the rapid rate of change in technology and position in the marketplace, as well as increased stockholder demands, have created

strains on existing organizational forms. Fifty years ago companies could survive with only one or perhaps two product lines. The classical management organization was found to be satisfactory for control, and conflicts were at a minimum.

However, with the passing of time, companies found that survival depended on multiple product lines (that is diversification) and vigorous integration of technology into the existing organization. As organizations grew and matured, managers found that company activities were not being integrated effectively, and that new conflicts were arising in the well-established formal and informal channels.

Managers began searching for more innovative organizational forms that would alleviate the integration and conflict problems. The advantages and disadvantages of this type of organizations are listed in tables 4.1 and 4.2 respectively.

- Easier budgeting and cost control are possible.
- Better technical control is possible.
 - Specialists can be grouped to share knowledge and responsibility.
 - Personnel can be used on many different projects.
 - All projects will benefit from the most advanced technology (better utilization of scarce personnel).
- It provides flexibility in the use of manpower.
- It provides a broad manpower base to work with.
- It provides continuity in the functional disciplines; policies, procedures, and lines of responsibility are easily defined and understandable.
- It readily admits mass production activities within established specifications.
- It provides good control over personnel, since each employee has one and only one person to report to.
- Communication channels are vertical and well established.
- Quick reaction capability exists, but may be dependent upon the priorities of the functional managers.

Table 4.1: Advantages of the traditional/classical organization

- No one individual is directly responsible for the total project (i.e., no formal authority; committee solutions).
- It does not provide the project-oriented emphasis necessary to accomplish the project tasks.
- Coordination becomes complex, and additional lead time is required for approval of decisions.
- Decisions normally favor the strongest functional groups.
- There is no customer focal point.
- Response to customer needs is slow.
- There is difficulty in pinpointing responsibility; this is the result of little or no direct project reporting, very little project-oriented planning, and no project authority.
- Motivation and innovation are decreased.
- Ideas tend to be functionally oriented with little regard for ongoing projects.

Table 4.2: Disadvantages of the traditional/classical organization

4.8.2 Line–Staff Organization (Project Coordinator):

It soon became obvious that control of a project must be given to personnel whose first loyalty is directed toward the completion of the project. For this purpose, the project management position must be separated from any controlling influence of the functional managers. Two possible situations can exist with this form of line–staff project control. In the first situation, the project manager serves only as the focal point for activity control, that is, a center for information. The prime responsibility of the project manager is to keep the division manager informed of the status of the project and to attempt to "influence" managers into completing activities on time.

The amount of authority given to the project manager posed serious problems. Almost all upper level and division managers were from the classical management schools and therefore maintained serious reservations about how much authority to relinquish. Many of these managers considered it a demotion if they had to give up any of their long-established powers.

4.8.3 Pure Product (Projectized) Organization:

The pure product organization develops as a division within a division. As long as there exists a continuous flow of projects, work is stable and conflicts are at a minimum. The major advantage of this organizational flow is that one individual, the program manager, maintains complete line authority over the entire project. Not only does he assign work, but he also conducts merit reviews. Because each individual reports to only one person, strong communication channels develop that result in a very rapid reaction time.

In pure product organizations, long lead times became a thing of the past. Trade-off studies could be conducted as fast as time would permit without the need to look at the impact on other projects (unless, of course, identical facilities or equipment were required). Functional managers were able to maintain qualified staffs for new product development without sharing personnel with other programs and projects.

The responsibilities attributed to the project manager were entirely new. First of all, his authority was now granted by the vice president and general manager. The program manager handled all conflicts, both those within his organization and those involving other projects. Interface management was conducted at the program manager level. Upper-level management was now able to spend more time on executive decision making than on conflict arbitration. Advantages and disadvantages of Projectized organizations are listed in tables 4.3 and 4.4 respectively.

- It provides complete line authority over the project (i.e., strong control through a single project authority).
- The project participants work directly for the project manager. Unprofitable product lines are easily identified and can be eliminated.
- There are strong communications channels.
- Staffs can maintain expertise on a given project without sharing key personnel.
- Very rapid reaction time is provided.
- Personnel demonstrate loyalty to the project; better morale with product identification.
- A focal point develops for out-of-company customer relations.
- There is flexibility in determining time (schedule), cost, and performance trade-offs.
- Interface management becomes easier as unit size is decreased.
- Upper-level management maintains more free time for executive decision making.

Table 4.3: Advantages of the Projectized organization

- Cost of maintaining this form in a multiproduct company would be prohibitive due to duplication of effort, facilities, and personnel; inefficient usage.
- There exists a tendency to retain personnel on a project long after they are needed. Upper-level management must balance workloads as projects start up and are phased out.
- Technology suffers because, without strong functional groups, outlook of the future to improve company's capabilities for new programs would be hampered (i.e., no perpetuation of technology).
- Control of functional (i.e., organizational) specialists requires top-level coordination.
- There is a lack of opportunities for technical interchange between projects.
- There is a lack of career continuity and opportunities for project personnel.

Table 4.4: Disadvantages of the Projectized organization

4.8.4 Matrix Organizational Form:

The matrix organizational form is an attempt to combine the advantages of the pure functional structure and the product organizational structure. This form is ideally suited for companies, such as construction, that are "project-driven." Each project manager reports directly to the vice president and general manager. Since each project represents a potential profit center, the power and authority used by the project manager come directly from the general manager. The project manager has total responsibility and accountability for project success.

The functional departments, on the other hand, have functional responsibility to maintain technical excellence on the project. Each functional unit is headed by a department manager whose prime responsibility is to ensure that a unified technical base is maintained and that all available information can be exchanged for each project. Department managers must also keep their people aware of the latest technical accomplishments in the industry.

Project management is a "coordinative" function, whereas matrix management is a collaborative function division of project management. In the coordinative or project organization, work is generally assigned to specific people or units who "do their own thing." In the collaborative or matrix organization, information sharing may be mandatory, and several people may be required for the same piece of work. In a project organization, authority for decision making and direction rests with the project leader, whereas in a matrix it rests with the team.

Certain ground rules exist for matrix development. These are:

- Participants must spend full time on the project; this ensures a degree of loyalty.
- Horizontal as well as vertical channels must exist for making commitments.
- There must be quick and effective methods for conflict resolution.
- There must be good communication channels and free access between managers.
- All managers must have input into the planning process.
- Both horizontally and vertically oriented managers must be willing to negotiate for resources.
- The horizontal line must be permitted to operate as a separate entity except for administrative purposes.

These ground rules simply state some of the ideal conditions that matrix structures should possess. Each ground rule brings with it advantages and disadvantages that are described in tables 4.5 and 4.6 respectively.

- The project manager maintains maximum project control (through the line managers) over all resources, including cost and personnel.
- Policies and procedures can be set up independently for each project, provided that they do not contradict company policies and procedures.
- The project manager has the authority to commit company resources, provided that scheduling does not cause conflicts with other projects.
- Rapid responses are possible to changes, conflict resolution, and project needs (as technology or schedule).
- The functional organizations exist primarily as support for the project.
- Each person has a "home" after project completion. People are susceptible to motivation and end-item identification. Each person can be shown a career path.
- Because key people can be shared, the program cost is minimized. People can work on a variety of problems; that is, better people control is possible.
- A strong technical base can be developed, and much more time can be devoted to complex problem-solving. Knowledge is available for all projects on an equal basis.
- Conflicts are minimal, and those requiring hierarchical referrals are more easily resolved.
- There is a better balance between time, cost, and performance.
- Rapid development of specialists and generalists occurs.
- Authority and responsibility are shared.
- Stress is distributed among the team (and the functional managers).

Table 4.5: Advantages of the Matrix organization

- Multidimensional information flow.
- Multidimensional work flow.
- Dual reporting.
- Continuously changing priorities.
- Management goals different from project goals.
- Potential for continuous conflict and conflict resolution.
- Difficulty in monitoring and control.
- Company-wide, the organizational structure is not cost-effective because more people than necessary are required, primarily administrative.
- Each project organization operates independently. Care must be taken that duplication of efforts does not occur.
- More effort and time are needed initially to define policies and procedures, compared to traditional form.
- Functional managers may be biased according to their own set of priorities.
- Balance of power between functional and project organizations must be watched.
- Balance of time, cost, and performance must be monitored.
- Although rapid response time is possible for individual problem resolution, the reaction time can become quite slow.
- Employees and managers are more susceptible to role ambiguity than in traditional form.
- Conflicts and their resolution may be a continuous process (possibly requiring support of an organizational development specialist).
- People do not feel that they have any control over their own destiny when continuously reporting to multiple managers.

Table 4.6: Disadvantages of the Matrix organization

4.8.4.1 Modification of Matrix Structures:

The matrix structure can take many forms, but there are basically three common varieties. Each type represents a different degree of authority attributed to the program manager and indirectly identifies the relative size of the company. This type of arrangement works best for small

companies that have a minimum number of projects and assume that the general manager has sufficient time to coordinate activities between his project managers. In this type of arrangement, all conflicts between projects are hierarchically referred to the general manager for resolution.

As companies grew in size and the number of projects, the general manager found it increasingly difficult to act as the focal point for all projects. A new position was created, that of director of programs, or manager of programs or projects. The director of programs was responsible for all program management. This freed the general manager from the daily routine of having to monitor all programs himself.

The desired span of control, of course, will vary from company to company and must take the following into account:

- The demands imposed on the organization by task complexity
- Available technology
- The external environment
- The needs of the organizational membership
- The types of customers and/or products

These variables influence the internal functioning of the company. Executives must realize that there is no one best way to organize under all conditions. This includes the span of control.

4.9 Selecting the Organizational Form:

Project management has matured as an outgrowth of the need to develop and produce complex and/or large projects in the shortest possible time, within anticipated cost, with required reliability and performance, and (when applicable) to realize a profit. Granted that modern organizations have become so complex that traditional organizational structures and relationships no longer allow for effective management, how can executives determine which organizational form is best, especially since some projects last for only a few weeks or months while others may take years?

To answer such a question, we must first determine whether the necessary characteristics exist to warrant a project management organizational form. Generally speaking, the project management approach can be effectively applied to a one-time undertaking that is:

- Definable in terms of a specific goal
- Infrequent, unique, or unfamiliar to the present organization
- Complex with respect to interdependence of detailed tasks
- Critical to the company

Once a group of tasks is selected and considered to be a project, the next step is to define the kinds of projects. These include individual, staff, special, and matrix or aggregate projects.

Unfortunately, many companies do not have a clear definition of what a project is. As a result, large project teams are often constructed for small projects when they could be handled more quickly and effectively by some other structural form.

Organization Structure Project Characteristics	Functional	Matrix			Projectized
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Resource Availability	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Who controls the project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

Figure 4.13: Project Organizational Structure Influences on Projects

All structural forms have their advantages and disadvantages, but the project management approach appears to be the best possible alternative.

The basic factors that influence the selection of a project organizational form are:

- Project size
- Project length
- Experience with project management organization
- Philosophy and visibility of upper-level management
- Project location
- Available resources
- Unique aspects of the project

This last item requires further comment. Project management (especially with a matrix) usually works best for the control of human resources and thus, may be more applicable to labor-intensive projects rather than capital-intensive projects. Labor-intensive organizations have formal project management, whereas capital-intensive organizations may use informal project management.

Four fundamental parameters must be analyzed when considering implementation of a project organizational form:

- Integrating devices
- Authority structure
- Influence distribution
- Information system

PROJECT LIFE CYCLES**Broad Contents**

Life cycle phases of a Product
Life cycle phases of a System
System Costs
Cost Benefit Analysis
Characteristics of Project Life Cycle
Project Management Office
Project Management Officer (PMO)
Difference between Project Manager and Project Management Officer
Some Examples of Project Life Cycle

5.1 Life Cycle Phases of a Product:

Every program, project, or product has certain phases of development. A clear understanding of these phases permits managers and executives to better control total corporate resources in the achievement of desired goals. The phases of development are known as life-cycle phases. However, the breakdown and terminology of these phases differ, depending on whether we are discussing products or projects.

During the past few years, there has been at least partial agreement about the life cycle phases of a product. They include:

- Research and development
- Market introduction
- Growth
- Maturity
- Deterioration
- Death

Today, there is no agreement among industries, or even companies within the same industry, about the life cycle phases of a project. This is understandable because of the complex nature and diversity of projects.

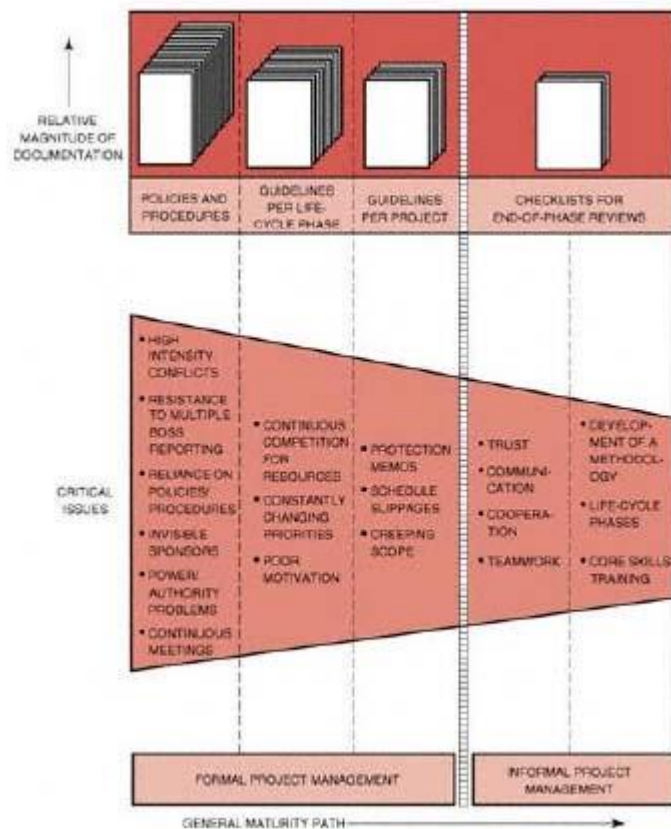


Figure 5.1: Maturity Path

5.2 Life Cycle Phases of a System:

The theoretical definitions of the life cycle phases of a system can be applied to a project. These phases include:

- Conceptual
- Planning
- Testing
- Implementation
- Closure

5.2.1 Conceptual Phase:

The first phase, the conceptual phase, includes the preliminary evaluation of an idea. Most important in this phase is a preliminary analysis of risk and the resulting impact on the time, cost, and performance requirements, together with the potential impact on company resources. The conceptual phase also includes a "first cut" at the feasibility of the effort.

5.2.2 Planning Phase:

The second phase is the planning phase. It is mainly a refinement of the elements described under the conceptual phase. The planning phase requires a firm identification of the resources to be required together with the establishment of realistic time, cost, and performance parameters. This phase also includes the initial preparation of all documentation necessary to support the system. For a project based on competitive bidding, the conceptual phase would include the decision of whether to bid, and the planning phase would include the development of the total bid package (i.e., time, schedule, cost, and performance).

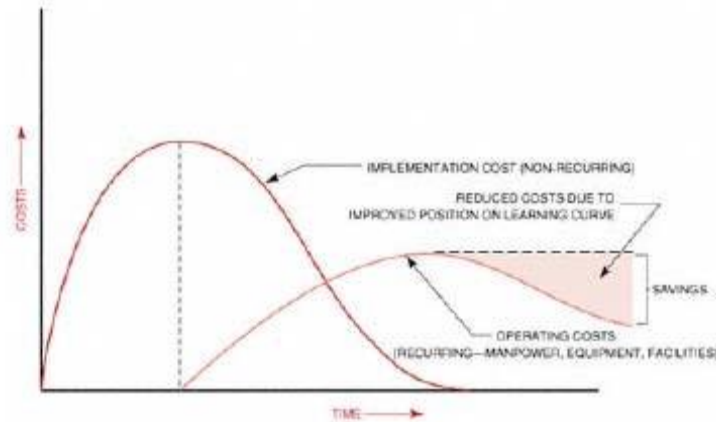


Figure 5.2: System Costs

5.2.2.1 System Costs:

Because of the amount of estimating involved, analyzing system costs during the conceptual and planning phases is not an easy task. As shown in Figure 5.2, most project or system costs can be broken down into operating (recurring) and implementation (nonrecurring) categories. The implementation costs include one-time expenses such as construction of a new facility, purchasing computer hardware, or detailed planning. Operating costs, on the other hand, include recurring expenses such as manpower. The operating costs may be reduced as shown in Figure 5.2, if personnel perform at a higher position on the learning curve. The identification of a learning curve position is vitally important during the planning phase when firm cost positions must be established.

Of course, it is not always possible to know what individuals will be available or how soon they can perform at a higher learning curve position.

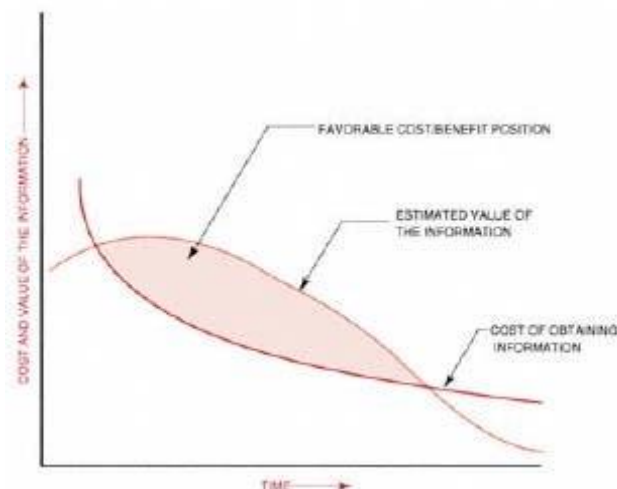


Figure 5.3: Cost Benefit Analysis

5.2.2.2 Cost Benefit Analysis:

Once the approximate total cost of the project is determined, a cost-benefit analysis should be conducted (see Figure 5.3) to determine if the estimated

value of the information obtained from the system exceeds the cost of obtaining the information. This analysis is often included as part of a feasibility study.

There are several situations, such as in competitive bidding, where the feasibility study is actually the conceptual and definition phases. Because of the costs that can be incurred during these two phases, top-management approval is almost always necessary before the initiation of such a feasibility study.

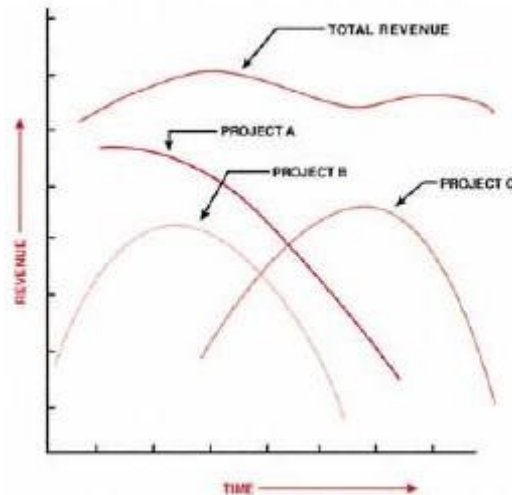


Figure 5.4: A Stream of Projects

5.2.3 Testing Phase:

The third phase— testing— is predominantly a testing and final standardization effort so that operations can begin. Almost all documentation must be completed in this phase.

5.2.4 Implementation Phase:

The fourth phase is the implementation phase, which integrates the project's product or services into the existing organization. If the project was developed for establishment of a marketable product, then this phase could include the product life cycle phases of market introduction, growth, maturity, and a portion of deterioration.

5.2.5 Closure Phase:

The final phase is closure and includes the reallocation of resources. The question to be answered is, "Where the resources should be reassigned?" Consider a company that sells products on the open consumer market. As one product begins the deterioration and death phases of its life cycle (i.e., the divestment phase of a system), then new products or projects must be established. Such a company would, therefore, require a continuous stream of projects as a necessity for survival, as shown in Figure 5.4. As projects A and B begin their decline, new efforts (project C) must be developed for resource reallocation. In the ideal situation these new projects will be established at such a rate that total revenue will increase and company growth will be clearly visible.

The closure phase evaluates the efforts on the total system and serves as input to the conceptual phases for new projects and systems. This final phase also has an impact on other ongoing projects with regard to priority identification.

Thus, so far no attempt has been made to identify the size of a project or system. Large projects generally require full-time staffs, whereas small projects, although they undergo the same system life cycle phases, may require only part-time people. This

implies that an individual can be responsible for multiple projects, possibly with each project existing in a different life cycle phase.

The following questions must be considered in multi-project management:

1. Are the project objectives the same?
 - For the good of the project
 - For the good of the company
2. Is there a distinction between large and small projects?
3. How do we handle conflicting priorities?
 - Critical versus critical projects
 - Critical versus non-critical projects
 - Non-critical versus non-critical projects

5.2.6 Explanation of Various Life Cycle Phases:

Later topics discuss methods of resolving conflicts and establishing priorities.

The phases of a project and those of a product are compared in Figure 5.5. Notice that the life cycle phases of a product generally do not overlap, whereas the phases of a project can and often do overlap.

Table 5.1 identifies the various life cycle phases that are commonly used. Even in mature project management industries such as construction, one could survey ten different construction companies and find ten different definitions for the life cycle phases.

Engineering	Manufacturing	Computer Programming	Construction
• Start-up	• Formation	• Conceptual	• Planning, data gathering and procedures
• Definition	• Buildup	• Planning	• Studies and basic engineering
• Main	• Production	• Definition and design	• Major review
• Termination	• Phase-out	• Implementation	• Detail engineering
	• Final audit	• Conversion	• Detail engineering/ construction overlap
			• Construction
			• Testing and commissioning

Table 5.1: Life Cycle Phase Definitions

The life cycle phases for computer programming, as listed in Table above, are also shown in Figure 5.5 which illustrates how manpower resources can build up and decline during a project. In Figure 5.5, PMO stands for the present method of operations, and PMO' will be the "new" present method of operations after conversion. This life cycle would probably be representative of a twelve-month activity.

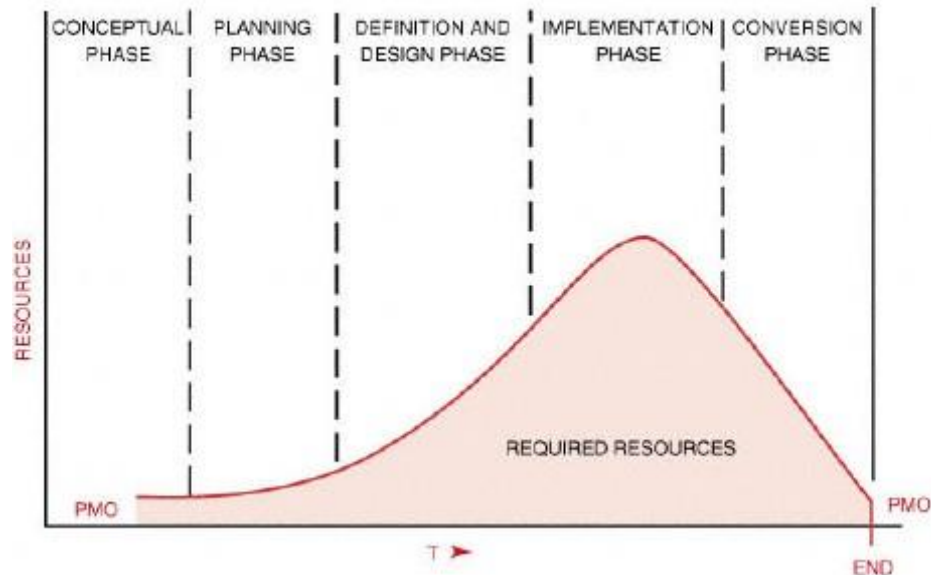


Figure 5.5: Definition of a Project Life Cycle

Most executives prefer short data processing life cycles because computer technology changes at a very rapid rate. An executive of a major utility commented that his company was having trouble determining how to terminate a computer programming project to improve customer service because by the time a package is ready for full implementation, an updated version appears on the scene. Should the original project be canceled and a new project begun? The solution appears to lie in establishing short data processing project life cycle phases, perhaps through segmented implementation. In any case, we can conclude that top management is responsible for the periodic review of major projects. This should be accomplished, at a minimum, at the completion of each life cycle phase.

More and more companies are preparing procedural manuals for project management and for structuring work using life cycle phases. There are several reasons for this trend. These are as follows:

- Clear description of the work to be accomplished in each phase may be possible.
- Pricing and estimating may be easier if well-structured work definitions exist.
- There exists key decision points at the end of each life cycle phase so that incremental funding is possible.

Reader should be aware that not all projects can be simply transposed into lifecycle phases (e.g., Research and Development). In such a case it might be possible (even in the same company) for different definitions of life-cycle phases to exist because of schedule length, complexity, or just the difficulty of managing the phases.

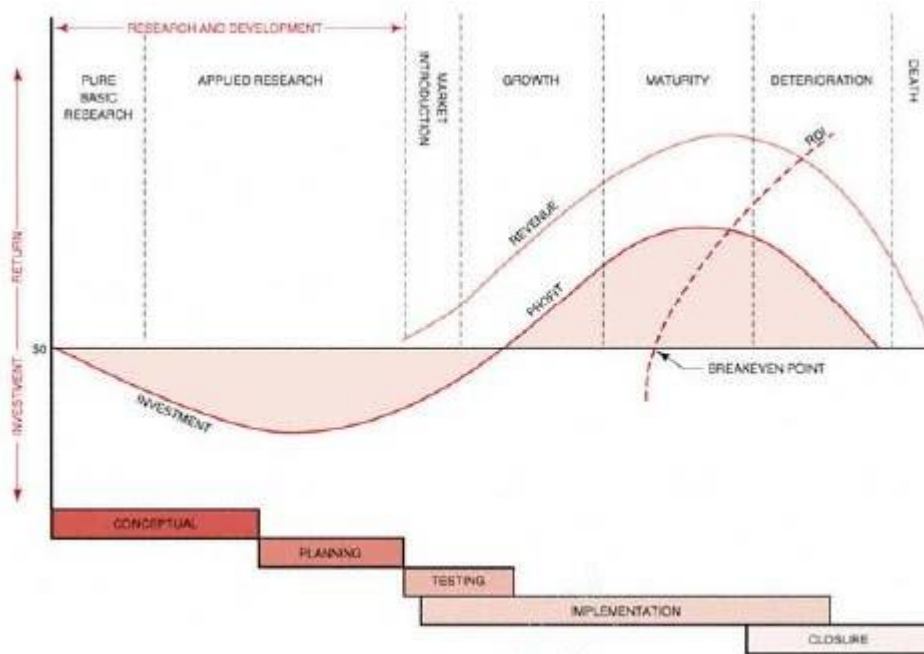


Figure 5.6: System/Product Life Cycles

5.3 Characteristics of Project Life Cycle:

- Project life cycle defines phases that connect beginning and end of the project. After each phase deliverables are reviewed for the completeness in time, accuracy according to defined objectives and their final approval (approval for acceptance) before moving to the next phase.
- As shown in the diagrams in the beginning, phases can be overlapped to save time and to have fast tracking on the life cycle. This technique is used to compress the whole schedule (if required resources are available or manageable)
- There is no way to define Project Life Cycle ideally. Because of this every project management team can define its own way to work on the project. They can use best common practices and can learn new ways of dealing projects by their experiences in detail or in general. Only three phases are always certain to be performed; conceptualization, intermediate phase(s), and closure.
- Generally phases are defined in sequential order by technical information officer.
- Cost and staffing level is defined for every single phase.
- Project may have sub-project(s) and sub-projects may have their own project life cycle.
- In the beginning of the project, level of uncertainty and risk is always high.
- The typical project life cycle – initiating, implementing and closing – has critical decision points where the project may continue, be changed, or be abandoned.
- There are many points within the project life cycle where *Community of Professionals (COPs)* may provide support and guidance. For example, initiating the project involves such activities as identifying the project team members, defining the scope and business objectives of the project and identifying key stakeholders.

- During project close, reassignment and intelligent preservation of resources, knowledge projects (i.e. deliverables), and sharing lessons learned are facilitated.

5.4 Project Management Office:

The Project Management Office sets project standards and oversees the organization's portfolio of projects. This allows the organization to evaluate the use of resources across all projects and resolve conflicts that affect project timelines. The Project Management Office is also a very good place to examine how communities are linked across projects. Using the communities as the linkage point for knowledge transfer is far more efficient for the following several reasons:

- In communities, the evaluation of knowledge is generally done by a broader range of people, ensuring that the ideas are more completely vetted.
- Communities generally exist outside the project framework and trust is already established.
- They can be used as opposed to setting up more formal structures and methods to get the required information transferred to the project.
- In communities, knowledge is transferred from expert to recipient. This includes tacit knowledge transfer as well as explicit knowledge transfer. This is a much more efficient transfer mechanism than is normally used. Generally, documents would be transferred from project to project with minimal expert knowledge available to add value.
- Community transfer shares the knowledge broadly, strengthening the entire organization for future projects.
- As mentioned earlier, Project Management Office and top management are responsible for the periodic review of major projects. This should be accomplished, at a minimum, at the completion of each life cycle phase.

5.5 Project Management Officer (PMO):

Project Management Officer (PMO) centralizes and coordinates management of project under his domain, and oversees management of project and product (system/program) both. Project Management Officer may not be directly related to the project at spot. He/she focuses on coordination planning, prioritization of all resources and deliverables of projects and sub projects. It is the responsibility of Project Management Officer to keep top management and clients/parents organization connected and informed about all projects running or product life cycle. He/she is involved in selection, management and re-deployment of shared projects as much as authorized.

Project Management Officer is generally responsible for:

- Providing monitoring platform for Project Manager.
- Identifying the Project Management Methodology and best practices for specific project.
- Clearing house, i.e. defining and refining project policies, procedures, templates and shared documents.
- Configuration management for all projects under work.
- For developing and keeping repository and risk management for projects.

- Developing Project Management Office for operation and maintaining tools for project management. Normally it includes Enterprise Wide Project Management Software creation and installation.
- Management and coordination and monitoring of communications across the projects, project timelines and budget, quality standards.
- Project Management Officer may be having authority to terminate project anytime when he gets it not feasible anymore.

5.6 Difference Between Project Manager and Project Management Officer:

1. Both have different objectives - driven by different requirements, aligned with strategic needs of organization.
2. Project Manager is responsible for delivering specific project objectives within project constraints, while Project Management Officer is responsible for organizational structure specific mandates having much vast perspective.
3. Project Manager focuses on project objectives, while Project Management Officer focuses on major programs, scope and changes required and authenticated. Project Management Officer considers all potential opportunities to have business goals achieved.
4. Project Manager is constrained with assigned resources for specific project to meet its full objective. On the other hand, Project Management Officer is supposed to optimize the use of shared organizational resources across all projects overall.
5. Project Manager manages scope, schedule, cost, and quality of product, while the Project Management Officer manages overall risk, opportunities, interdependencies and links among different projects.
6. Project Manager reports on project progress/project specific information to the top management, while Project Management Officer provides consolidated reporting/enterprise view of project or all the running projects.

5.7 Some Examples of Project Life Cycle:

There are many variations on the theme of the project phases, influenced by the project's scope of work. The project phase selected in the examples here are arbitrary and serve only to illustrate the technique for different types of projects. The main features to look for are the key issues, key activities, limiting factors, decision and hold points in each phase.

The project life cycle is conveniently represented by a bar chart which clearly indicates the duration of each phase and its overlap (if any) with the other phases.

5.7.1 House Project:

The construction of a house provides a project many of us have personally experienced. Consider here the following simple sub-division into four phases.

The level of effort follows the typical life cycle profile by increasing to a maximum during the building phase before declining during the interior phase.

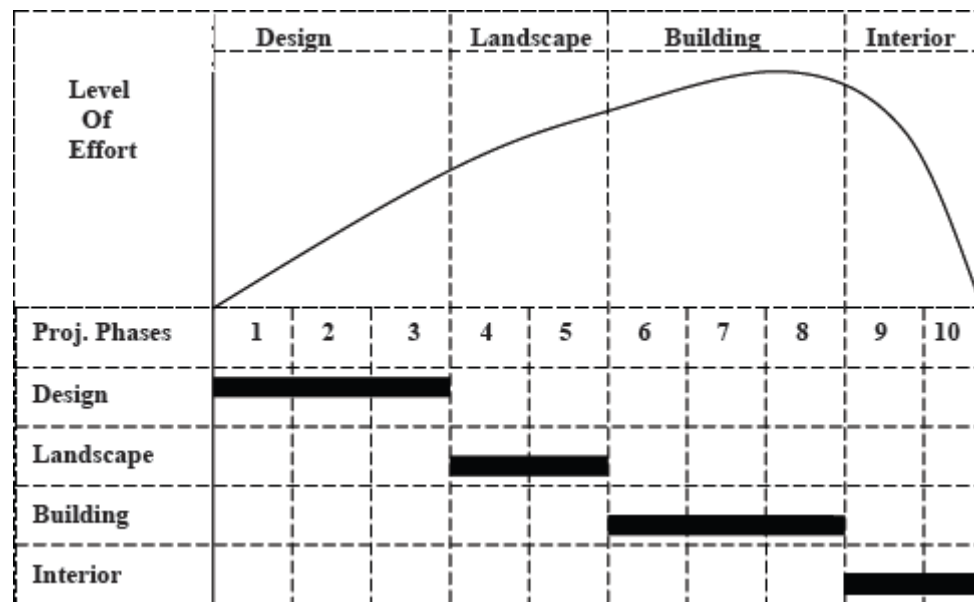


Figure 5.7: Project Life Cycle: House Project

5.7.2 Computer installation:

With the improved cost effectiveness of computer facilities most companies will experience a computer installation project sooner or later.

Note that the training phase overlaps with both system selection and the implementation phase.

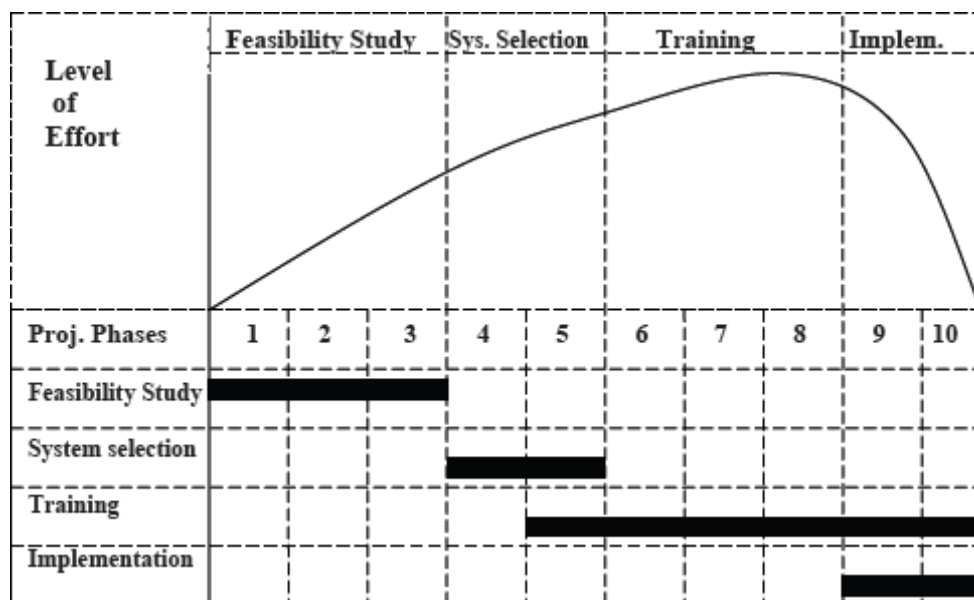


Figure 5.8: Project Life Cycle: Computer Installation

5.7.3 Engineering Project:

An engineering type project is a popular example to illustrate the project phases. Note here that all phases overlap which could indicate a fast tracking.

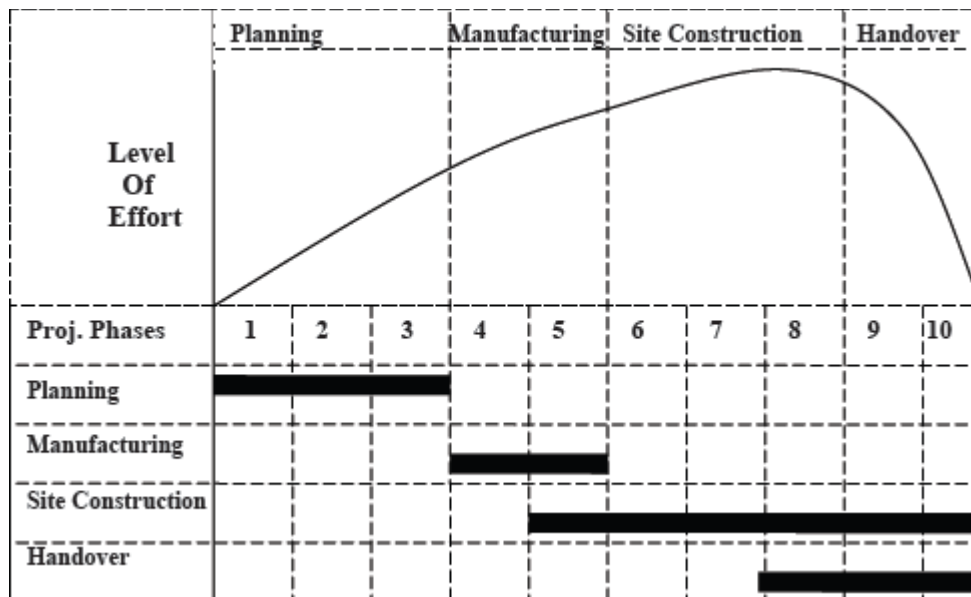


Figure 5.9: Project Life Cycle: Engineering Project

5.7.4 Nuclear Power Station Project:

This project may well span 50 years with the people involved in the initial phases being retired long before the final phases.

The interesting point here is that the environmental constraints have changed significantly over the fifty years between the design phase and the decommissioning phase.

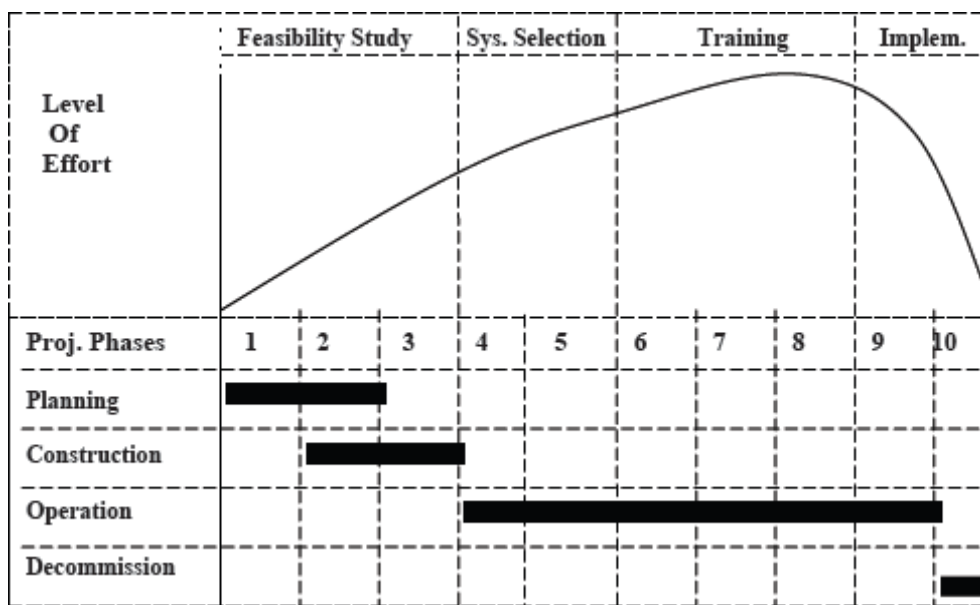


Figure 5.10: Project Life Cycle: Nuclear Power Station Project

THE PROJECT MANAGER

Broad Contents

Skills needed in a Project Manager
Functional Manager versus Project Managers
Selecting the Project Manager
Location, reporting and salary of the Project Manager
Duties and job description of Project Managers
Next generation Project Managers

6.1 Skill Requirements for Project Managers:

Projects are often complex and multifaceted. Managing these projects represents a challenge, requiring skills in team building, leadership, conflict resolution, technical expertise, planning, organization, entrepreneurship, administration, management support, and the allocation of resources.

This section examines these skills relative to Project Management effectiveness. A key factor to good project performance is the Project Manager's ability to integrate personnel from many disciplines into an effective work team. To get results, the Project Manager must relate to:

1. The people to be managed
2. The task to be done
3. The tools available
4. The organizational structure
5. The organizational environment, including the customer community

All work factors are interrelated and operate under the limited control of the Project Manager. With an understanding of the interaction of corporate organization and behavior elements, the manager can build an environment conducive to the working team's needs.

The internal and external forces that impinge on the organization of the project must be reconciled to mutual goals. Thus, the Project Manager must be, both socially and technically aware to understand how the organization functions and how these functions will affect the Project organization of the particular job to be done. In addition, the Project Manager must understand the culture and value system of the organization he is working with. Research and experience show that effective Project Management performance is directly related to the level of proficiency at which these skills are mastered.

Ten specific skills are identified (in no particular order) and discussed in this section:

1. *Team building*
2. *Leadership*
3. *Conflict resolution*
4. *Technical expertise*
5. *Planning*
6. *Organization*
7. *Entrepreneurship*
8. *Administration*
9. *Management support*
10. *Resource allocation*

It is important that the personal management traits underlying these skills operate to form a homogeneous management style. The right mixture of skill levels depends on the project task, the techniques employed, the people assigned, and the organizational structure. To be effective, Project Managers must consider all facets of getting the job done. Their management style must facilitate the integration of multidisciplinary project resources for synergistic operations. The days of the manager who gets by with technical expertise alone or pure administrative skills are gone. The ten specific skills required in a good Project Manager can be discussed as follows:

1. **Team Building Skills:**

Building the project team is one of the prime responsibilities of the Project Manager. Team building involves a whole spectrum of management skills required to identify, commit, and integrate the various task groups from the traditional functional organization into a single Project Management system.

To be effective, the Project Manager must provide an atmosphere conducive to teamwork. He must nurture a climate with the following characteristics:

- Team members committed to the project
- Good interpersonal relations and team spirit
- The necessary expertise and resources
- Clearly defined goals and project objectives
- Involved and supportive top management
- Good project leadership
- Open communication among team members and support organizations
- A low degree of detrimental interpersonal and inter-group conflict

Three major considerations are involved in all of the above factors aimed towards integration of people from many disciplines into an effective team:

- a) Effective communication
- b) Sincere interest in the professional growth of team members
- c) Commitment to the project

2. **Leadership Skills:**

An absolutely essential prerequisite for project success is the Project Manager's ability to lead the team within a relatively unstructured environment. It involves dealing effectively with managers and supporting personnel across functional lines with little or no formal authority. It also involves information processing skills, the ability to collect and filter relevant data valid for decision making in a dynamic environment. It involves the ability to integrate individual demands, requirements, and limitations into decisions that benefit overall project performance. It further involves the Project Manager's ability to resolve inter-group conflicts that is an important factor in overall project performance.

Perhaps more than in any other position below the general manager's level, quality leadership depends heavily on the Project Manager's personal experience and credibility within the organization. An effective management style might be characterized this way:

- Clear project leadership and direction
- Assistance in problem solving
- Facilitating the integration of new members into the team
- Ability to handle interpersonal conflict

- Facilitating group decisions
- Capability to plan and elicit commitments
- Ability to communicate clearly
- Presentation of the team to higher management
- Ability to balance technical solutions against economic and human factors

The personal traits desirable and supportive of the above skills are:

- Project management experience
- Flexibility and change orientation
- Innovative thinking
- Initiative and enthusiasm
- Charisma and persuasiveness
- Organization and discipline

3. ***Conflict Resolution Skills:***

Conflict is fundamental to complex task management. It is often determined by the interplay of the Project organization and the larger host organization and its multifunctional components.

Understanding the determinants of conflicts is important to the Project Manager's ability to deal with conflicts effectively. When conflict becomes dysfunctional, it often results in poor project decision making, lengthy delays over issues, and a disruption of the team's efforts, all negative influences to project performance. However, conflict can be beneficial when it produces involvement and new information and enhances the competitive spirit.

A number of suggestions have been derived from various research studies aimed at increasing the Project Manager's ability to resolve conflict and thus, improve overall project performance.

Project managers must:

- Understand interaction of the organizational and behavioral elements in order to build an environment conducive to their team's motivational needs. This will enhance active participation and minimize unproductive conflict.
- Communicate effectively with all organizational levels regarding both project objectives and decisions. Regularly scheduled status review meetings can be an important communication vehicle.
- Recognize the determinants of conflict and their timing in the project life cycle.

Effective project planning, contingency planning, securing of commitments, and involving top management can help to avoid or minimize many conflicts before they impede project performance.

The value of the conflict produced depends on the ability of the Project Manager to promote beneficial conflict while minimizing its potential hazardous consequences. The accomplished manager needs a "sixth sense" to indicate when conflict is desirable, what kind of conflict will be useful, and how much conflict is optimal for a given situation. In the final analysis, he has the sole responsibility for his Project and how conflict will contribute to its success or failure.

4. **Technical Skills:**

The Project Manager rarely has all the technical, administrative, and marketing expertise needed to direct the Project single-handedly. Nor is it necessary or desirable. It is essential, however, for the Project Manager to understand the technology, the markets, and the environment of the business to participate effectively in the search for integrated solutions and technological innovations. More important, without this understanding, the integrated consequences of local decisions on the total Project, the potential growth ramifications, and relationships to other business opportunities cannot be foreseen by the manager. Further technical expertise is necessary to evaluate technical concepts and solutions, to communicate effectively in technical terms with the project team, and to assess risks and make trade-offs between cost, schedule, and technical issues. This is why in complex problem-solving situations so many project managers must have an engineering background.

Taken together, technical expertise is important to the successful management of engineering projects. It is composed of an understanding of the:

- Technology involved
- Engineering tools and techniques employed
- Specific markets, their customers, and requirements
- Product applications
- Technological trends and evolutions
- Relationship among supporting technologies
- People who are part of the technical community

This is normally an excellent testing ground for the future Project Manager. It also allows top management to judge the new candidate's capacity for managing the technological innovations and integration of solutions needed for success.

5. **Planning Skills:**

Planning skills are helpful for any undertaking; they are absolutely essential, however, for the successful management of large complex projects. The project plan is the road map that defines how to get from the start to the final results.

Project planning is an ongoing activity at all organizational levels. However, the preparation of a project summary plan, prior to project start, is the responsibility of the Project Manager. Effective project planning requires particular skills far beyond writing a document with schedules and budgets. It requires communication and information processing skills to define the actual resource requirements and administrative support necessary. It requires the ability to negotiate the necessary resources and commitments from key personnel in various support organizations with little or no formal authority, including the definition of measurable milestones.

Effective planning requires skills in the areas of:

- Information processing
- Communication
- Resource negotiations
- Securing commitments
- Incremental and modular planning
- Assuring measurable milestones
- Facilitating top management involvement

In addition, the Project Manager must assure that the plan remains a viable document. Changes in project scope and depth are inevitable. The plan should reflect necessary changes through formal revisions and should be the guiding document throughout the life cycle of the Project. Nothing is more useless than an obsolete or irrelevant plan.

Finally, Project Managers need to be aware that planning can be overdone. If not controlled, planning can become an end in itself and a poor substitute for innovative work. Individuals retreat to the utopia of no responsibility where innovative actions cannot be taken "because it is not in the plan." It is the responsibility of the Project Manager to build flexibility into the plan and regulate it against such misuse.

6. *Organizational Skills:*

The Project Manager must be a social architect, that is, he must understand how the organization works and how to work with the organization. Organizational skills are particularly important during project formation and startup when the Project Manager establishes the project organization by integrating people from many different disciplines into an effective work team. It requires far more than simply constructing a project organization chart. At a minimum, it requires defining the reporting relationships, responsibilities, lines of control, and information needs. Supporting skills in the area of planning, communication, and conflict resolution are particularly helpful. A good project plan and a task matrix are useful organizational tools. In addition, the organizational effort is facilitated by clearly defined project objectives, open communication channels, good project leadership, and senior management support.

7. *Entrepreneurial Skills:*

The Project Manager also needs a general management perspective. For example, economic considerations are one important area that normally affects the organization's financial performance. However, objectives often are much broader than profits. Customer satisfaction, future growth, cultivation of related market activities, and minimum organizational disruptions of other projects might be equally important goals. The effective Project Manager is concerned with all these issues. Entrepreneurial skills are developed through actual experience. However, formal training (MBA type), special seminars, and cross-functional training projects can help to develop the entrepreneurial skills needed by Project Managers.

8. *Administrative Skills:*

Administrative skills are essential. The Project Manager must be experienced in planning, staffing, budgeting, scheduling, and other control techniques. In dealing with technical personnel, the problem is seldom to make people understand administrative techniques such as budgeting and scheduling, but to impress on them that costs and schedules are just as important as elegant technical solutions.

Particularly on larger projects, managers rarely have all the administrative skills required. While it is important that Project Managers understand the company's operating procedures and available tools, it is often necessary for the program manager to free him/her from administrative details regardless of his/her ability to handle them. He/she has to delegate considerable administrative tasks to support groups or hire a project administrator.

Some helpful tools for the manager in the administration of his project include:

- The meeting
- The report
- The review
- The budget and schedule controls

Project Managers must be thoroughly familiar with these available tools and know how to use them effectively.

9. *Management Support Building Skills:*

The Project Manager is surrounded by a myriad of organizations that either support them or control their activities. An understanding of these interfaces is important to Project Managers as it enhances their ability to build favorable relationships with senior management. Management support is often an absolute necessity for dealing effectively with interface groups. Project organizations are shared power systems with personnel of many diverse interests and "ways of doing things." These power systems have a tendency toward imbalance. Only a strong leader backed by senior management can prevent the development of unfavorable biases.

Four key variables influence the project manager's ability to create favorable relationships with senior management. These are:

1. Their ongoing credibility
2. The visibility of their project
3. The priority of the project relative to other organizational undertakings
4. Their own accessibility

All these factors are interrelated and can be developed by the individual manager. Furthermore, senior management can aid such development significantly.

10. *Resource Allocation Skills:*

A project organization has many bosses. Functional lines often shield support organizations from direct financial control by the project office. Once a task has been authorized, it is often impossible to control the personnel assignments, priorities, and indirect manpower costs. In addition, profit accountability is difficult owing to the interdependencies of various support departments and the often changing work scope and contents.

Effective and detailed project planning may facilitate commitment and reinforce control. Part of the plan is the "Statement of Work," which establishes a basis for resource allocation. It is also important to work out specific agreements with all key contributors and their superiors on the tasks to be performed and the associated budgets and schedules. Measurable milestones are not only important for hardware components, but also for the "invisible" project components such as systems and software tasks. Ideally, these commitments on specifications, schedules, and budgets should be established through involvement by key personnel in the early phases of project formation, such as the proposal phase. This is the time when requirements are still flexible, and trade-offs among performance, schedule, and budget parameters are possible.

6.2 Functional Manager versus Project Manager:

Assuming that the Project and Functional Managers is not the same person, we can identify a specific role for the Functional Manager. There are the following elements to this role:

- The Functional Manager has the responsibility to define *how* the task will be done and *where* the task will be done (i.e., the technical criteria).
- The Functional Manager has the responsibility to provide sufficient resources to accomplish the objective within the project's constraints (i.e., *who* will get the job done).
- The Functional Manager has the responsibility for the deliverable.

The major responsibility of the Project Manager is planning. If project planning is performed correctly, then it is conceivable that the Project Manager will work himself out of a job because the project can run itself. As the architect of the project plan, the Project Manager must provide:

- Complete task definitions
- Resource requirement definitions (possibly skill levels)
- Major timetable milestones
- Definition of end item quality and reliability requirements
- The basis for performance measurement

These factors, if properly established, result in:

- Assurance that functional units will understand their total responsibilities toward achieving project needs.
- Assurance that problems resulting from scheduling and allocation of critical resources are known beforehand.
- Early identification of problems that may jeopardize successful project completion so that effective corrective action and re-planning can be done to prevent or resolve the problems.

Project Manager are responsible for project administration and, therefore, must have the right to establish their own policies, procedures, rules, guidelines, and directives – provided these policies, guidelines etc. conform to overall company policy. Companies with mature project management structures usually have rather loose company guidelines, so project managers have some degree of flexibility in how to control their projects.

6.3 Selecting the Project Manager:

Probably the most difficult decision facing upper level management is the selection of Project Manager. Some Managers work best on long-duration projects where decision making can be slow; others may thrive on short-duration projects that can result in a constant pressure environment.

The new individual is apt to make the same mistakes the veteran made. However, executives cannot always go with the seasoned veterans without creating frustrating career path opportunities for the younger personnel. Project Manager selection is a general management responsibility:

- A Project Manager is given license to cut across several organizational lines. His activities, therefore, take on a flavor of general management, and must be done well.
- Project management will not succeed without good Project Managers. Thus, if general management sees fit to establish a project, it should certainly see fit to select a good man as its leader.
- A Project Manager is far more likely to accomplish desired goals if it is obvious that general management has selected and appointed him.

The selection process for Project Manager is not an easy one. Five basic questions must be considered:

1. What are the internal and external sources?
2. How do we select?
3. How do we provide career development in project management?
4. How can we develop project management skills?
5. How do we evaluate project management performance?

Project management cannot succeed unless a good Project Manager is at the controls. The selection process is an upper level management responsibility because the Project Manager is delegated the authority of the general manager to cut across organizational lines in order to accomplish the desired objectives successfully. It is far more likely that Project Manager will succeed if it is obvious to the subordinates that the general manager has appointed them. Usually, a brief memo to the line managers will suffice.

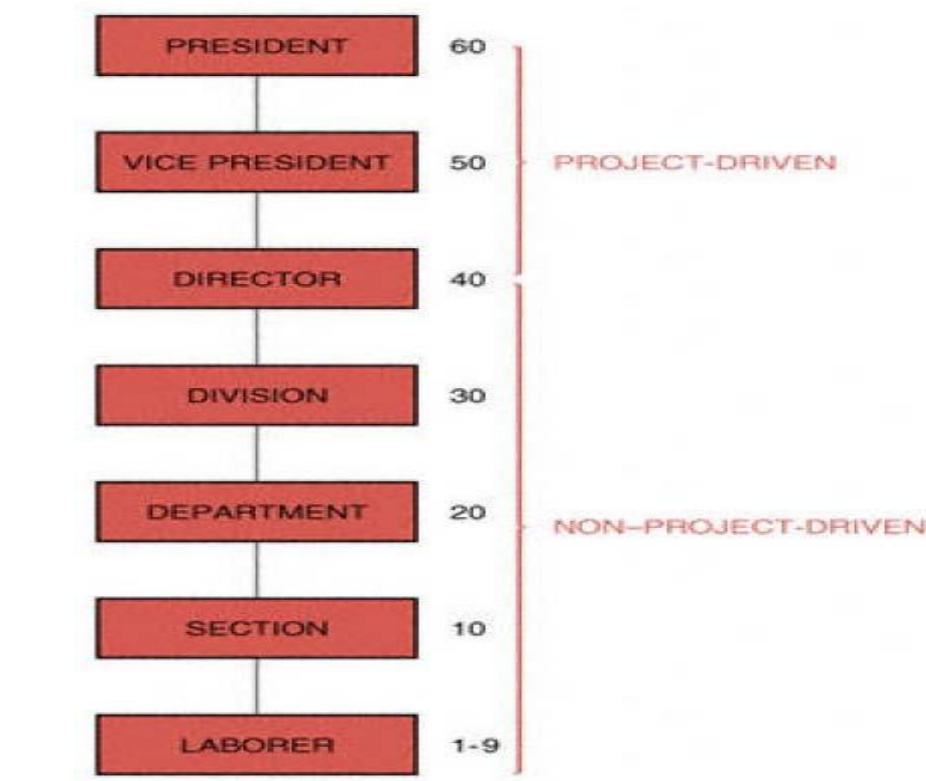


Figure 6.1: Organizational hierarchy

6.5 Duties and Job Descriptions:

Since projects, environments, and organizations differ from company to company as well as project to project, it is not unusual for companies to struggle to provide reasonable job descriptions of the Project Manager and associated personnel. Below is a simple list identifying the duties of a project manager in the construction industry.

6.5.1 Planning:

- Become completely familiar with all contract documents.
- Develop the basic plan for executing and controlling the project.
- Direct the preparation of project procedures.
- Direct the preparation of the project budget.

- Direct the preparation of the project schedule.
- Direct the preparation of basic project design criteria and general specifications.
- Direct the preparation of the plan for organizing, executing, and controlling field construction activities.
- Review plans and procedures periodically and institute changes if necessary.

6.5.2 Organizing:

- Develop organization chart for project.
- Review project position descriptions, outlining duties, responsibilities, and restrictions for key project supervisors.
- Participate in the selection of key project supervisors.
- Develop project manpower requirements.
- Continually review project organization and recommend changes in organizational structure and personnel, if necessary.

6.5.3 Directing:

- Direct all work on the project that is required to meet contract obligations.
- Develop and maintain a system for decision making within the project team whereby decisions are made at the proper level.
- Promote the growth of key project supervisors.
- Establish objectives for Project Manager and performance goals for key Project Supervisors.
- Foster and develop a spirit of project team effort.
- Assist in resolution of differences or problems between departments or groups on assigned projects.
- Anticipate and avoid or minimize potential problems by maintaining current knowledge of overall project status.

6.5.4 Controlling:

- Monitor project activities for compliance with company purpose and philosophy and general corporate policies.
- Interpret, communicate, and require compliance with the contract, the approved plan, project procedures, and directives of the client.
- Maintain personal control of adherence to contract warranty and guarantee provisions.
- Closely monitor project activities for conformity to contract scope provisions. Establish change notice procedure to evaluate and communicate scope changes.
- Maintain effective communications with the client and all groups performing project work.

6.6 Next Generation Project Managers:

The skills needed to be an effective, twenty-first century Project Manager have changed from those needed during the 1980s. Historically, only engineers were given the opportunity to become Project Managers. The belief was that the Project Manager had to have a command of technology in order to make all of the technical decisions. As project management began to grow and as projects became larger and more complex, it became obvious that Project Managers might need simply an understanding rather than a command of technology. This trend will become even more pronounced in the twenty-first century.

The primary skills needed to be an effective project manager in the this century will be:

- Knowledge of the business
- Risk management
- Integration skills

The critical skill is risk management. However, to perform risk management effectively, a sound knowledge of the business is required. Figure 6.2 below shows the changes in project management skills needed between 1985 and 2000. Training in these business skills is on the increase.

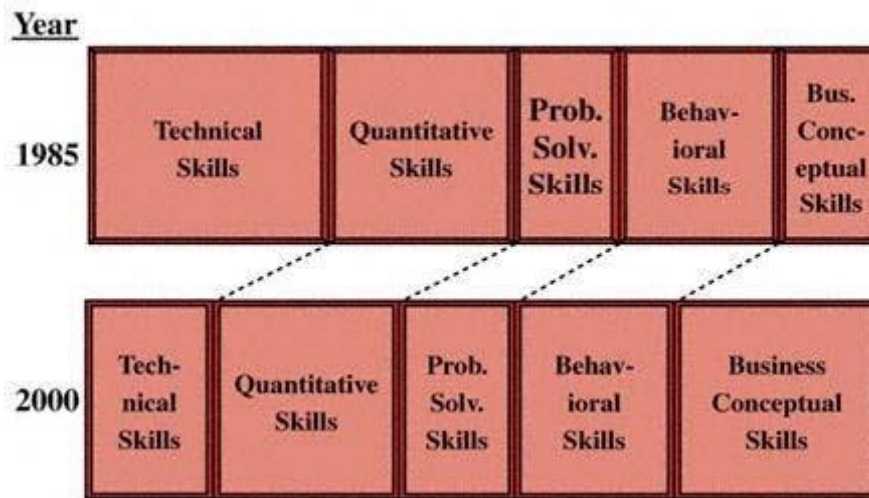


Figure 6.2: Project Management Skills

6.7 Table: Methods and Techniques for Developing Project Managers:

I. Experiential training/on-the-job

- Working with experienced professional leader
- Working with project team member
- Assigning a variety of project management responsibilities, consecutively
- Job rotation
- Formal on-the-job training
- Supporting multifunctional activities
- Customer liaison activities

II. Conceptual training/schooling

- Courses, seminars, workshops
- Simulations, games, cases
- Group exercises
- Hands-on exercises in using project management techniques
- Professional meetings
- Conventions, symposia
- Readings, books, trade journals, professional magazines

III. Organizational development

- Formally established and recognized project management function
- Proper project organization
- Project support systems
- Project charter
- Project management directives, policies, and procedures.

THE PROJECT MANAGER (CONTD.)

Broad Contents

Successful Project Manager
Role of Project Manager
Project Champions
Project Manager's Power/ Authority
Functional and Project Organizations

7.1 Successful Project Manager:

A good project management methodology provides a framework with repeatable processes, guidelines, and techniques to greatly increase the odds of success, and therefore, provides value to the project and the Project Manager. However, it should be understood up front that project management is not totally a science, and there is never a guarantee of success. Just the fact that a Project Manager is using a methodology increases the odds of project success. Successful project management is strongly dependent on:

- A good daily working relationship between the Project Manager and those line managers who directly assign resources to projects.
- The ability of functional employees to report vertically to their line manager at the same time that they report horizontally to one or more Project Managers.

These two items become critical. In the first item, functional employees who are assigned to a Project Manager still take technical direction from their line managers. Second, employees who report to multiple managers will always favor the managers who control their purse strings. Thus, most Project Managers appear always to be at the mercy of the line managers.

Classical management has often been defined as a process in which the manager does not necessarily perform things for himself, but accomplishes objectives through others in a group situation. This basic definition also applies to the Project Manager. In addition, a Project Manager must help himself. There is nobody else to help him.

If we take a close look at project management, we will see that the Project Manager actually works for the line managers, not vice versa. Many executives do not realize this. They have a tendency to put a halo around the head of the Project Manager and give him a bonus at project termination, when, in fact, the credit should really go to the line managers, who are continually pressured to make better use of their resources. The Project Manager is simply the agent through whom this is accomplished. So why do some companies glorify the project management position?

7.2 Role of the Project Manager:

A Project Manager is the person who has the overall responsibility for the successful planning and execution of a project. This title is used in the construction industry, architecture, information technology and many different occupations that are based on production of a product or service.

The Project Manager must possess a combination of skills including an ability to ask penetrating questions, detect unstated assumptions and resolve interpersonal conflicts as well as more systematic management skills.

Key amongst his/her duties is the recognition that risk directly impacts the likelihood of success and that this risk must be both formally and informally measured throughout the lifetime of the project.

Risk arises primarily from uncertainty and the successful Project Manager is the one who focuses upon this as the main concern. Most of the issues that impact a project arise in one way or another from risk. A good Project Manager can reduce risk significantly, often by adhering to a policy of open communication, ensuring that every significant participant has an opportunity to express opinions and concerns.

It follows from the above that a Project Manager is one who is responsible for making decisions both large and small, in such a way that risk is controlled and uncertainty minimized. Every decision taken by the Project Manager should be taken in such a way that it directly benefits the project.

Project Managers use project management software, such as Microsoft Project, to organize their tasks and workforce. These software packages allow Project Managers to produce reports and charts in a few minutes, compared to the several hours it can take if they do not use a software package.

7.3 Roles and Responsibilities of Project Manager:

The role of the Project Manager encompasses many activities including:

- Planning and defining scope
- Activity planning and sequencing
- Resource planning
- Developing schedules
- Time estimating
- Cost estimating
- Developing a budget
- Controlling quality
- Managing risks and issues
- Creating charts and schedules
- Risk analysis
- Benefits realization
- Scalability, interoperability and portability analysis
- Documentation
- Team leadership
- Strategic influencing
- Customer liaison

To illustrate the role of the Project Manager, consider the time, cost, and performance constraints shown in the Figure 7.1 below. Many functional managers, if left alone, would recognize only the performance constraint: "Just give me another \$50,000 and two more months, and I will give you the ideal technology."

The Project Manager, as part of these communicating, coordinating, and integrating responsibilities, reminds the line managers that there are also time and cost constraints on the project. This is the starting point for better resource control.



Figure 7.1: Overview of Project Management

Success in project management is like a three-legged stool. The first leg is the Project Manager, the second leg is the line manager, and the third leg is senior management. If any of the three legs fail, then even delicate balancing may not prevent the stool from toppling down.

The critical node in project management is the Project Manager–Line Manager interface. At this interface, the project and line managers must view each other as equals and be willing to share authority, responsibility, and accountability. In excellently managed companies, Project Managers do not negotiate for resources but simply ask for the line manager's commitment to executing his portion of the work within time, cost, and performance. Therefore, in excellent companies, it should not matter who the line manager assigns as long as the line manager lives up to his commitments.

Since the project and line managers are "equals," senior management involvement is necessary to provide advice and guidance to the Project Manager, as well as to provide encouragement to the line managers to keep their promises. When executives act in this capacity, they assume the role of project sponsors, as shown in Figure 7.2 below, which also shows that sponsorship need not always be at the executive levels. The exact person appointed as the project sponsor is based on the dollar value of the project, the priority of the project, and who the customer is.

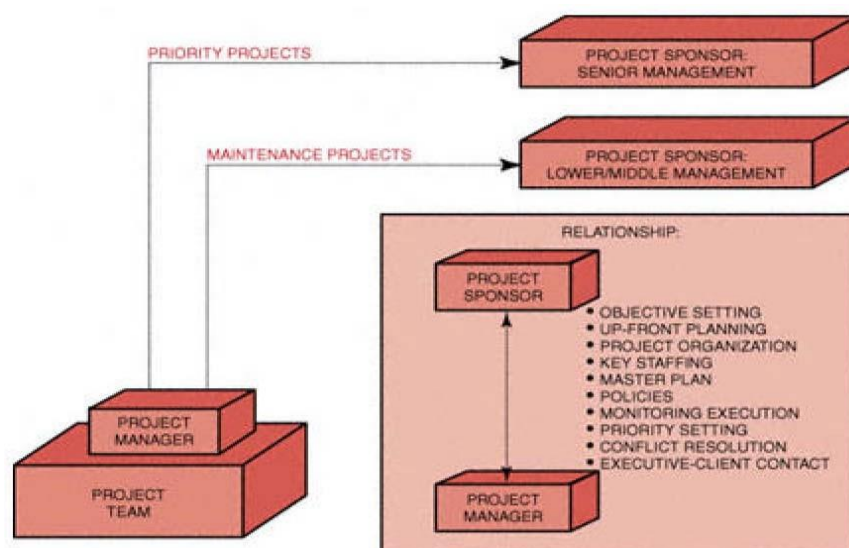


Figure 7.2: The project sponsor interface

The ultimate objective of the project sponsor is to provide behind-the-scenes assistance to project personnel for projects both "internal" to the company, as well as "external," as shown in Figure 7.2 above.

Projects can still be successful without this commitment and support, as long as all work flows smoothly. But in time of crisis, having a "big brother" available as a possible sounding board will surely help.

When an executive is required to act as a project sponsor, then the executive has the responsibility to make effective and timely project decisions. To accomplish this, the executive needs timely, accurate, and complete data for such decisions. The Project Manager must be made to realize that keeping management informed serves this purpose, and that the all-too-common practice of "stonewalling" will prevent an executive from making effective decisions related to the project.

The line manager has to cope with:

- Unlimited work requests (especially during competitive bidding)
- Predetermined deadlines
- All requests having a high priority
- Limited number of resources
- Limited availability of resources
- Unscheduled changes in the project plan
- Unpredicted lack of progress
- Unplanned absence of resources
- Unplanned breakdown of resources
- Unplanned loss of resources
- Unplanned turnover of personnel

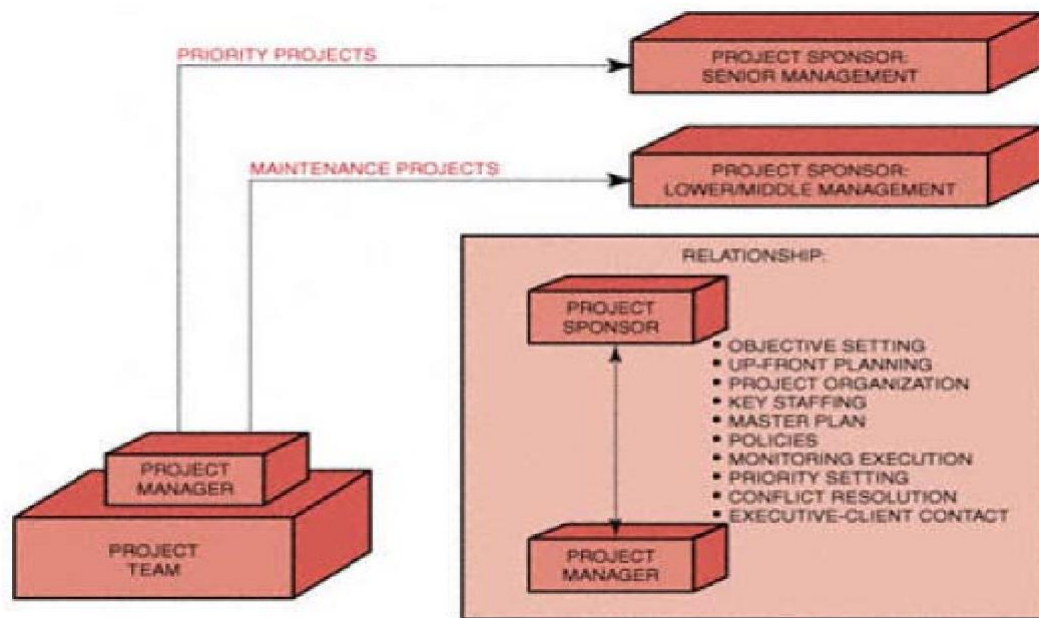


Figure 7.3: Negotiating activities of System Management

The difficulty in staffing, especially for Project Managers or Assistant Project Managers, is in determining what questions to ask during an interview to see if an individual has the necessary or desired characteristics. There are numerous situations in which individuals are qualified to be promoted vertically but not horizontally. An individual with poor communication skills and

interpersonal skills can be promoted to a line management slot because of his technical expertise, but this same individual is not qualified for project management promotion.

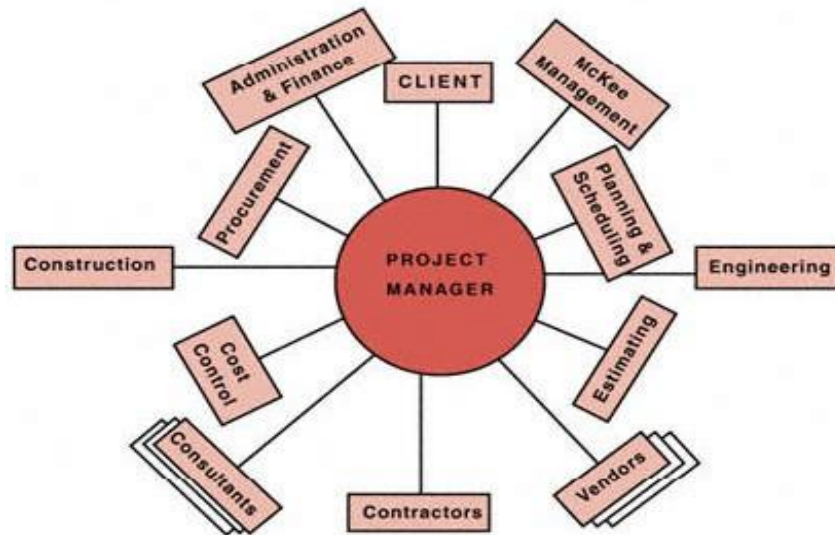


Figure 7.4: Managing the Project

Most executives have found that the best way to interview is by reading each element of the job description to the potential candidate. Many individuals want a career path in project management but are totally unaware of what the Project Manager's duties are.

So far we have discussed the personal characteristics of the Project Manager. There are also job related questions to consider, such as:

- Are feasibility and economic analyses necessary?
- Is complex technical expertise required? If so, is it within the individual's capabilities?
- If the individual is lacking expertise, will there be sufficient backup strength in the line organizations?
- Is this the company's or the individual's first exposure to this type of project and/or client? If so, what are the risks to be considered?
- What is the priority for this project, and what are the risks?
- With whom must the Project Manager interface, both inside and outside the organization?

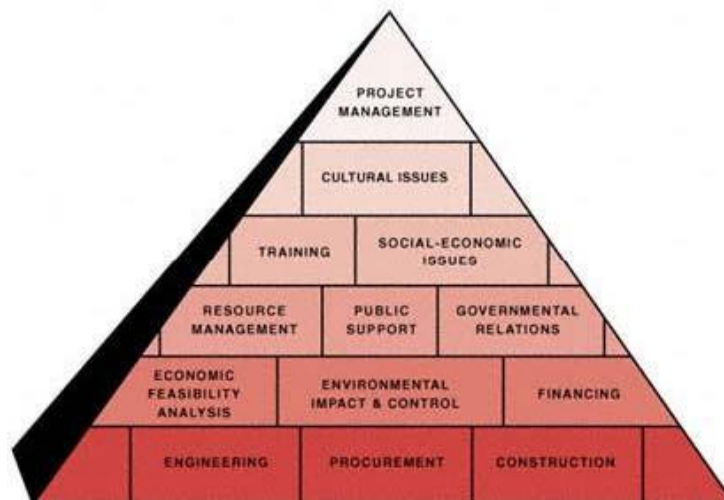


Figure 7.5: Project management responsibilities

Most good Project Managers generally know how to perform feasibility studies and cost-benefit analyses. Sometimes this capability can create organizational conflict. A major utility company begins each computer project with a feasibility study in which a cost-benefit analysis is performed.

The Project Managers, all of whom report to a project management division, perform the study themselves without any direct functional support. The functional managers argue that the results are grossly inaccurate because the functional experts are not involved. The Project Manager, on the other hand, argues that they never have sufficient time or money to perform a complete analysis.

There are also good reasons for recruiting from outside the company. A new Project Manager hired from the outside would be less likely to have strong informal ties to any one line organization and thus, could show impartiality on the project. Some companies further require that the individual spend an apprenticeship period of twelve to eighteen months in a line organization to find out how the company functions, to become acquainted with some of the people, and to understand the company's policies and procedures.

One of the most important but often least understood characteristics of good Project Managers is their ability to understand and know both themselves and their employees in terms of strengths and weaknesses.

7.4 Project Champions:

Corporations encourage employees to think up new ideas that, if approved by the corporation, will generate monetary and non-monetary rewards for the idea generator. One such reward is to identify the individual as a "*Project Champion*". Unfortunately, all too often the Project Champion becomes the Project Manager, and, although the idea was technically sounds, the project fails.

Project Managers	Project Champions
• Prefer to work in groups	• Prefer working individually
• Committed to their managerial and technical responsibilities	• Committed to technology
• Committed to the corporation	• Committed to the profession
• Seek to achieve the objective	• Seek to exceed the objective
• Are willing to take risks	• Are unwilling to take risks; try to test everything
• Seek what is possible	• Seek perfection
• Think in terms of short time spans	• Think in terms of long time spans
• Manage people	• Manage things
• Are committed to and pursue material values	• Are committed to and pursue intellectual values

Table 7.1: Project Managers versus Project Champions

7.5 Power and Authority of Project Manager:

One form of the Project Manager's authority can be defined as the legal or rightful power to command, act, or direct the activities of others. The breakdown of the Project Manager's authority is shown in Figure 7.6 below. Authority can be delegated from one's superiors. Power,

on the other hand, is granted to an individual by his subordinates and is a measure of their respect for him. A manager's authority is a combination of his power and influence such that subordinates, peers, and associates willingly accept his judgment.

In the traditional structure, the power spectrum is realized through the hierarchy, whereas in the project structure, power comes from credibility, expertise, or being a sound decision-maker. Authority is the key to the project management process. The Project Manager must manage across functional and organizational lines by bringing together activities required to accomplish the objectives of a specific project. Project authority provides the way of thinking required to unify all organizational activities toward accomplishment of the project regardless of where they are located.

The Project Manager who fails to build and maintain his alliances will soon find opposition or indifference to his project requirements.

The amount of authority granted to the Project Manager varies according to project size, management philosophy, and management interpretation of potential conflicts with functional managers. There do exist, however, certain fundamental elements over which the Project Manager must have authority in order to maintain effective control.

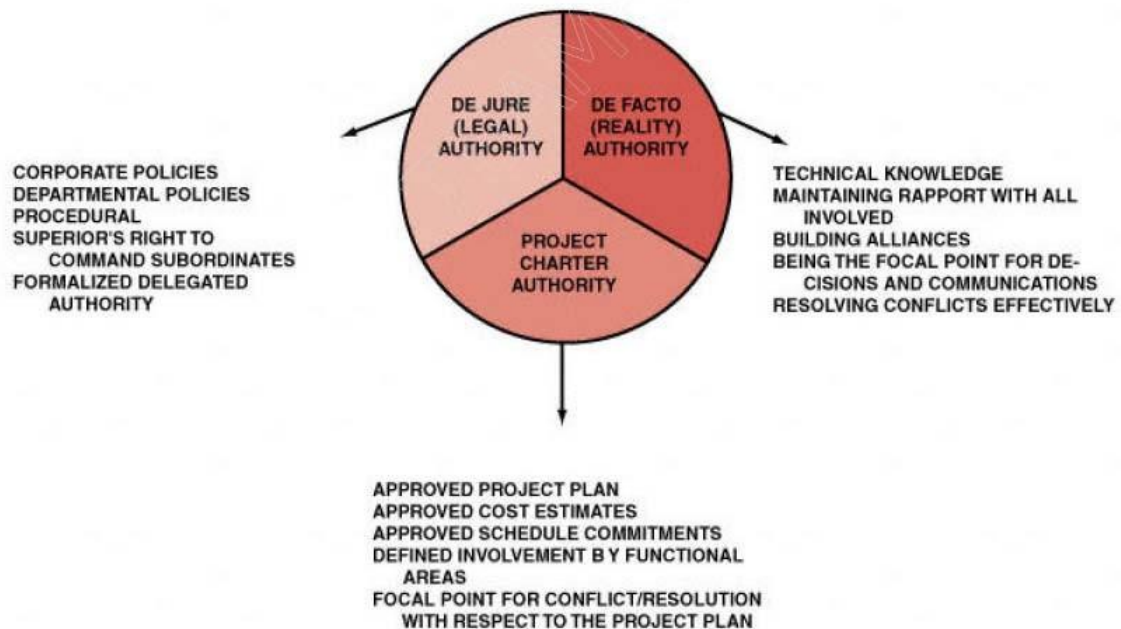


Figure 7.6: Project Authority Breakdown

Generally speaking, a project manager should have more authority than his responsibility calls for, the exact amount of authority usually depending on the amount of risk that the Project Manager must take. The greater the risk, the greater the amount of authority is. A good Project Manager knows where his authority ends and does not hold an employee responsible for duties that he (the Project Manager) does not have the authority to enforce. Some projects are directed by Project Managers who have only monitoring authority. These Project Managers are referred to as influence Project Managers.

Failure to establish authority relationships can result in:

- Poor communication channels
- Misleading information
- Antagonism, especially from the informal organization
- Poor working relationships with superiors, subordinates, peers, and associates
- Surprises for the customer

The following are the most common sources of power and authority problems in a project environment:

- Poorly documented or no formal authority
- Power and authority perceived incorrectly
- Dual accountability of personnel
- Two bosses (who often disagree)
- The project organization encouraging individualism
- Subordinate relations stronger than peer or superior relationships
- Shifting of personnel loyalties from vertical to horizontal lines
- Group decision making based on the strongest group
- Ability to influence or administer rewards and punishment
- Sharing resources among several projects

The project management organizational structure is an arena of continuous conflict and negotiation. Although there are many clearly defined authority boundaries between functional and project management responsibilities, the fact that each project can be inherently different from all others almost always creates new areas where authority negotiations are necessary.

Certain ground rules exist for authority control through negotiations. Negotiations should take place at the lowest level of interaction.

Definition of the problem must be the first priority. This should include:

- The issue
- The impact
- The alternative
- The recommendations

Higher-level authority should be used if, and only if, agreement cannot be reached.

7.6 Functional and Project Organizations:

Functional organization is structure in which authority rests with the functional heads; the structure is sectioned by departmental groups.

7.6.1 Advantages of Functional Structure:

- Simple and clear; coordination left to top management
- Reduces overhead
- Provides clearly marked career paths for hiring and promotion
- Employees work alongside colleagues who share similar interests

7.6.2 Disadvantages of Functional Structure:

- Coordination of functional tasks is difficult; little reward for cooperation with other groups since authority resides with functional supervisor.
- Provides scope for different department heads to pass-off company project failures as being due to the failures of other departments.

7.6.3 Matrix Organizations:

Most organizations fall somewhere between the fully functional and fully projectized organizational structure. These are *matrix organizations*. Three points along the organizational continuum have been defined.

1. **Weak/Functional Matrix:**
A Project Manager (often called a project administrator under this type of organization) with only limited authority is assigned to oversee the cross-functional aspects of the project. The functional managers maintain control over their resources and project areas. The project administrator's role is to enhance communication between functional managers and track overall project progress.
2. **Balanced/Functional Matrix:**
A Project Manager is assigned to oversee the project. Power is shared equally between the Project Manager and the functional managers. Proponents of this structure believe it strikes the correct balance, bringing forth the best aspects of functional and projectized organizations. However, this is the most difficult system to maintain as the sharing of power is a very delicate proposition. This is also the most complex organizational structure to maintain.
3. **Strong/Project Matrix:**
A Project Manager is primarily responsible for the project. Functional managers provide technical expertise and assign resources on an as-needed basis. Because project resources are assigned as necessary, there can be conflicts between the Project Manager and the functional manager over resource assignment. The functional manager has to staff multiple projects with the same experts.
4. **Soft boundaries Matrix:**
A fourth organization type is the "soft boundaries matrix". In this the functional team members provide technical expertise and assign resources on an as-needed basis. Because project resources are assigned as necessary there is no need for Project Managers or a functional manager over resource assignment.

PROJECT CONCEPTION AND PROJECT FEASIBILITY

Broad Contents

Project Conception
Stages of Project Conception
What is Feasibility Assessment?
Types of Feasibility
Tangible and Intangible Benefits

8.1 Project Conception:

Conception of an Industrial Project is the initial step in the process of defining the actual scope of a project. Project conception generally starts with a manifestation of a requirement or an opportunity that will benefit the corporate interests, and culminates when one or more preliminary options have been formulated which will, theoretically, satisfy the company's expectations as originally presented.

The process presented here although illustrated by an industrial project has features directly translatable to conceptual evolution in many diverse applications. The fact that the project in question has been deferred is not uncharacteristic of the fate of many programs during the conceptual phase.

8.2 Stages of Project Conception:

Initial conceptualization of a project has various degrees of complexity, depending on the nature of the specific project and the particular analysis and approval procedures used by a company.

The company's planning strategy may require formulations of programs involving several projects. Conception of the overall program should then precede conception of the individual specific projects.

The conceptual stage involves the following activities:

1. Definition of a requirement or an opportunity that commands the interests of the company.
2. Formulation of a set of preliminary alternatives capable of fulfilling the initial requirement.
3. Selection of alternative(s) that might satisfy the requirements in terms and conditions attractive to the company.

A brief description of each of these activities in a specific situation and in an organized environment follows:

1. Definition of the Requirement of Opportunity:

The continuity of efficient operations and the opening of the new business areas are the main drives for capital investments for industrial firms. Investment opportunities are detected through operational analysis of current performance and by forecasts of the most likely future scenarios.

Initially, the scope of any new investment is likely to be vague. Subsequent definition involves consideration of all available relevant facts, required resource sand constraints associated with the original idea.

Proj Initiation

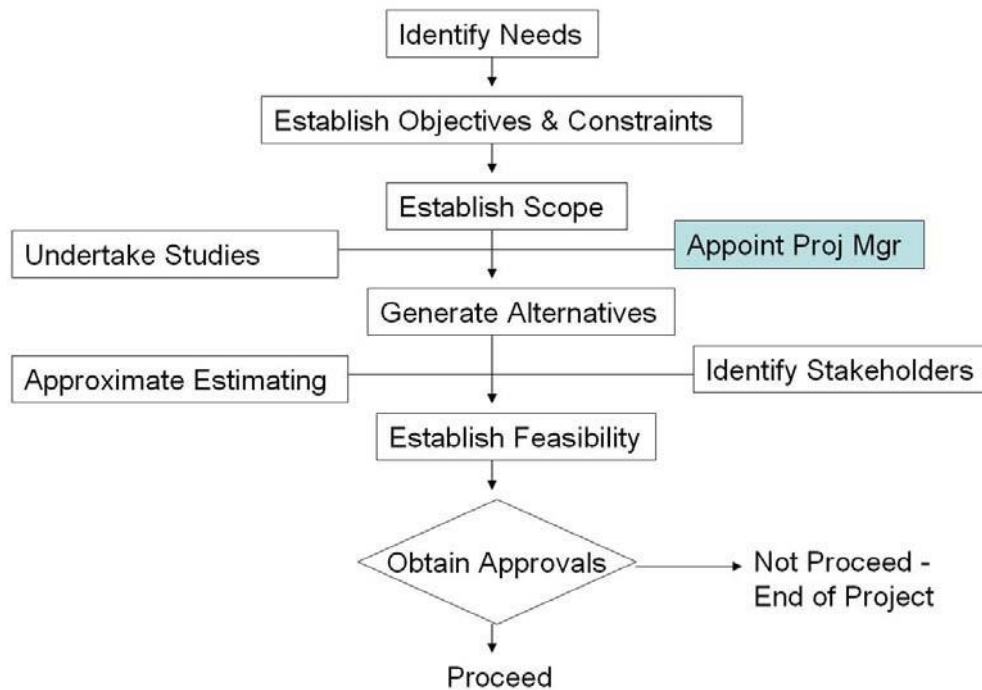


Figure 8.1: Project Initiation

2. Preliminary Formulation of the Alternatives:

Project conception continues with development of alternatives capable of fulfilling the expressed objectives. The preliminary formulation of alternatives is important as it sets the pace of the subsequent definition and elaboration of the project scope. During this phase, the company calls upon the experience and creativity of its technicians, manager and directors to generate an adequate group of alternatives to fulfill the expressed need.

3. Initial Selection of Alternatives:

After the alternatives have been identified, comparative analyses are made in order to select the most beneficial and to reject the least attractive. The selection process employs a basic feasibility analysis of each alternative the establishment of criteria that will allow the identification of the most attractive options. At this point, further consideration of the rejected alternative is terminated along with the need to prepare elaborate definitions for them.

The cost, schedule, profitability, and other salient advantages and disadvantages of each of the selected alternatives are assessed in terms of order of magnitude. Difference among the options is sought still without establishing precise project parameters.

8.3 Feasibility Analysis:

A feasibility study is an analytical tool used during the project planning process, shows how a business would operate under an explicitly stated set of assumptions. These assumptions include the technology used (the facilities, types of equipment, manufacturing process, etc.) and the financial aspects of the project (capital needs, volume, cost of goods, wages etc.).

8.4 What is Feasibility Assessment?

As the name implies, a feasibility study is an analysis of the viability of an idea. The feasibility study focuses on helping answer the essential question of “should we proceed with the proposed project idea?” All activities of the study are directed toward helping answer this question.

Feasibility studies can be used in many ways but primarily focus on proposed business ventures. Farmers and others with a business idea should conduct a feasibility study to determine the viability of their idea before proceeding with the development of the business. Determining early on that a business idea will not work saves time, money and heartache later.

A feasible business venture is one where the business will generate adequate cash flow and profits, withstand the risks it will encounter, remain viable in the long-term and meet the goals of the founders. The venture can be a new start-up business, the purchase of an existing business, an expansion of current business operations or a new enterprise for an existing business. Information file, a feasibility study outline is provided to give guidance on how to proceed with the study and what to include. Also, information file, how to use and when to do a feasibility study helps through the process and also to get the most out of the study.

A feasibility study is only one step in the business idea assessment and business development process. Reviewing this process and reading the information below will help put the role of the feasibility study in perspective.

A feasibility study is usually conducted after producers have discussed a series of business ideas or scenarios. The feasibility study helps to “frame” and “flesh-out” specific business alternatives so they can be studied in-depth. During this process the number of business alternatives under consideration is usually quickly reduced.

During the feasibility process you may investigate a variety of ways of organizing the business and positioning your product in the marketplace. It is like an exploratory journey and you may take several paths before you reach your destination. Just because the initial analysis is negative does not mean that the proposal does not have merit if organized in a different fashion or if there are market conditions that need to change for the idea to be viable. Sometimes limitations or flaws in the proposal can be corrected.

A pre-feasibility study may be conducted first to help sort out relevant alternatives. Before proceeding with a full-blown feasibility study, you may want to do some pre-feasibility analysis of your own. If you find out early on that the proposed business idea is not feasible, it will save you time and money.

However, if the findings lead you to proceed with the feasibility study, your work may have resolved some basic issues. A consultant may help you with the pre-feasibility study, but you should be involved. This is an opportunity for you to understand the issues of business development.

A market assessment may be conducted to help determine the viability of a proposed product in the marketplace. The market assessment will help you identify opportunities in a market or market segment. If no opportunities are found, there may be no reason to proceed with a feasibility study. If opportunities are found, the market assessment can give focus and direction to the construction of business alternatives to investigate in the feasibility study. A market assessment will provide much of the information for the marketing section of the feasibility study.

The conclusions of the feasibility study should outline in depth the various alternatives examined and the implications and strengths and weaknesses of each. The project leaders need

to study the feasibility study and challenge its underlying assumptions. This is the time to be skeptical.

Do not expect one alternative to “jump off the page” as being the best one. Feasibility studies do not suddenly become positive or negative. As you accumulate information and investigate alternatives, neither a positive nor negative outcome may emerge. The decision of whether to proceed often is not clear-cut. Major stumbling blocks may emerge that negate the project. Sometimes these weaknesses can be overcome. Rarely does the analysis come out overwhelmingly positive. The study will help you assess the tradeoff between the risks and rewards of moving forward with the business project.

Remember, it is not the purpose of the feasibility study or the role of the consultant to decide whether or not to proceed with a business idea; it is the role of the project leaders.

The go/no-go decision is one of the most critical in business development. It is the point of no return. Once you have definitely decided to pursue a business venture, there is usually no turning back. The feasibility study will be a major information source in making this decision. This indicates the importance of a properly developed feasibility study.

A feasibility study is not a business plan. The separate roles of the feasibility study and the business plan are frequently misunderstood. The feasibility study provides an investigating function. It addresses the question of “Is this a viable business venture?” The business plan provides a planning function. The business plan outlines the actions needed to take the proposal from “idea” to “reality.”

The feasibility study outlines and analyzes several alternatives or methods of achieving business success. So, the feasibility study helps to narrow the scope of the project to identify the best business model. The business plan deals with only one alternative or model. The feasibility study helps to narrow the scope of the project to identify and define two or three scenarios or alternatives. The consultant conducting the feasibility study may work with the group to identify the “best” alternative for their situation. This becomes the basis for the business plan.

The feasibility study is conducted before the business plan. A business plan is prepared only after the business venture has been deemed to be feasible. If a proposed business venture is considered to be feasible, then a business plan constructed that provides a “roadmap” of how the business will be created and developed. The business plan provides the “blueprint” for project implementation. If the venture is deemed not to be feasible, efforts may be made to correct its deficiencies, other alternatives may be explored, or the idea is dropped.

Project leaders may find themselves under pressure to skip the “feasibility analysis” step and go directly to building a business. Individuals from within and outside of the project may push to skip this step.

Reasons given for not doing feasibility analysis include:

- We know it is feasible. An existing business is already doing it.
- Why do another feasibility study when one was done just a few years ago?
- Feasibility studies are just a way for consultants to make money.
- The feasibility analysis has already been done by the business that is going to sell us the equipment.
- Why not just hire a general manager who can do the study?
- Feasibility studies are a waste of time. We need to buy the building, tie up the site and bid on the equipment.

The reasons given above should not dissuade you from conducting a meaningful and accurate feasibility study. Once decisions have been made about proceeding with a proposed business, they are often very difficult to change. You may need to live with these decisions for a long time.

From a financial perspective, project selection is basically a two -part process. First, the organization will conduct a feasibility study to determine whether the project *can* be done. The second part is to perform a benefit-to-cost analysis to see whether the company *should* do it. The purpose of the feasibility study is to validate that the project meets feasibility of cost, technological, safety, marketability, and ease of execution requirements. It is possible for the company to use outside consultants or Subject Matter Experts (SMEs) to assist in both feasibility studies and benefit-to-cost analyses. A project manager may not be assigned until after the feasibility study is completed.

As part of the feasibility process during project selection, senior management often solicits input from Subject Matter Experts (SMEs) and lower level managers through rating models. The rating models normally identify the business and/or technical criteria against which the ratings will be made. Once feasibility is determined, a benefit-to-cost analysis is performed to validate that the project will, if executed correctly, provide the required financial and non-financial benefits. Benefit-to-cost analyses require significantly more information to be scrutinized than is usually available during a feasibility study. This can be an expensive proposition.

8.5 Types of Feasibility:

Feasibility is of the following types:

1. **Technical Feasibility:**

This area reviews the engineering feasibility of the project, including structural, civil and other relevant engineering aspects necessitated by the project design. The technical capabilities of the personnel as well as the capability of the projected technologies to be used in the project are considered. In some instances, particularly when projects are in third world countries, technology transfer between geographical areas and cultures needs to be analyzed to understand productivity loss (or gain) and other implications due to differences in topography, geography, fuels availability, infrastructure support and other issues.

2. **Managerial Feasibility:**

Demonstrated management capability and availability, employee involvement, and commitment are key elements required to ascertain managerial feasibility. This addresses the management and organizational structure of the project, ensuring that the proponent's structure is as described in the submittal and is well suited to the type of operation undertaken.

3. **Economic Feasibility:**

This involves the feasibility of the proposed project to generate economic benefits. A benefit-cost analysis (addressing a problem or need in the manner proposed by the project compared to other, the cost of other approaches to the same or similar problem) is required. A breakeven analysis when appropriate is also a required aspect of evaluating the economic feasibility of a project. (This addresses fixed and variable costs and utilization/sales forecasts). The tangible and intangible aspects of a project should be translated into economic terms to facilitate a consistent basis for evaluation. Even when a project is non-profit in nature, economic feasibility is critical.

4. **Financial Feasibility:**
Financial feasibility should be distinguished from economic feasibility. Financial feasibility involves the capability of the project organization to raise the appropriate funds needed to implement the proposed project. In many instances, project proponents choose to have additional investors or other sources of funds for their projects. In these cases, the feasibility, soundness, sources and applications of these project funds can be an obstacle. As appropriate, loan availability, credit worthiness, equity, and loan schedule still be reviewed as aspects of financial feasibility analysis. Also included in this area are the review of implications of land purchases, leases and other estates in land.
5. **Cultural Feasibility:**
Cultural feasibility deals with the compatibility of the proposed project with the cultural environment of the project. In labor-intensive projects, planned functions must be integrated with the local cultural practices and beliefs. For example, religious beliefs may influence what an individual is willing to do or not do.
6. **Social Feasibility:**
Social feasibility addresses the influences that a proposed project may have on the social system in the project environment. The ambient social structure may be such that certain categories of workers may be in short supply or nonexistent. The effect of the project on the social status of the project participants must be assessed to ensure compatibility. It should be recognized that workers in certain industries may have certain status symbols within the society.
7. **Safety Feasibility:**
Safety feasibility is another important aspect that should be considered in project planning. Safety feasibility refers to an analysis of whether the project is capable of being implemented and operated safely with minimal adverse effects on the environment. Unfortunately, environmental impact assessment is often not adequately addressed in complex projects.
8. **Political Feasibility:**
Political considerations often dictate directions for a proposed project. This is particularly true for large projects with significant visibility that may have significant government inputs and political implications. For example, political necessity may be a source of support for a project regardless of the project's merits. On the other hand, worthy projects may face insurmountable opposition simply because of political factors. Political feasibility analysis requires an evaluation of the compatibility of project goals with the prevailing goals of the political system.
9. **Environmental Feasibility:**
Often a killer of projects through long, drawn-out approval processes and outright active opposition by those claiming environmental concerns. This is an aspect worthy of real attention in the very early stages of a project. Concern must be shown and action must be taken to address any and all environmental concerns raised or anticipated. This component also addresses the ability of the project to timely obtain and at a reasonable cost, needed permits, licenses and approvals.
10. **Market Feasibility:**
This area should not be confused with the Economic Feasibility. The market needs analysis to view the potential impacts of market demand, competitive activities, etc. and market share available. Possible competitive activities by competitors, whether local, regional, national or international, must also be analyzed for early contingency funding

and impacts on operating costs during the start-up, ramp-up, and commercial start-up phases of the project.

8.6 Tangible and Intangible Benefits:

Estimating benefits and costs in a timely manner is very difficult. Benefits are often defined as:

- Tangible benefits for which dollars may be reasonably quantified and measured.
- Intangible benefits that may be quantified in units other than dollars or may be identified and described subjectively.

Costs are significantly more difficult to quantify, at least in a timely and inexpensive manner. The minimum costs that must be determined are those that specifically are used for comparison to the benefits. These include:

- The current operating costs or the cost of operating in today's circumstances.
- Future period costs that are expected and can be planned for.
- Intangible costs that may be difficult to quantify. These costs are often omitted if quantification would contribute little to the decision-making process.

There must be careful documentation of all known constraints and assumptions that were made in developing the costs and the benefits. Unrealistic or unrecognized assumptions are often the cause of unrealistic benefits. The go or no-go decision to continue with a project could very well rest upon the validity of the assumptions.

PROJECT FEASIBILITY (CONTD.)

Broad Contents

What is a Feasibility Study?
Why is a Feasibility Study done?
What a Feasibility Study is not?
Scope of a Feasibility Study
Elements of a Feasibility Study

9.1 What is a Feasibility Study?

A feasibility study is essentially a process for determining the viability of a proposed initiative or service and providing a framework and direction for its development and delivery. It is a process for making sound decisions and setting direction. It is also a process which:

- Is driven by research and analysis
- Usually involves some form of consultation with stakeholders, community, users, etc.
- Focuses on analyzing, clarifying and resolving key issues and areas of concern or uncertainty
- Very often involves basic modeling and testing of alternative concepts and approaches

There is no universal format for a feasibility study. Feasibility studies can be adapted and shaped to meet the specific needs of any given situation.

A feasibility study is designed to provide an overview of the primary issues related to a business idea. The purpose is to identify any “make or break” issues that would prevent your business from being successful in the marketplace. In other words, a feasibility study determines whether the business idea makes sense.

A thorough feasibility analysis provides a lot of information necessary for the business plan. For example, a good market analysis is necessary in order to determine the project’s feasibility. This information provides the basis for the market section of the business plan.

Because putting together a business plan is a significant investment of time and money, you want to make sure that there are no major roadblocks facing your business idea before you make that investment. *Identifying such roadblocks is the purpose of a feasibility study.*

A feasibility study looks at three major areas:

- a) Market issues
- b) Organizational/technical issues
- c) Financial issues

Again, this is meant to be a “first cut” look at these issues. For example, a feasibility study should not do in-depth long-term financial projections, but it should do a basic break-even analysis to see how much revenue would be necessary to meet your operating expenses.

9.2 Why Do Feasibility Studies?

Developing any new business venture is difficult. Taking a project from the initial idea through the operational stage is a complex and time-consuming effort. Most ideas, whether from a

cooperative or an investor owned business, do not develop into business operations. If these ideas make it to the operational stage, most fail within the first 6 months. Before the potential members invest in a proposed business project, they must determine if it can be economically viable and then decide if investment advantages outweigh the risks involved.

Many cooperative business projects are quite expensive to conduct. The projects involve operations that differ from those of the members' individual business. Often, cooperative businesses' operations involve risks with which the members are unfamiliar. The study allows groups to preview potential project outcomes and to decide if they should continue. Although the costs of conducting a study may seem high, they are relatively minor when compared with the total project cost. The small initial expenditure on a feasibility study can help to protect larger capital investments later.

Feasibility studies are useful and valid for many kinds of projects. Evaluation of a new business ventures, both from new groups and established businesses, is the most common, but not the only usage. Studies can help groups decide to expand existing services, build or remodel facilities, change methods of operation, add new products, or even merge with another business. A feasibility study assists decision makers whenever they need to consider alternative development opportunities.

Feasibility studies permit planners to outline their ideas on paper before implementing them. This can reveal errors in project design before their implementation negatively affects the project. Applying the lessons gained from a feasibility study can significantly lower the project costs.

The study presents the risks and returns associated with the project so the prospective members can evaluate them. There is no "magic number" or correct rate of return a project needs to obtain before a group decides to proceed. The acceptable level of return and appropriate risk rate will vary for individual members depending on their personal situation.

The proposed project usually requires both risk capital from members and debt capital from banks and other financiers to become operational. Lenders typically require an objective evaluation of a project prior to investing. A feasibility study conducted by someone without a vested interest in the project outcome can provide this assessment.

General requirements and potential benefits of conducting feasibility study include:

- Developing any new business venture is difficult.
- Taking a project from initiation of idea to operational stage is a complex and time consuming effort.
- Most ideas, whether from cooperative or investor-owned businesses, do not develop into business operations.
- If these ideas make it to the operational stage, majority of them fail within first six months.
- Projects involve business operations that differ from Individual business.
- These operations involve risks of unfamiliar.
- Feasibility study allows groups developing a business idea to preview potential project outcomes and decide if they want to continue developing the project.
- Though the cost of conducting a study can seem high, almost always, these costs are relatively minor when compared to the total project cost.
- Small initial expenditure on a feasibility study by a group can help to protect larger capital investments later.
- Feasibility study is a useful tool and is valid for many kinds of projects.

9.3 What a Feasibility Study is not:

Feasibility studies are conducted on "real-world" projects. They are not academic or research papers. Simulations or projection models, though useful on some projects, do not replace a feasibility study. The study should not be a "cookie cutter" approach to a project. The study should not merely be a generic source of information. Once completed, a study should permit a group to make better decisions for the strategic issues of their specific project.

A feasibility study is not a business plan. A business plan is elaborated later in the project development process than the feasibility study. The main purpose of a business plan is to function as a blueprint for the group's business operations. The business plan presents the group's intended responses to the critical issues raised in the feasibility study. The feasibility study results forms the basis for developing a business plan.

The purpose of a feasibility study is not to identify new ideas or concepts for a project. These ideas should be clearly identified before a study is initiated. The group need accomplish a number of steps, before feasibility study is instituted. The closer the assumptions lie to the "real-world", the more value feasibility study will hold for the group.

A feasibility study should not be conducted as a forum merely to support a desire that the project will be successful. The study should be an objective evaluation of the project's chance for success. Negative results can be just as useful for decision-makers as positive results.

Financers may require a feasibility study before providing loans, but this should not be the only purpose of a study. A feasibility study should enhance a banker's ability to evaluate a project; but the primarily goal should be to aid a group's decision-making, not to secure financing.

A feasibility study will not determine whether or not a project should be undertaken. The potential members have to decide if the economic returns justify the risks involved in their continuing the project. The results of the feasibility study assist them in this.

A feasibility study serves as an analytical tool to present the basic assumptions of a project idea, shows how results vary when these assumptions change, and provides guidance as to critical elements of a project. It provides a group with project specific information to assist in making decisions. Groups using feasibility studies should lower the risks in proceeding with a project.

9.4 Scope of Feasibility Analysis:

In general terms, the elements of a feasibility analysis for a project should cover the following:

1. **Need Analysis:**

This indicates recognition of a need for the project. The need may affect the organization itself, another organization, the public, or the government. A preliminary study is then conducted to confirm and evaluate the need. A proposal of how the need may be satisfied is then made. Pertinent questions that should be asked include:

- Is the need significant enough to justify the proposed project?
- Will the need still exist by the time the project is completed?
- What are the alternate means of satisfying the need?
- What are the economic, social, environmental, and political impacts of the need?

2. **Process Work:**

This is the preliminary analysis done to determine what will be required to satisfy the need. The work may be performed by a consultant who is an expert in the project field.

The preliminary study often involves system models or prototypes. For technology oriented projects, artist's conception and scaled-down models may be used for illustrating the general characteristics of a process. A simulation of the proposed system can be carried out to predict the outcome before the actual project starts.

3. **Engineering and Design:**

This involves a detailed technical study of the proposed project. Written quotations are obtained from suppliers and subcontractors as needed. Technology capabilities are evaluated as needed. Product design, if needed, should be done at this time.

4. **Cost Estimate:**

This involves estimating project cost to an acceptable level of accuracy. Levels of around -5% to +15% are common at this level of a project plan. Both the initial and operating costs are included in the cost estimation. Estimates of capital investment and of recurring and nonrecurring costs should also be contained in the cost estimate document. Sensitivity analysis can be carried out on the estimated cost values to see how sensitive the project plan is to the estimated cost values.

5. **Financial Analysis:**

This involves an analysis of the cash flow profile of the project. The analysis should consider rates of return, inflation, sources of capital, payback periods, breakeven point, residual values, and sensitivity. This is a critical analysis since it determines whether or not and when funds will be available to the project. The project cash flow profile helps to support the economic and financial feasibility of the project.

6. **Project Impacts:**

This portion of the feasibility study provides an assessment of the impact of the proposed project. Environmental, social, cultural, political, and economic impacts may be some of the factors that will determine how a project is perceived by the public. The value added potential of the project should also be assessed. A value added tax may be assessed based on the price of a product and the cost of the raw material used in making the product. The tax so collected may be viewed as a contribution to government coffers.

7. **Conclusions and Recommendations:**

The feasibility study should end with the overall outcome of the project analysis. This may indicate an endorsement or disapproval of the project. Recommendations on what should be done should be included in this section of the feasibility report.

9.5 Elements of a Feasibility Assessment:

As a first step, a feasibility assessment should define the business idea, be it a new project, product or service. The project or business idea feasibility can then be determined. The feasibility needs to account for the current circumstances of the proponent. For example, for a business intender it should take into account personal readiness, skills, resources, knowledge and goals. For established businesses, linkages to existing lines of business, customers, suppliers, employees and other stakeholders need to be accounted for.

A feasibility report should have the following structure:

1. **Executive Summary:**

It provides a quick overview of the main points of the assessment, helping to form a picture of the proposal along with the recommendations. It should be concise and include the major findings covered in the main body of the report.

2. **Need Analysis:**

Need Analysis information provide a context to the business proposition. It analyzes the justification of the idea, with a study of possible alternatives. It links the business idea to the current circumstances and helps to inform evaluation of the business idea.

3. **Engineering:**

Description of the technical aspects of the business idea, including any changes needed to be made to existing processes or the need to add items to existing range of products and services.

4. **Advantages and Disadvantages:**

Advantages and disadvantages of the business idea compared to alternatives, such as competing products; or for a new concept, its relevance to current practices, and to unmet or potential demand.

5. **Market for the Product Offerings:**

State the number of customers, expected frequency and size of average purchase, and any reduction in costs across the business arising from the new product or service. Any assumptions about customer purchase behavior should be identified so that they can be evaluated in terms of likelihood of being achieved or exceeded. For changes in business operations, the payoff may come from competitive advantages such as increased market share, cost savings or higher prices. Research should focus on:

- **Customers:**

You need to be clear about the type of customer you will target, and why they will respond to your offering. Identify your target market segments or groups: What knowledge do you have of your market segments or groups? How many are there? What will they buy? How often will they buy? What will be their average purchase?

- **Products and Services:**

Create a list showing the products/services you will be offering to each segment; how much customers will pay for each product or service.

- **Competition:**

List your competitors and note their perceived strengths and weaknesses. You need to understand why they are competition to your proposed business.

Ask the question: How can you attract customers from them (i.e. your competitors)? Price should not be the only answer; whole of life value, product features, distribution and promotion strategies, and after sales options may all be part of the purchase decision.

- **Map:**

Obtain a map and define on it your market boundaries, your location, access routes, your competitors, your suppliers, and demographic information on your market such as population and distribution.

- **Costing:**

Costing for the implementation of the business idea is done. Assess how long it will take you or your staff to produce or obtain the proposed products or services and to deliver them to your customers and work out the cost of that time. Determine how much it will cost to buy, assemble or produce them. This approach should account for all costs over and above the existing activity. For existing businesses this section should clearly specify if marginal or average costs have been used to determine costing. Assumptions should be stated, for example, assumed raw material prices, availability of supplies, staff skills, plant and equipment etc. Costs

of alternative production/implementation strategies should also be considered in the analysis.

- **Suppliers:**
Identify preferred and alternative suppliers; collect their catalogues and price lists.
- **Location:**
Identify your site, is it rented, owned or at home? Do you need more room than existing business? Why locate there? What are the advantages and disadvantages?
- **Resources:**
Resources such as assets and equipment that will be required, cost of acquiring them, alternative methods of acquisition etc. are assessed. For example, outright purchase versus hire purchase or other forms of leasing.
- **Staff:**
What staff will you need? What skills will they need? What will you need to pay them?

6. **Financial analysis:**
Work out the profits from a given level of operations, the capital required and how the capital will be found to commence operating.
7. **Risk analysis of the Preferred Solution:**
Risk analysis may take the form of basic break-even analysis, i.e. the level of business operation that will ensure that the business does not incur a loss. Sophisticated analysis may consider various business scenarios based on the assumptions made in costing and market analyses.
8. **Comparative Analysis:**
Comparative analysis of alternatives should reflect the objectives of the project. For example, decision making may be based on maximizing profit or minimizing of loss for various business scenarios. Some alternatives may be riskier, which will be reflected in higher financial payoffs under certain scenarios and potential losses under other scenarios; while some may be less risky with low financial profits or losses under a wide variety of circumstances. The choice between a “high payoff but high risk of failure” option instead of a “low payoff with associated low risk” option is one that you can then make in the context of your objectives, your market and your financial situation.
9. **Recommendations:**
Recommendations of the preferred alternative with an associated plan of action; or a decision not to proceed, should be covered in this section. Possible plans of action will be – going back to the drawing board, developing more promising alternatives, further research to minimize possibility of failure or moving forward to develop detailed business plan.

PROJECT FEASIBILITY (CONTD.)

Broad Contents

Characteristics of a Feasibility Study
The Feasibility Study - What Bankers Like to See in Them
The Feasibility Assessment Process
The Process of Feasibility Study
Conclusion – Feasibility Study

10.1 Characteristics of a Feasibility Study:

The feasibility study phase considers the technical aspects of the conceptual alternatives and provides a firmer basis on which to decide whether to undertake the project.

The purpose of the feasibility phase is to:

- Plan the project development and implementation activities.
- Estimate the probable elapsed time, staffing, and equipment requirements.
- Identify the probable costs and consequences of investing in the new project.

If practical, the feasibility study results should evaluate the alternative conceptual solutions along with associated benefits and costs.

The objective of this step is to provide management with the predictable results of implementing a specific project and to provide generalized project requirements. This, in the form of a feasibility study report, is used as the basis on which to decide whether to proceed with the costly requirements, development, and implementation phases.

User involvement during the feasibility study is critical. The user must supply much of the required effort and information, and, in addition, must be able to judge the impact of alternative approaches. Solutions must be operationally, technically, and economically feasible. Much of the economic evaluation must be substantiated by the user.

Therefore, the primary user must be highly qualified and intimately familiar with the workings of the organization and should come from the line operation.

The feasibility study also deals with the technical aspects of the proposed project and requires the development of conceptual solutions. Considerable experience and technical expertise are required to gather the proper information, analyze it, and reach practical conclusions.

Improper technical or operating decisions made during this step may go undetected or unchallenged throughout the remainder of the process. In the worst case, such an error could result in the termination of a valid project — or the continuation of a project that is not economically or technically feasible.

In the feasibility study phase, it is necessary to define the project's basic approaches and its boundaries or scope. A typical feasibility study checklist might include:

- Summary level
- Evaluate alternatives
- Evaluate market potential
- Evaluate cost effectiveness

- Evaluate producibility
- Evaluate technical base
- Detail level
- A more specific determination of the problem
- Analysis of the state-of-the-art technology
- Assessment of in-house technical capabilities
- Test validity of alternatives
- Quantify weaknesses and unknowns
- Conduct trade-off analysis on time, cost, and performance
- Prepare initial project goals and objectives
- Prepare preliminary cost estimates and development plan

The end result of the feasibility study is a management decision on whether to terminate the project or to approve its next phase. Although management can stop the project at several later phases, the decision is especially critical at this point, because later phases require a major commitment of resources. All too often, management review committees approve the continuation of projects merely because termination at this point might cast doubt on the group's judgment in giving earlier approval.

The decision made at the end of the feasibility study should identify those projects that are to be terminated. Once a project is deemed feasible and is approved for development, it must be prioritized with previously approved projects waiting for development (given a limited availability of capital or other resources). As development gets underway, management is given a series of checkpoints to monitor the project's actual progress as compared to the plan.

10.2 The Feasibility Study - What Bankers Like to See in Them:

A cardinal rule in banking is to borrow from a lender who understands your business; or, never to lend money on a business project that you do not understand. For this reason, even though most groups involve their banker early in the process, a feasibility study is often done with an eye towards explaining the project to potential financiers. Bankers, as different clients for the feasibility study, can have different requirements for the study than group members. In many cases, the feasibility study is the formal project presentation to a lender. This section summarizes a feasibility study here with the banker in mind.

Many groups work with bankers with whom they already have an established business relationship. This relationship could be with another cooperative project or with their personal business. This can ease the process of obtaining financing for a project. However even when working with a banker, who is familiar with the members, it is important that the banker know and understand the unique aspects of cooperatives.

From the perspective of a banker, or other perspective financier, the feasibility study should contain the information described in the table 10.1 below.

The executive summary should contain:

- Project purpose. What is it and who is involved?
- Repayment capacity. Can the investment to be recovered over a specific time period? Does it give investment (cost) parameters? Can it convince bankers the investment is needed, even if it is marginally feasible?
- Projected Financial Returns. What are projected revenues, operating costs, and net income?
- Economic Benefits. What is the return on investment and the internal rate of return of the project

The financial blueprint package should contain:

- The assets to be financed.
- What is the project's funding potential and repayment terms? What is the rate of conversion to cash-liquidity?
- What are internal (yields, costs, etc.) and external (inflation, energy, etc.) project risks? What if the key assumptions are not perfect? What is the group's risk exposure?
- Evaluate economic consequences. Do net reserves cover capital cost? Does the plan keep the project from capital erosion?
- What are the projected cash flows, operating statements, and balance sheets? What are the source and use of funds
 - Financial commitment of members
 - Documentation. What rationale is used to support the assumptions?

Table 10.1: Information Content of Feasibility Study

This does not mean that a banker or financier is not interested in other aspects of the feasibility study. Each has their own area of interest and concern; however, the following will be needed for most, if not all bankers.

1. Executive Summary:

This should be short, to the point, yet still complete. If the banker cannot read the summary and understand the basics of the project the odds are that project will receive financing. This should contain:

- *Project purpose:* What is the project and who is involved?
- *Repayment possibility:* Does the study show the ability of the investment to be recovered over a specific time period? Does it give investment (cost) parameters? Can it convince bankers the investment is needed, even if it is marginally feasible?
- *Projected Financial Returns:* What are the projected financial scale, the revenues, and the operating costs? What is net the income?
- *Economic Benefits:* What are the Return on Investment (ROI) and the Internal Rate of Return (IRR) of the project?

2. The Financial Package Blueprint:

The banker needs to clearly see what resources the group wants from the bank. The bank will require information to calculate potential project risk and the bank's exposure for any monies loaned to the group. They also want to know the financial commitment to the project from the members. This blueprint should contain the following elements:

- Characteristics of assets to be financed.
- Expected rate of conversion to cash-liquidity – What is the project's funding potential and what repayment terms will be required?
- Risk evaluation data – What are internal (yields, costs, etc) and external (inflation, energy, etc) project risks? What if the key assumptions are not perfect? What is the bank's exposure?
- Evaluating Economic Consequences – Do net reserves cover capital cost? Does the plan keep the project from capital erosion?

- Financial Forecast – What are the next three years projected cash flows, operating statements, and balance sheets? What are the source and use of funds?
- Documentation – What rationale is used to support the assumptions?

10.3 The Feasibility Assessment Process:

It is often suggested that feasibility studies should encompass at least two assessments:

- Technical feasibility
- Economic feasibility

The technical feasibility embodies an assessment of the physical, technical and technological dimensions of the project while the economic feasibility assesses the project's economic viability within its defined domain.

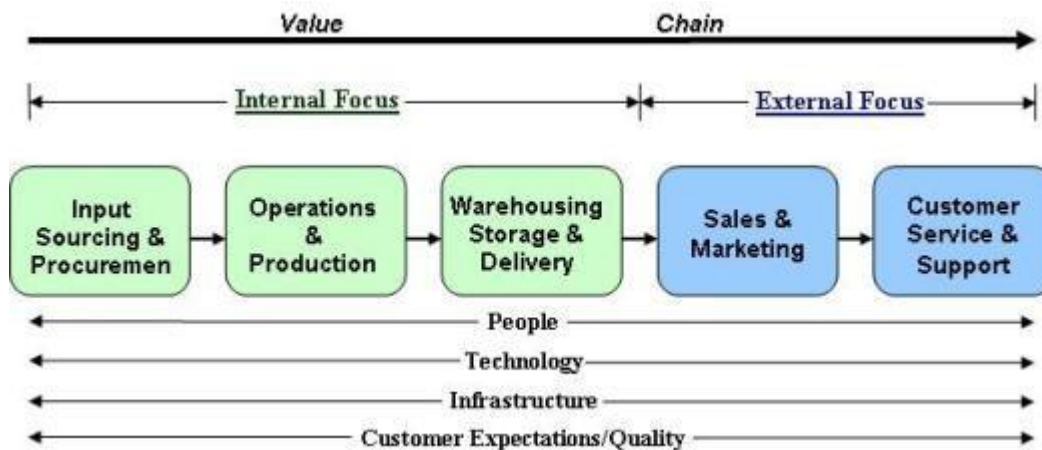


Figure 10.1: The Value Chain Approach to Feasibility Assessment

The value chain approach (shown in Figure 10.1 above) allows the two assessments to be embedded into a single initiative, facilitating an increased understanding and appreciation of the domain's effects on the different stages from input sourcing and procurement to customer service and support. It also facilitates an appreciation of the resources, technology, customer expectations and infrastructure required for the initiative to succeed, allowing an assessment of their level and depth at each subsequent stage in the value chain.

10.3.1 Input Sourcing and Procurement:

We begin conducting the feasibility of the business initiative from the logical point in the value chain, i.e., input sourcing and procurement. The technical dimension of the analysis at this stage encompasses the availability of the required inputs in the appropriate levels of quality and quantity. The assessment of availability involves an evaluation of cycles and trends for both quantity and quality of the inputs. We are also interested in the physical movement of the inputs from their origination points to the facilities where they will be processed. Different sources of supply are evaluated for their quality and quantity as well as cycles/trends in these characteristics. If specific human resources and technologies are required to facilitate the effectiveness of the input sourcing and procurement stage, their availability is assessed within the domain of the project. Likewise, the infrastructure support for effectively procuring inputs from origination points to processing facility is also assessed.

The economics of input sourcing and procurement emanates directly from the technical assessment. The prevailing market prices of inputs as well as costs associated with the procurement are assessed at the input sourcing and procurement stage. The objective is

not to determine the price but the range of prices that have been typical in the domain over a reasonable period of time to allow for the capture of the trends and cycles in the prices. The price trends and cycles can be matched against the quantity and quality trends and cycles to provide insights into potential bottlenecks in the input sourcing and procurement function of the business initiative under consideration.

10.3.2 Operations and Production:

The transformation of inputs into outputs occurs at the operations and production stage of the value chain. This is also the stage that will generally absorb the lion's share of the investment capital. Therefore, from the capital resource allocation perspective, the feasibility requirements at the operations and production stage must be conducted with all the diligence necessary to address all the requisite issues.

The objective of the technical feasibility assessment at operations and production stage of the value chain is to determine if the technology being envisaged for the proposed project is suitable for the desired quantity and quality of product the project wants to present to the marketplace. It also seeks to determine if the equipment and its associated technologies are at the appropriate operational scale. Within the value chain framework, the feasibility assessment of the operations and production technologies is conducted by laying out the physical process from input receipts to packaging and transfer to storage and warehousing and/or delivery.

Because of the level of specialized knowledge required to do justice to the operations and production technical aspects of the feasibility assessment, it is pertinent that the professionals with the required knowledge and experience are recruited to provide the intellectual content for the process. It is important that you do not lock yourself into a technological jam by myopically focusing only on a single technology. Instead, you must encourage your engineering and technical professional input providers to provide you with the full range of their knowledge about the technologies and equipments available. You also need to assess the physical layout of the equipment and its impact on operational efficiency. These professionals must also be encouraged to provide insights into how the different technologies compare with respect to the number of people and their requisite skill levels required to operate them from beginning to end as well as their attendant operational inputs – electricity, natural gas or gasoline, maintenance protocols and shut down protocols, availability and turnaround of technical support, etc.

The previous information provides the foundation for the economic assessment of the alternative technical solutions that can be used in the production process and their attendant operational requirements. The technical efficiencies of the alternative technologies should be weighed against their economic efficiencies to determine their overall effectiveness in the project's feasibility. The best sources of the economic data to support the assessment of the technologies and operations are the suppliers of the equipment.

Such primary data can be collected by providing a detailed description of your product to potential suppliers in a Request for Quote (RFQ) offer. The principal advantage of using a Request for Quote (RFQ) is to improve your knowledge of alternative solutions which you may be unaware of, should you settle on the supplier you know. Given the rate of technical obsolescence, it is imperative that capital investments in technologies are made to maximize their longevity given technical and economic efficiency considerations. You should not overlook the alternative of not making direct investments in operations and production technologies, but seek to assess the possibilities of allying with a company with existing processing and operation capacity.

The technical nature of the operations and production stages of the feasibility assessment requires that unbiased people who are knowledgeable of the processes are hired to help review the responses to the Request for Quote (RFQ). You should arrange for the responding suppliers to make presentations so you and your consultants can ask the necessary questions. Although this process can be cumbersome and time consuming, it is worthwhile if the equipment, buildings and other operational inputs are a significant component of the proposed project's capital outlay.

10.3.3 Warehousing, Storage and Delivery:

Generally, agricultural value-added products are stored or warehoused prior to delivery to customers. Therefore, the feasibility analysis should assess the implications of warehousing, storage and delivery systems for the project. It is important that the feasibility study assesses alternative sources of warehousing and storage – from owning facilities to renting facilities to strategic alliance with others. The objective of these alternatives is to provide the project with realistic alternatives for consideration if the project is found to be feasible. The feasibility assessment should not only focus on the physical facilities but also on the management technologies of warehouse and storage facilities management. The product tracking systems that facilitate maximization of space utilization and turnover are critical components of the assessment process. Additionally, available infrastructures to support the physical movement of products to warehouses or storage, and from there to customers, must also be assessed. For example, transportation systems may influence how consumer ready products can be shipped to improve processor efficiency.

The economics of the physical buildings, location, infrastructure, technologies and other associated resources are brought to bear on the technical options to ensure that the most technically efficient and economically effective alternatives qualify for consideration. The best sources of technical and economic information are suppliers of warehousing and storage services. Trucking and rail companies are often very forthcoming in providing information on delivery charges for specific products from certain locations to certain destinations. The accuracy of the data supplied by these service suppliers is dependent on the clarity and precision of the input information they need to calculate their estimates. Thus, the stepwise process of gathering information is important because it provides the requisite information that feeds into future steps.

10.3.4 Sales and Marketing:

Marketing and sales are often taken for granted in feasibility studies. However, they provide a direct insight into the project's potential market and the *Structure, Conduct and Performance (SCP)* characteristics of the players within the industry. Therefore, the sales and marketing feasibility assessment bridges the intra-firm feasibility dimensions (those inside the firm) with the extra-firm feasibility dimensions (those outside of the firm).

The conceptual backbone for the Structure, Conduct and Performance (SCP) is the assessment of the demand and supply conditions of the product and the behavior of the other firms in the industry. The supply and demand conditions should cover the size and scope economies in the industry, seasonality and trends, availability and strength of substitutes to the product, industry growth rates and demand elasticities.

Industry (market) structure refers to the number and size of the firms (products) in the industry (market) that you intend to enter. Industry conduct describes the pricing behavior and price discovery mechanisms used by firms in the industry. In addition, it

assesses product distribution mechanisms and available channels as well as promotional initiatives that are used in the industry. The intensity of research and development and the extent of legal tactics in the industry all provide indications of the depth of the transaction costs emanating from the conduct of firms in the industry. Finally, the industry performance assesses the profitability of firms in the industry. This requires information on prices, product quality, technical progress and industry capacity utilization.

10.3.5 Non-Market Factors:

A technically and economically feasible project can fail when confronted with certain government policies and/or regulations. Therefore, feasibility studies should assess the existing and/or planned regulatory initiatives that impinge on the project. For example, environmental regulations that are in place and their technical and economic compliance effects on the project must be analyzed to assess their implications for technology, location, and other decisions. Similarly, there is need to assess the implications of specific policies targeted to the industry of interest and evaluate changes in these policies. For example, policies that offer significant competitive advantage to the industry but are subject to change by administrative fiat need to be assessed for the potential effect on the viability of the proposed project.

The results of the foregoing analysis form the backdrop for assessing the feasibility of your product in the defined market domain. It helps you position your product within the context of what already exists and how it may differentiate itself to ensure its competitive advantage. The characteristics that are engineered into the product, as well as the pricing, promotion and distribution or placement opportunities are all influenced by a clear understanding and appreciation of the industry's Structure, Conduct and Performance (SCP).

10.3.6 Data Collection:

Information on industry structure and performance may be obtained from various government statistics, such as those developed and maintained by the Department of Commerce. These databases offer information on the number of firms and employees, average wages and benefits, total value of shipments, gross margins, etc. In addition to government databases, specific industries also collect their own statistics and commission reports that may be purchased. Interviews with specific industry experts can also be a major information source. Similarly, significant information may be obtained from industry news in the main media or in industry-specific publications. For example, when industry news reports indicate that plant closures are increasing, it may be logically extrapolated that industry capacity is high and utilization is low. The implication of this for performance is often easily inferred for undifferentiated or commodity industries. Marketing and promotional information may be obtained from special publications focusing on product marketing and promotions. These function-specific publications often discuss the successful initiatives and can provide significant insights into the approaches used in particular industries. Another source of information on industries is academics publications and government documents. Because Structure, Conduct and Performance (SCP) issues present important policy implications, they are the subject of study in many government and academic documents and they can provide important and significant insights on market structure, conduct and performance situation in many industries.

For agricultural value-added initiatives, secondary data can suffice for the input sourcing and procurement segment of the feasibility assessment. The sources of these secondary data include industry and trade publications as well as statistics of industry

associations. Additionally, a number of government departments collect, analyze and publish some of these data. In special cases, primary data collection may be necessary and this may be done through formal surveys or interviews. For example, different suppliers may be asked to provide information on their products – prices, quantities and qualities – as well as the stability of their quotes, e.g., the frequency with which they change their prices, quantities and quality. In most cases, when potential suppliers feel the project initiative is credible, they will invest their best efforts to provide the required information.

It is important to note that the effective collection of primary data can be expensive and time consuming. An alternative to primary data when secondary data is not neatly available is to pull them together from different sources, ensuring that measurements and definitions are similar across sources. It may sometimes be necessary to transform data from different sources to comparable units to attain the necessary congruence required for analysis.

10.3.7 Customer Service and Support:

What do customers want? Ask them. The final step in the value chain framework to feasibility assessment is finding out what customers needs are not being satisfied by the current marketplace. The purpose of this is to determine if the proposed project's offer stand to make a difference in satisfying customer needs. The results will provide a credible input into the project's product differentiation index and allow the proponents to identify the appropriate placement and promotional options to employ. Customer service and support research allow the proposed project to gain insights into the nature and structure of its potential market. It can develop market segments at this step, allowing it to refocus other components of the initiative or revisit earlier steps in the feasibility assessment process. Since customers are the final arbiters on the success of a product, assessing how the project addresses their unmet needs is fundamental to the project's economic feasibility.

Information for the customer segment of the feasibility can be obtained from reviewing consumer publications and industry publications for general assessment of needs and how the project's offering addresses them. Direct information may be obtained by conducting focus group interviews, surveys and/or interviews. While these initiatives can be expensive, they are worthwhile if technical and economic assessments thus, far are supportive of the project and more information is required to make the decision. For this reason, it is prudent for the customer segment to be where it is in the value chain, i.e., the end. However, it is important to remember that the process described in this document is hardly linear but rather iterative, using information from one stage to dig deeper into or gather new information gathered from an earlier stage.

10.3.8 The Decision Recommendation:

The purpose of a business feasibility study is to make a decision about whether to proceed with a particular business opportunity. It provides the general internal and external value chain conditions that confront the business initiative and evaluates the proposed initiative's ability to be economically viable if it is found to be technically and operationally feasible. Therefore, the emphasis on the recommendations resulting from the feasibility study is economic or financial.

The easiest approach to the economic decision is to gather all the information at the different stages of the value chain and identify those that require capital expenditure and estimate these expenditures. Additionally, identify the different types of people and skills required to operate each stage of the value chain and determine what their wages,

salaries and benefits will be. Finally, identify other project related costs such as infrastructure development or improvements, occupancy, advertising and promotion, office supplies and utility as well as fees and municipal or state development taxes specific to the project. Next, using the production capacity, projected market share growth rates and the estimated market size, in conjunction with price information collected in the various stages of the feasibility study; develop a projected revenue or sales statement. It is important to specifically define all assumptions that drive the income and cash flow projections, e.g., the mean or median wages, salaries and benefits, current price and industry average of plant operating capacity, etc. Also, analyze all the data that were collected to determine their ranges, adjusted for special circumstances and use these to conduct the sensitivity analysis on the economic outcomes of the project.

10.3.9 Cost and Revenue Projections:

The cost and revenue projections together allow the development of the net cash flow emanating from the business over the projected time frame. This statement can then be subjected to capital investment analysis by selecting a reasonable discount rate and estimating the Net Present Value (NPV) and/or estimating the Internal Rate of Return (IRR) associated with the projected cash flow. A positive Net Present Value (NPV) implies an economically feasible project and the larger the positive Net Present Value, the more economically feasible the project, assuming the technical and operational feasibility can be assumed. If the project owners are making a decision based on the Internal Rate of Return, then they need to determine their required rate of return and compare it to the estimated Internal Rate of Return. If the Internal Rate of Return (IRR) exceeds their required rate of return, then the project is economically feasible. On the other hand, if the estimated Internal Rate of Return is less than the proponents' required rate of return, then the project is deemed economically infeasible even if it is both operationally and technically feasible.

10.3.10 Sensitivity Analysis:

It is important that the project cash flow is subjected to the full range of sensitivity analysis under a range of prices based on data that is collected for the feasibility study. This will provide the full range of conditions that support the feasibility of the project. The wider the band of feasible outcomes results from varying the critical assumptions, the more confident you can be about the viability of your project. On the other hand, if the band of feasibility is narrow vis-à-vis the critical variables, then the project's viability is more susceptible to uncertain shifts in its marketplace. For this reason, it is emphasized that the sensitivity analysis of the feasibility analysis be conducted over the full range of the project's industry possibilities. These possibilities may be divided into three blocks – worse case, normal case and best case scenarios. Additionally, the sensitivity analysis must be conducted for different scenarios, for example, best price with worst demand conditions. This provides insights into the critical bottlenecks to the project's viability and allows the proponents to assess the decision recommendations within a more informed framework.

10.4 Conclusion:

The purpose of a feasibility study is to help assess the viability of a business proposition, technically, operationally and economically. The value chain framework for conducting feasibility studies has the unique advantage of laying out the project in its logical configuration – from input procurement to customer service – and assessing the technical, operational and economic feasibility at each stage, and finally putting it all together to assess the total project feasibility. The advantage in this approach is revealed in exposing the bottlenecks to feasibility

along the value chain so they can be assessed for possible improvement. The iterative nature of the approach is also helpful because it allows the analyst to revisit previous steps when information from latter steps suggests the need. In the end, the logical and step-wise process for conducting feasibility assessment within the value chain framework helps enhance transparency of the analysis and provide the foundations for better decisions.

The report was laid out to reflect expectation of presentation of a good feasibility report. Thus, it is expected that such a report will cover the input sourcing and procurement, operations and production, warehousing, storage and delivery. These three cover the logistics aspects of the production process and draws on the infrastructure conditions, technological and technical realities, human resource availability, capabilities and skills and customer expectations of quality associated with the product. Marketing, sales and customer service take the analysis into the project's external domain to assess industry structure, conduct and performance characteristics as well as regulatory hurdles that confront the project. The customer service and support component demand of the analyst to determine the specific needs of customers that may be addressed by the project's offering and estimate the product differentiation index.

Pulling all the information together into financial units, the analyst can build the investment, operational costs and revenue projections over a reasonable time frame and estimate the Net Present Value (NPV) and/or the Internal Rate of Return (IRR) to facilitate making decision recommendations. A project returning a positive Net Present Value is deemed feasible and the larger the Net Present Value the better. Project analyst needs to determine the required rate of return that investors in the project would deem acceptable and compare it to the Internal Rate of Return to determine the project's feasibility. If the former is lower than the estimated Internal Rate of Return, then the project is judged to be feasible and vice versa.

PROJECT SELECTION

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11.1 Introduction:

Project selection is the ***process of choosing a project or set of projects to be implemented by the organization***. Since projects in general require a substantial investment in terms of money and resources, both of which are limited, it is of vital importance that the projects that an organization selects provide good returns on the resources and capital invested. This requirement must be balanced with the need for an organization to move forward and develop. The high level of uncertainty in the modern business environment has made this area of project management crucial to the continued success of an organization with the difference between choosing good projects and poor projects literally representing the difference between operational life and death.

Because a successful model must capture every critical aspect of the decision, more complex decisions typically require more sophisticated models. “There is a simple solution to every complex problem; unfortunately, it is wrong”. This reality creates a major challenge for tool designers. Project decisions are often high-stakes, dynamic decisions with complex technical issues—precisely the kinds of decisions that are most difficult to model:

- Project selection decisions are high-stakes because of their strategic implications. The projects a company chooses can define the products it supplies, the work it does, and the direction it takes in the marketplace. Thus, project decisions can impact every business stakeholder, including customers, employees, partners, regulators, and shareholders. A sophisticated model may be needed to capture strategic implications.
- Project decisions are dynamic because a project may be conducted over several budgeting cycles, with repeated opportunities to slow, accelerate, re-scale, or terminate the project. Also, a successful project may produce new assets or products that create time-varying financial returns and other impacts over many years. A more sophisticated model is needed to address dynamic impacts.
- Project decisions typically produce many different types of impacts on the organization. For example, a project might increase revenue or reduce future costs. It might impact how customers or investors perceive the organization. It might provide new capability or learning, important to future success. Making good choices requires not just estimating the financial return on investment; it requires understanding all of the ways that projects add value. A more sophisticated model is needed to account for all of the different types of potential impacts that project selection decisions can create.

11.2 Project Decisions:

Project decisions often entail risk and uncertainty. The significance of a project risk depends on the nature of that risk and on the other risks that the organization is taking. A more sophisticated model is needed to correctly deal with risk and uncertainty.

Project selection is the process of evaluating individual projects or groups of projects, and then choosing to implement some set of them so that the objectives of the parent organization will be achieved. This same systematic process can be applied to any area of the organization's business in which choices must be made between competing alternatives. For example:

- A manufacturing firm can use evaluation/selection techniques to choose which machine to adopt in a part-fabrication process.
- A television station can select which of several syndicated comedy shows to rerun in its 7:30 p.m. weekday time-slot
- A construction firm can select the best subset of a large group of potential projects on which to bid
- A hospital can find the best mix of psychiatric, orthopedic, obstetric, and other beds for a new wing.

Each project will have different costs, benefits, and risks. Rarely are these known with certainty. In the face of such differences, the selection of one project out of a set is a difficult task. Choosing a number of different projects, a **portfolio**, is even more complex. In the following sections, we discuss several techniques that can be used to help senior managers select projects. Project selection is only one of many decisions associated with project management.

To deal with all of these problems, we use *decision aiding models*. We need such models because they abstract the relevant issues about a problem from the plethora of detail in which the problem is embedded. Reality is far too complex to deal with in its entirety. An “idealist” is needed to strip away almost all the reality from a problem, leaving only the aspects of the “real” situation with which he or she wishes to deal. This process of carving away the unwanted reality from the bones of a problem is called *modeling the problem*. The idealized version of the problem that results is called a *model*.

The model represents the problem's *structure*, its form. Every problem has a form, though often we may not understand a problem well enough to describe its structure. We will use many models in this book—graphs, analogies, diagrams, as well as *flow graph and network models* to help solve scheduling problems, and *symbolic* (mathematical) models for a number of purposes.

Models may be quite simple to understand, or they may be extremely complex. In general, introducing more reality into a model tends to make the model more difficult to manipulate. If the input data for a model are not known precisely, we often use probabilistic information; that is, the model is said to be *stochastic* rather than *deterministic*.

Again, in general, stochastic models are more difficult to manipulate. We live in the midst of what has been called the “knowledge explosion.” We frequently hear comments such as “90 percent of all we know about physics has been discovered since Albert Einstein published his original work on special relativity”; and “80 percent of what we know about the human body has been discovered in the past 50 years.” In addition, evidence is cited to show that knowledge is growing exponentially.

Such statements emphasize the importance of the *management of change*. To survive, firms should develop strategies for assessing and reassessing the use of their resources. Every allocation of resources is an investment in the future. Because of the complex nature of most strategies, many of these investments are in projects.

To cite one of many possible examples, special visual effects accomplished through computer animation are common in the movies and television shows we watch daily. A few years ago

they were unknown. When the capability was in its idea stage, computer companies as well as the firms producing movies and television shows faced the decision whether or not to invest in the development of these techniques. Obviously valuable as the idea seems today, the choice was not quite so clear a decade ago when an entertainment company compared investment in computer animation to alternative investments in a new star, a new rock group, or a new theme park.

The proper choice of investment projects is crucial to the long-run survival of every firm. Daily we witness the results of both good and bad investment choices. In our daily newspapers we read of Cisco System's decision to purchase firms that have developed valuable communication network software rather than to develop its own software. We read of Procter and Gamble's decision to invest heavily in marketing its products on the Internet; British Airways' decision to purchase passenger planes from Airbus instead of from its traditional supplier, Boeing; or problems faced by school systems when they update student computer labs—should they invest in Windows-based systems or stick with their traditional choice, Apple®. But can such important choices be made rationally? Once made, do they ever change, and if so, how? These questions reflect the need for effective selection models.

Within the limits of their capabilities, such models can be used to increase profits, select investments for limited capital resources, or improve the competitive position of the organization. They can be used for ongoing evaluation as well as initial selection, and thus, are a key to the allocation and reallocation of the organization's scarce resources.

11.2.1 Modeling:

A model is an object or concept, which attempts to capture certain aspects of the real world. The purpose of models can vary widely, they can be used to test ideas, to help teach or explain new concepts to people or simply as decorations. Since the uses that models can be put are so many it is difficult to find a definition that is both clear and conveys all the meanings of the word. In the context of project selection the following definition is useful:

“A model is an explicit statement of our image of reality. It is a representation of the relevant aspects of the decision with which we are concerned. It represents the decision area by structuring and formalizing the information we possess about the decision and, in doing so, presents reality in a simplified organized form. A model, therefore, provides us with an abstraction of a more complex reality”. (Cooke and Slack, 1991)

When project selection models are seen from this perspective it is clear that the need for them arises from the fact that it is impossible to consider the environment, within which a project will be implemented, in its entirety. The challenge for a good project selection model is therefore clear. It must balance the need to keep enough information from the real world to make a good choice with the need to simplify the situation sufficiently to make it possible to come to a conclusion in a reasonable length of time.

11.3 Criteria for Choosing Project Model:

When a firm chooses a project selection model, the following criteria, based on Souder (1973), are most important:

1. **Realism:**

The model should reflect the reality of the manager's decision situation, including the multiple objectives of both the firm and its managers. Without a common measurement system, direct comparison of different projects is impossible.

For example, Project A may strengthen a firm's market share by extending its facilities, and Project B might improve its competitive position by strengthening its technical staff. Other things being equal, which is better? The model should take into account the

realities of the firm's limitations on facilities, capital, personnel, and so forth. The model should also include factors that reflect project risks, including the technical risks of performance, cost, and time as well as the market risks of customer rejection and other implementation risks.

2. **Capability:**

The model should be sophisticated enough to deal with multiple time periods, simulate various situations both internal and external to the project (for example, strikes, interest rate changes), and optimize the decision. An optimizing model will make the comparisons that management deems important, consider major risks and constraints on the projects, and then select the best overall project or set of projects.

3. **Flexibility:**

The model should give valid results within the range of conditions that the firm might experience. It should have the ability to be easily modified, or to be self-adjusting in response to changes in the firm's environment; for example, tax laws change, new technological advancements alter risk levels, and, above all, the organization's goals change.

4. **Ease of Use:**

The model should be reasonably convenient, not take a long time to execute, and be easy to use and understand. It should not require special interpretation, data that are difficult to acquire, excessive personnel, or unavailable equipment. The model's variables should also relate one-to-one with those real-world parameters, the managers believe significant to the project. Finally, it should be easy to simulate the expected outcomes associated with investments in different project portfolios.

5. **Cost:**

Data gathering and modeling costs should be low relative to the cost of the project and must surely be less than the potential benefits of the project. All costs should be considered, including the costs of data management and of running the model.

Here, we would also add a sixth criterion:

6. **Easy Computerization:**

It should be easy and convenient to gather and store the information in a computer database, and to manipulate data in the model through use of a widely available, standard computer package such as Excel, Lotus 1-2-3, Quattro Pro, and like programs. The same ease and convenience should apply to transferring the information to any standard decision support system.

In what follows, we first examine fundamental types of project selection models and the characteristics that make any model more or less acceptable. Next we consider the limitations, strengths, and weaknesses of project selection models, including some suggestions of factors to consider when making a decision about which, if any, of the project selection models to use. We then discuss the problem of selecting projects when high levels of uncertainty about outcomes, costs, schedules, or technology are present, as well as some ways of managing the risks associated with the uncertainties.

Finally, we comment on some special aspects of the information base required for project selection. Then we turn our attention to the selection of a set of projects to help the organization achieve its goals and illustrate this with a technique called the *Project Portfolio Process*. We finish the chapter with a discussion of project proposals.

11.4 The Nature of Project Selection Models:

There are two basic types of project selection models, *numeric* and *nonnumeric*. Both are widely used. Many organizations use both at the same time, or they use models that are combinations of the two. Nonnumeric models, as the name implies, do not use numbers as inputs. Numeric models do, but the criteria being measured may be either objective or subjective. It is important to remember that the *qualities* of a project may be represented by numbers, and that *subjective* measures are not necessarily less useful or reliable than *objective* measures.

Before examining specific kinds of models within the two basic types, let us consider just what we wish the model to do for us, never forgetting two critically important, but often overlooked facts.

- Models do not make decisions—people do. The manager, not the model, bears responsibility for the decision. The manager may “delegate” the task of making the decision to a model, but the responsibility cannot be abdicated.
- All models, however sophisticated, are only partial representations of the reality they are meant to reflect. Reality is far too complex for us to capture more than a small fraction of it in any model. Therefore, no model can yield an optimal decision except within its own, possibly inadequate, framework.

We seek a model to assist us in making project selection decisions. This model should possess the characteristics discussed previously and, above all, it should evaluate potential projects by the degree to which they will meet the firm’s objectives. To construct a selection/evaluation model, therefore, it is necessary to develop a list of the firm’s objectives.

A list of objectives should be generated by the organization’s top management. It is a direct expression of organizational philosophy and policy. The list should go beyond the typical clichés about “survival” and “maximizing profits,” which are certainly real goals but are just as certainly not the only goals of the firm. Other objectives might include maintenance of share of specific markets, development of an improved image with specific clients or competitors, expansion into a new line of business, decrease in sensitivity to business cycles, maintenance of employment for specific categories of workers, and maintenance of system loading at or above some percent of capacity, just to mention a few.

A model of some sort is implied by any conscious decision. The choice between two or more alternative courses of action requires reference to some objective(s), and the choice is thus, made in accord with some, possibly subjective, “model.” Since the development of computers and the establishment of operations research as an academic subject in the mid-1950s, the use of formal, numeric models to assist in decision making has expanded. Many of these models use financial metrics such as profits and/or cash flow to measure the “correctness” of a managerial decision. Project selection decisions are no exception, being based primarily on the degree to which the financial goals of the organization are met. As we will see later, this stress on financial goals, largely to the exclusion of other criteria, raises some serious problems for the firm, irrespective of whether the firm is for profit or not-for-profit.

When the list of objectives has been developed, an additional refinement is recommended. The elements in the list should be *weighted*. Each item is added to the list because it represents a contribution to the success of the organization, but each item does not make an equal contribution. The weights reflect different degrees of contribution each element makes in accomplishing a set of goals.

Once the list of goals has been developed, one more task remains. The probable contribution of each project to each of the goals should be estimated. A project is selected or rejected because it is predicted to have certain outcomes if implemented.

These outcomes are expected to contribute to goal achievement. If the estimated level of goal achievement is sufficiently large, the project is selected. If not, it is rejected.

The relationship between the project's expected results and the organization's goals must be understood. In general, the kinds of information required to evaluate a project can be listed under production, marketing, financial, personnel, administrative, and other such categories.

The following table 11.1 is a list of factors that contribute, positively or negatively, to these categories.

In order to give focus to this list, we assume that the projects in question involve the possible substitution of a new production process for an existing one. The list is meant to be illustrative. It certainly is not exhaustive.

Production Factors	
1. Time until ready to install	3. Payout period
2. Length of disruption during installation	4. Cash requirements
3. Learning curve—time until operating as desired	5. Time until break-even
4. Effects on waste and rejects	6. Size of investment required
5. Energy requirements	7. Impact on seasonal and cyclical fluctuations
6. Facility and other equipment requirements	Personnel Factors
7. Safety of process	1. Training requirements
8. Other applications of technology	2. Labor skill requirements
9. Change in cost to produce a unit output	3. Availability of required labor skills
10. Change in raw material usage	4. Level of resistance from current work force
11. Availability of raw materials	5. Change in size of labor force
12. Required development time and cost	6. Inter- and intra-group communication requirements
13. Impact on current suppliers	7. Impact on working conditions
14. Change in quality of output	Administrative and Miscellaneous Factors
Marketing Factors	1. Meet government safety standards
1. Size of potential market for output	2. Meet government environmental standards
2. Probable market share of output	3. Impact on information system
3. Time until market share is acquired	4. Reaction of stockholders and securities markets
4. Impact on current product line	5. Patent and trade secret protection
5. Consumer acceptance	6. Impact on image with customers, suppliers, and competitors
6. Impact on consumer safety	7. Degree to which we understand new technology
7. Estimated life of output	8. Managerial capacity to direct and control new process
8. Spin-off project possibilities	
Financial Factors	
1. Profitability, net present value of the investment	
2. Impact on cash flows	

Table 11.1: Factors Contributing to Various Organizational Categories

Some factors in this list have a one-time impact and some recur. Some are difficult to estimate and may be subject to considerable error. For these, it is helpful to identify a *range of uncertainty*. In addition, the factors may occur at different times.

And some factors may have *thresholds*, critical values above or below which we might wish to reject the project. We will deal in more detail with these issues later in this chapter.

Clearly, no single project decision needs to include all these factors. Moreover, not only is the list incomplete, it also contains redundant items. Perhaps more important, the factors are not at the same level of generality: *profitability* and *impact on organizational image* both affect the overall organization, but *impact on working conditions* is more oriented to the production system. Nor are all elements of equal importance.

Change in production cost is usually considered more important than *impact on current suppliers*. Shortly, we will consider the problem of generating an acceptable list of factors and measuring their relative importance. At that time we will discuss the creation of a Decision Support System (DSS) for project evaluation and selection.

The same subject will arise once more in the next lecture(s) when we consider project auditing, evaluation, and termination.

Although the process of evaluating a potential project is time-consuming and difficult, its importance cannot be overstated. A major consulting firm has argued (Booz, Allen, and Hamilton, 1966) that the primary cause for the failure of Research and Development (R and D) projects is insufficient care in evaluating the proposal before the expenditure of funds. What is true for such projects also appears to be true for other kinds of projects, and it is clear that product development projects are more successful if they incorporate user needs and satisfaction in the design process (Matzler and Hinterhuber, 1998). Careful analysis of a potential project is a *sine qua non* for profitability in the construction business. There are many horror stories (Meredith, 1981) about firms that undertook projects for the installation of a computer information system without sufficient analysis of the time, cost, and disruption involved.

Later, we will consider the problem of conducting an evaluation under conditions of uncertainty about the outcomes associated with a project. Before dealing with this problem, however, it helps to examine several different evaluation/selection models and consider their strengths and weaknesses. Recall that the problem of choosing the project selection model itself will also be discussed later.

11.5 Types of Project Selection Models:

Of the two basic types of selection models (numeric and nonnumeric), nonnumeric models are older and simpler and have only a few subtypes to consider. We examine them first.

- **Non-Numeric Models:**

These include the following:

1. ***The Sacred Cow:***

In this case the project is suggested by a senior and powerful official in the organization. Often the project is initiated with a simple comment such as, “If you have a chance, why don’t you look into . . .,” and there follows an undeveloped idea for a new product, for the development of a new market, for the design and adoption of a global database and information system, or for some other project requiring an investment of the firm’s resources. The immediate result of this bland statement is the creation of a “project” to investigate whatever the boss has suggested.

The project is “sacred” in the sense that it will be maintained until successfully concluded, or until the boss, personally, recognizes the idea as a failure and terminates it.

2. ***The Operating Necessity:***

If a flood is threatening the plant, a project to build a protective dike does not require much formal evaluation, which is an example of this scenario. XYZ Steel Corporation has used this criterion (and the following criterion also) in evaluating potential projects. If the project is required in order to keep the

system operating, the primary question becomes: Is the system worth saving at the estimated cost of the project? If the answer is yes, project costs will be examined to make sure they are kept as low as is consistent with project success, but the project will be funded.

3. ***The Competitive Necessity:***

Using this criterion, XYZ Steel undertook a major plant rebuilding project in the late 1960s in its steel bar manufacturing facilities near Chicago. It had become apparent to XYZ's management that the company's bar mill needed modernization if the firm was to maintain its competitive position in the Chicago market area. Although the planning process for the project was quite sophisticated, the decision to undertake the project was based on a desire to maintain the company's competitive position in that market.

In a similar manner, many business schools are restructuring their undergraduate and Masters in Business Administration (MBA) programs to stay competitive with the more forward looking schools. In large part, this action is driven by declining numbers of tuition paying students and the need to develop stronger programs to attract them.

Investment in an *operating necessity* project takes precedence over a *competitive necessity* project, but both types of projects may bypass the more careful numeric analysis used for projects deemed to be less urgent or less important to the survival of the firm.

4. ***The Product Line Extension:***

In this case, a project to develop and distribute new products would be judged on the degree to which it fits the firm's existing product line, fills a gap, strengthens a weak link, or extends the line in a new, desirable direction.

Sometimes careful calculations of profitability are not required. Decision makers can act on their beliefs about what will be the likely impact on the total system performance if the new product is added to the line.

5. ***Comparative Benefit Model:***

For this situation, assume that an organization has many projects to consider, perhaps several dozen. Senior management would like to select a subset of the projects that would most benefit the firm, but the projects do not seem to be easily comparable. For example, some projects concern potential new products, some concern changes in production methods, others concern computerization of certain records, and still others cover a variety of subjects not easily categorized (e.g., a proposal to create a daycare center for employees with small children).

The organization has no formal method of selecting projects, but members of the selection committee think that some projects will benefit the firm more than others, even if they have no precise way to define or measure "benefit."

The concept of comparative benefits, if not a formal model, is widely adopted for selection decisions on all sorts of projects. Most United Way organizations use the concept to make decisions about which of several social programs to fund. Senior management of the funding organization then examines all projects with positive recommendations and attempts to construct a portfolio that best fits the organization's aims and its budget.

PROJECT SELECTION (CONTD.)

Broad Contents

Q-Sort Model
 Pay-back Period
 Average Rate of Return
 Discounted Cash Flow
 Internal Rate of Return (IRR)

12.1 Types of Project Selection Models (Continued):

- **Non-Numeric Models:**

- **Q-Sort Model:**

Of the several techniques for ordering projects, the Q-Sort (Helin and Souder, 1974) is one of the most straightforward. First, the projects are divided into three groups—*good*, *fair*, and *poor*—according to their relative merits. If any group has more than eight members, it is subdivided into two categories, such as *fair-plus* and *fair-minus*. When all categories have eight or fewer members, the projects within each category are ordered from best to worst. Again, the order is determined on the basis of relative merit. The rater may use specific criteria to rank each project, or may simply use general overall judgment. (See Figure 12.1 below for an example of a Q-Sort.)

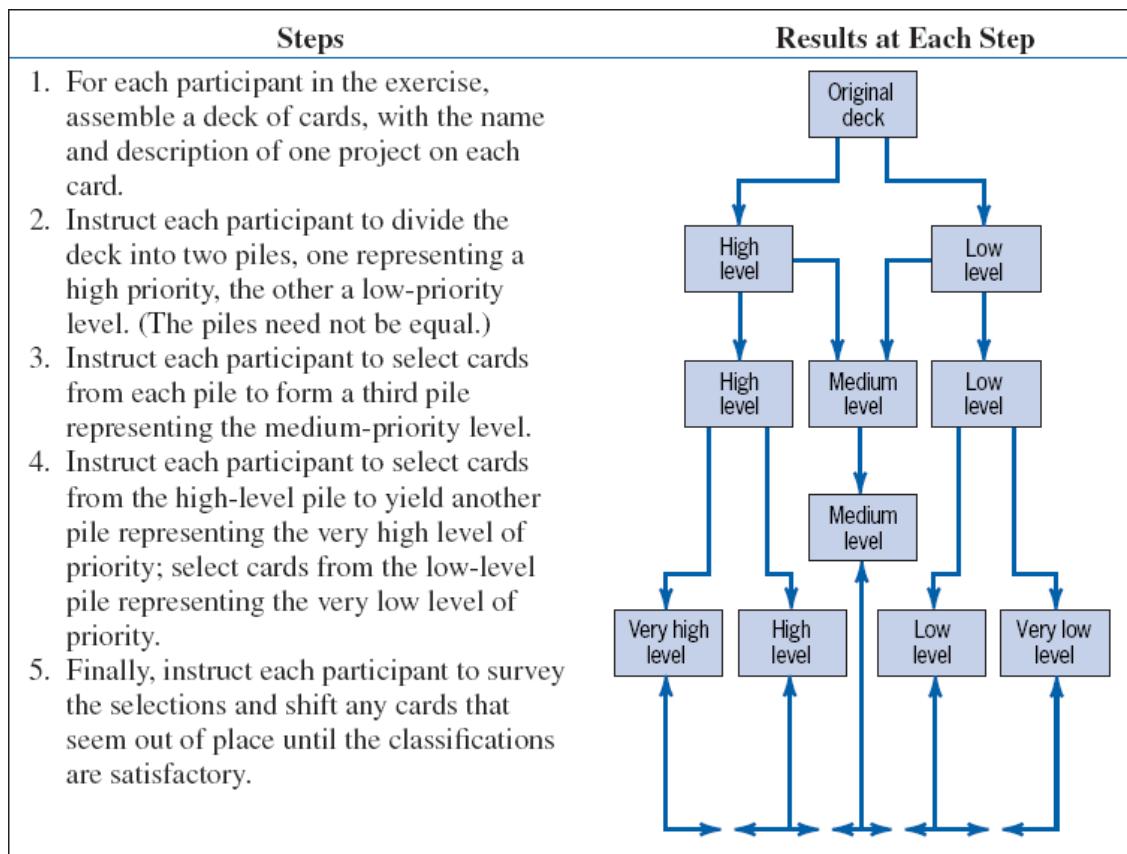


Figure 12.1: Example of a Q-Sort

The process described may be carried out by one person who is responsible for evaluation and selection, or it may be performed by a committee charged with the responsibility. If a committee handles the task, the individual rankings can be developed anonymously, and the set of anonymous rankings can be examined by the committee itself for consensus. It is common for such rankings to differ somewhat from rater to rater, but they do not often vary strikingly because the individuals chosen for such committees rarely differ widely on what they feel to be appropriate for the parent organization.

Projects can then be selected in the order of preference, though they are usually evaluated financially before final selection.

There are other, similar nonnumeric models for accepting or rejecting projects. Although it is easy to dismiss such models as unscientific, they should not be discounted casually. These models are clearly goal-oriented and directly reflect the primary concerns of the organization.

The sacred cow model, in particular, has an added feature; sacred cow projects are visibly supported by “the powers that be.” Full support by top management is certainly an important contributor to project success (Meredith, 1981). Without such support, the probability of project success is sharply lowered.

- **Numeric Models: Profit/Profitability**

As noted earlier, a large majority of all firms using project evaluation and selection models use profitability as the sole measure of acceptability. We will consider these models first, and then discuss models that surpass the profit test for acceptance.

1. **Payback Period:**

The payback period for a project is the initial fixed investment in the project divided by the estimated annual net cash inflows from the project. The ratio of these quantities is the number of years required for the project to repay its initial fixed investment. For example, assume a project costs \$100,000 to implement and has annual net cash inflows of \$25,000. Then

$$\text{Payback period} = \$100,000 / \$25,000 = 4 \text{ years}$$

This method assumes that the cash inflows will persist at least long enough to pay back the investment, and it ignores any cash inflows beyond the payback period. The method also serves as an (inadequate) proxy for risk. The faster the investment is recovered, the less the risk to which the firm is exposed.

2. **Average Rate of Return:**

Often mistaken as the reciprocal of the payback period, *the average rate of return is the ratio of the average annual profit (either before or after taxes) to the initial or average investment in the project.* Because average annual profits are usually not equivalent to net cash inflows, the average rate of return does not usually equal the reciprocal of the payback period. Assume, in the example just given, that the average annual profits are \$15,000:

$$\text{Average rate of return} = \$15,000 / \$100,000 = 0.15$$

Neither of these evaluation methods is recommended for project selection, though payback period is widely used and does have a legitimate value for cash

budgeting decisions. The major advantage of these models is their simplicity, but neither takes into account the time-value of money. Unless interest rates are extremely low and the rate of inflation is nil, the failure to reduce future cash flows or profits to their present value will result in serious evaluation errors.

3. **Discounted Cash Flow:**

Also referred to as the Net Present Value (NPV) method, the discounted cash flow method determines the net present value of all cash flows by discounting them by the required rate of return (also known as the hurdle rate, cutoff rate, and similar terms) as follows:

$$\text{NPV (project)} = A_0 + \sum_{t=1}^n \frac{F_t}{(1 + k)^t}$$

where

F_t = the net cash flow in period t ,

k = the required rate of return, and

A_0 = initial cash investment (because this is an outflow, it will be negative).

To include the impact of inflation (or deflation) where p_t is the predicted rate of inflation during period t , we have

$$\text{NPV (project)} = A_0 + \sum_{t=1}^n \frac{F_t}{(1 + k + p_t)^t}$$

Early in the life of a project, net cash flow is likely to be negative, the major outflow being the initial investment in the project, A_0 . If the project is successful, however, cash flows will become positive. The project is *acceptable* if the sum of the net present values of all estimated cash flows over the life of the project is positive. A simple example will suffice. Using our \$100,000 investment with a net cash inflow of \$25,000 per year for a period of eight years, a required rate of return of 15 percent, and an inflation rate of 3 percent per year, we have

$$\begin{aligned} \text{NPV (project)} &= \$100,000 + \sum_{t=1}^8 \frac{\$25,000}{(1 + 0.15 + 0.03)^t} \\ &= \$1939 \end{aligned}$$

Because the present value of the inflows is greater than the present value of the outflow—that is, the net present value is positive—the project is deemed acceptable.

For example:

PsychoCeramic Sciences, Inc. (PSI), a large producer of cracked pots and other cracked items, is considering the installation of a new marketing software package that will, it is hoped, allow more accurate sales information concerning the inventory, sales, and deliveries of its pots as well as its vases designed to hold artificial flowers.

The information systems (IS) department has submitted a project proposal that estimates the investment requirements as follows: an initial investment of \$125,000 to be paid up-front to the Pottery Software.

Corporation; an additional investment of \$100,000 to modify and install the software; and another \$90,000 to integrate the new software into the overall information system. Delivery and installation is estimated to take one year; integrating the entire system should require an additional year.

Thereafter, the IS department predicts that scheduled software updates will require further expenditures of about \$15,000 every second year, beginning in the fourth year. They will not, however, update the software in the last year of its expected useful life.

The project schedule calls for benefits to begin in the third year, and to be up-to-speed by the end of that year. Projected additional profits resulting from better and more timely sales information are estimated to be \$50,000 in the first year of operation and are expected to peak at \$120,000 in the second year of operation, and then to follow the gradually declining pattern shown in the table 12.1 below.

Project life is expected to be 10 years from project inception, at which time the proposed system will be obsolete for this division and will have to be replaced. It is estimated, however, that the software can be sold to a smaller division of PsychoCeramic Sciences, Inc. (PSI) and will thus, have a salvage value of \$35,000. The Company has a 12 percent hurdle rate for capital investments and expects the rate of inflation to be about 3 percent over the life of the project. Assuming that the initial expenditure occurs at the beginning of the year and that all other receipts and expenditures occur as lump sums at the end of the year, we can prepare the Net Present Value analysis for the project as shown in the table 12.1 below.

The Net Present Value of the project is positive and, thus, the project can be accepted. (The project would have been rejected if the hurdle rate were 14 percent.) Just for the intellectual exercise, note that the total inflow for the project is \$759,000, or \$75,900 per year on average for the 10 year project. The required investment is \$315,000 (ignoring the biennial overhaul charges). Assuming 10 year, straight line depreciation, or \$31,500 per year, the payback period would be:

$$PB = \frac{\$315,000}{\$75,900 + 31,500} = 2.9 \text{ years}$$

A project with this payback period would probably be considered quite desirable.

<i>Year</i> <i>A</i>	<i>Inflow</i> <i>B</i>	<i>Outflow</i> <i>C</i>	<i>Net Flow</i> <i>D = (B – C)</i>	<i>Discount</i> <i>Factor</i> $1/(1 + k + p)^t$	<i>Net Present Value</i> <i>D (Disc. Fact.)</i>
2006*	\$ 0	\$125,000	\$–125,000	1.0000	\$–125,000
2006	0	100,000	–100,000	0.8696	–86,957
2007	0	90,000	–90,000	0.7561	–68,053
2008	50,000	0	50,000	0.6575	32,876
2009	120,000	15,000	105,000	0.5718	60,034
2010	115,000	0	115,000	0.4972	57,175
2011	105,000	15,000	90,000	0.4323	38,909
2012	97,000	0	97,000	0.3759	36,466
2013	90,000	15,000	75,000	0.3269	24,518
2014	82,000	0	82,000	0.2843	23,310
2015	65,000	0	65,000	0.2472	16,067
2015	35,000		35,000	0.2472	8,651
Total	\$759,000	\$360,000	\$ 399,000		\$ 17,997

* $t = 0$ at the beginning of 2006.

Table 12.1: Net Present Value (NPV) Analysis

4. Internal Rate of Return (IRR):

If we have a set of expected cash inflows and cash outflows, the internal rate of return is the discount rate that equates the present values of the two sets of flows. If A_t is an expected cash outflow in the period t and R_t is the expected inflow for the period t , the internal rate of return is the value of k that satisfies the following equation (note that the A_0 will be positive in this formulation of the problem):

$$A_0 + A_1/(1 + k) + A_2/(1 + k)^2 + \dots + A_n/(1 + k)^n = R_1/(1 + k) + R_2/(1 + k)^2 + \dots + R_n/(1 + k)^n$$

The value of k is found by trial and error.

5. Profitability Index:

Also known as the benefit–cost ratio, the profitability index is the net present value of all future expected cash flows divided by the initial cash investment. (Some firms do not discount the cash flows in making this calculation.) If this ratio is greater than 1.0, the project may be accepted.

6. Other Profitability Models:

There are a great many variations of the models just described. These variations fall into three general categories. These are:

- Those that subdivide net cash flow into the elements that comprises the net flow.
- Those that include specific terms to introduce risk (or uncertainty, which is treated as risk) into the evaluation.
- Those that extend the analysis to consider effects that the project might have on other projects or activities in the organization.

12.1.1 Advantages of Profit-Profitability Numeric Models:

Several comments are in order about all the profit-profitability numeric models. First, let us consider their advantages:

- The undiscounted models are simple to use and understand.
- All use readily available accounting data to determine the cash flows.
- Model output is in terms familiar to business decision makers.

- With a few exceptions, model output is on an “absolute” profit/profitability scale and allows “absolute” go/no-go decisions.
- Some profit models account for project risk.

12.1.2 Disadvantages of Profit-Profitability Numeric Models:

The disadvantages of these models are the following:

- These models ignore all non-monetary factors except risk.
- Models that do not include discounting ignore the timing of the cash flows and the time–value of money.
- Models that reduce cash flows to their present value are strongly biased toward the short run.
- Payback-type models ignore cash flows beyond the payback period.
- The internal rate of return model can result in multiple solutions.
- All are sensitive to errors in the input data for the early years of the project.
- All discounting models are nonlinear, and the effects of changes (or errors) in the variables or parameters are generally not obvious to most decision makers.
- All these models depend for input on a determination of cash flows, but it is not clear exactly how the concept of cash flow is properly defined for the purpose of evaluating projects.

12.1.3 Profit-Profitability Numeric Models – An Overview:

A complete discussion of profit/profitability models can be found in any standard work on financial management—see Ross, Westerfield, and Jordan (1995), for example.

In general, the net present value models are preferred to the internal rate of return models. Despite wide use, financial models rarely include non-financial outcomes in their benefits and costs. In a discussion of the financial value of adopting project management (that is, selecting as a project the use of project management) in a firm, Githens (1998) notes that traditional financial models “simply cannot capture the complexity and value-added of today’s process-oriented firm.”

The commonly seen phrase “Return on Investment,” or ROI, does not denote any *specific* method of calculation. It usually involves Net Present Value (NPV) or Internal Rate of Return (IRR) calculations, but we have seen it used in reference to undiscounted average rate of return models and (incorrectly) payback period models.

In our experience, the payback period model, occasionally using discounted cash flows, is one of the most commonly used models for evaluating projects and other investment opportunities. Managers generally feel that insistence on short payout periods tends to minimize the *risks* associated with outstanding monies over the passage of time. While this is certainly logical, we prefer evaluation methods that discount cash flows and deal with uncertainty more directly by considering specific risks. Using the payout period as a cash-budgeting tool aside, *its primary virtue is its simplicity.*

Real Options: Recently, a project selection model was developed based on a notion well known in financial markets. When one invests, one foregoes the value of alternative future investments. Economists refer to the value of an opportunity foregone as the “opportunity cost” of the investment made.

The argument is that a project may have greater net present value if delayed to the future. If the investment can be delayed, its cost is discounted compared to a present investment of the same amount. Further, if the investment in a project is delayed, its value may increase (or decrease) with the passage of time because some of the

uncertainties will be reduced. If the value of the project drops, it may fail the selection process. If the value increases, the investor gets a higher payoff. The real options approach acts to reduce both technological and commercial risk. For a full explanation of the method and its use as a strategic selection tool, see Luehrman (1998a and 1998b). An interesting application of real options as a project selection tool for pharmaceutical Research and Development (R and D) projects is described by Jacob and Kwak (2003). Real options combined with Monte Carlo simulation is compared with alternative selection/assessment methods by Doctor, Newton, and Pearson (2001).

PROJECT PROPOSAL

12.2 Introduction:

Project Proposal is the initial document that converts an idea or policy into details of a potential project, including the outcomes, outputs, major risks, costs, stakeholders and an estimate of the resource and time required.

To begin planning a proposal, remember the basic definition: ***a proposal is an offer or bid to do a certain project for someone.*** Proposals may contain other elements – technical background, recommendations, results of surveys, information about feasibility, and so on. But what makes a proposal a proposal is, that it asks the audience to approve, fund, or grant permission to do the proposed project.

If you plan to be a consultant or run your own business, written proposals may be one of your most important tools for bringing in business. And, if you work for a government agency, non-profit organization, or a large corporation, the proposal can be a valuable tool for initiating projects that benefit the organization or you the employee proposed (and usually both).

A proposal should contain information that would enable the audience of that proposal to decide whether to approve the project, to approve or hire you to do the work, or both. To write a successful proposal, put yourself in the place of your audience – the recipient of the proposal, and think about what sorts of information that person would need to feel confident having you do the project.

It is easy to get confused about proposals. Imagine that you have a terrific idea for installing some new technology where you work and you write up a document explaining how it works and why it is so great, showing the benefits, and then end by urging management to go for it. Is that a proposal? The answer is “No”, at least not in this context. It is more like a feasibility report, which studies the merits of a project and then recommends for or against it. Now, all it would take to make this document a proposal would be to add elements that ask management for approval for you to go ahead with the project. Certainly, some proposals must sell the projects they offer to do, but in all cases proposals must sell the writer (or the writer's organization) as the one to do the project.

12.3 Types of Project Proposals:

Consider the situations in which proposals occur. A company may send out a public announcement requesting proposals for a specific project. This public announcement, called a *Request for Proposal (RFP)*, could be issued through newspapers, trade journals, Chamber of Commerce channels, or individual letters. Firms or individuals interested in the project would then write proposals in which they summarize their qualifications, project schedules and costs, and discuss their approach to the project. The recipient of all these proposals would then evaluate them, select the best candidate, and then work up a contract.

But proposals come about much less formally. Imagine that you are interested in doing a project at work (for example, investigating the merits of bringing in some new technology to increase productivity). Imagine that you visited with your supervisor and tried to convince her of this. She might respond by saying, "Write me a proposal and I will present it to upper management." As you can see from these examples, proposals can be divided into several categories:

1. Internal Proposal:

If you write a proposal to someone within your organization (a business, a government agency, etc.), it is an internal proposal. With internal proposals, you may not have to include certain sections (such as qualifications), or you may not have to include as much information in them.

2. External Proposal:

An external proposal is one written by a separate, independent consultant proposing to do a project for another firm. It can be a proposal from organization or individual to another such entity.

3. Solicited Proposal:

If a proposal is solicited, the recipient of the proposal in some way requested the proposal. Typically, a company will send out requests for proposals (RFPs) through the mail or publish them in some news source. But proposals can be solicited on a very local level. For example, you could be explaining to your boss what a great thing it would be to install a new technology in the office; your boss might get interested and ask you to write up a proposal that offered to do a formal study of the idea.

4. Unsolicited Proposal:

Unsolicited proposals are those in which the recipient has not requested proposals. With unsolicited proposals, you sometimes must convince the recipient that a problem or need exists before you can begin the main part of the proposal.

Solicited vs. Unsolicited Proposals

1. Solicited

An organization (private/public foundation, state/federal agency, etc...) has solicited proposals when it sends out an announcement of a grant/contract/cooperative agreement program and invites other organizations/individuals to submit proposals.

a. Common Solicitations

RFA: request for applications (grant)

RFP: request for proposals (contract –usually)

RFQ: request for quotation (contract)

PA: program announcement (grant)

BAA: broad agency announcement

b. Response to solicitation: your proposal (*application, proposal, quotation: all synonymous*)

Usually includes the following (as outlined in the application request/solicitation):

Scope of work

Work plan, methodology, aims

Key personnel

Resources

Budget

Budget justification

2. Unsolicited

Even if an organization has not solicited proposals, it might accept and fund projects based on an unsolicited proposal.

a. Common unsolicited agreements:

Gifts

Grants

Contracts

Cooperative agreements

b. You initiate the contact.

Many agencies accept unsolicited proposals. Depending on the agency, unsolicited proposals range from lengthy full-proposals, using agency-specific forms, to short letter proposals, which consist of 2-4 pages and are also called letters of inquiry.

Table 12.2: Solicited Versus Unsolicited Proposals

12.3.1 Request for Proposal:

A Request for Proposal (referred to as RFP) is an invitation for suppliers, through a bidding process, to submit a proposal on a specific product or service.

A Request for Proposal (RFP) typically involves more than the price. Other requested information may include basic corporate information and history, financial information (can the company deliver without risk of bankruptcy), technical capability (used on major procurements of services, where the item has not previously been made or where the requirement could be met by varying technical means), product information such as stock availability and estimated completion period, and customer references that can be checked to determine a company's suitability.

In the military, Request for Proposal (RFP) is often raised to fulfill an Operational Requirement (OR), after which the military procurement authority will normally issue a detailed technical specification against which tenders will be made by potential contractors. In the civilian use, Request for Proposal (RFP) is usually part of a complex sales process, also known as enterprise sales.

Request for Proposals (RFPs) often include specifications of the item, project or service for which a proposal is requested. The more detailed the specifications, the better the chances that the proposal provided will be accurate. Generally Request for Proposals (RFPs) are sent to an approved supplier or vendor list.

The bidders return a proposal by a set date and time. Late proposals may or may not be considered, depending on the terms of the initial Request for Proposal. The proposals are used to evaluate the suitability as a supplier, vendor, or institutional partner. Discussions may be held on the proposals (often to clarify technical capabilities or to note errors in a proposal). In some instances, all or only selected bidders may be invited to participate in subsequent bids, or may be asked to submit their best technical and financial proposal, commonly referred to as a Best and Final Offer (BAFO).

12.3.2 Request for Proposal (RFP) Variation:

The Request for Quotation (RFQ) is used where discussions are not required with bidders (mainly when the specifications of a product or service are already known), and price is the main or only factor in selecting the successful bidder. Request for Quotation (RFQ) may also be used as a step prior to going to a full-blown Request for Proposal (RFP) to determine general price ranges. In this scenario, products, services or suppliers may be selected from the Request for Quotation (RFQ) results to bring in to further research in order to write a more fully fleshed out Request for Proposal (RFP).

Request for Proposal (RFP) is sometimes used for a Request for Pricing.

12.3.3 Request for Information (RFI):

Request for Information (RFI) is a proposal requested from a potential seller or a service provider to determine what products and services are potentially available in the marketplace to meet a buyer's needs and to know the capability of a seller in terms of offerings and strengths of the seller. Request for Information (RFIs) are commonly used on major procurements, where a requirement could potentially be met through several alternate means. A Request for Information (RFI), however, is not an invitation to bid, is not binding on either the buyer or sellers, and may or may not lead to a Request for Proposal (RFP) or Request for Quotation (RFQ).

PROJECT PROPOSAL

Broad Contents

Characteristics of a Project Proposal
Preparation for Future Proposal
Proposal Effort for Specific Proposals
Proposal Efforts
Typical Engineering, Procurement and Construction (EPC) Proposal Contents
Modifications to the Standard Proposal

13.1 Characteristics of a Project Proposal:

The more important characteristics of a project proposal are:

1. Proposal projects are high priority, short duration efforts. They must be completed to the owners schedule requirement regardless of the work load and other demands on the contracting organizations.
2. The owner's specifications for the preferred payment method must be adhered to, at least in the basic proposal. Alternates which offer benefits to both parties may be suggested for the owner's consideration.
3. The owner frequently will specify a particular format for the proposal and for presentation of the requested information.
4. The owner may express a clear preference as to the location where the project work will be done. The engineering company may suggest alternate arrangements that give the owner a more cost effective project without sacrificing the required contract. The base proposal however, must be as responsive as possible.
5. The owner may have a preference, openly expressed or merely implied, for the construction labor arrangement. If this preference has not been made clear in the Request for Proposal (RFP) or in the discussions with the owner, it should be determined at the earliest possible time in the proposal effort so that the proper construction program may be planned.
6. A proposal project requires forming a team of the representatives for sales, project management, technical and support functions. Many of these have responsibilities over and above the proposal project. These work loads must be considered and respected insofar as is possible.
7. Proposal projects are normally costed against corporate overhead and therefore will be tightly budgeted and be closely monitored by senior management.

13.2 Preparation for Future Proposal:

Because of the price restraints and the repetitive nature of much of the data used in proposals, it is helpful to collect as much as possible of the proposal information in advance. This is especially true for the following areas:

- Proposal project manager should be identified in advance. In a company with a significant continuing proposals load, a group may be formed consisting of former project managers with verbal skills and the proper personality to allow them to function in the pressure

cooking environment of proposal preparation. These individuals must have a high tolerance for working under tight schedules, stringent budgets, with borrowed personnel, and being the object of continual criticism which is not always constructive.

- A proposal publication staff should be in place to be fully effective. These individuals should have skills in editing, use of word processing and reproducing equipment, as well as graphic art capability. They should be able to work effectively with the masses of material in various stages of progress to assure that all of it comes together according to the schedule.
- A technical information data base including the full range of the type of projects offered by the company, including feasibility studies, engineering projects, as well as full scope projects for various types of facilities.
- Standard scope of services should be developed that can be readily customized for the particular project on word processing system. Much of the particular information of various projects is quiet similar and only requires bringing it into conformance with owner's requirements or with those of particular facility of location.
- The company should have developed comprehensive definitions for the various levels of efforts associated with producing cost estimates of various accuracies. This is particularly important for developing proposals for feasibility studies.
- Work plans should also be developed for the various basic types of projects. These can be of general information which can then be modified to conform to the plans for the specified project under consideration.
- A data bank is helpful to standardize commercial terms and conditions together with listing that define those costs included in overhead and those which are not. This is particularly important in reimbursable contracts to control charges to the standard check list and the resultant changes in the reimbursable unit cost.
- Qualification material should be updated frequently in several different standard formats such as:
 - Project performance data, schedule and cost
 - Descriptions of past projects
 - Resumes of key personnel
 - Write ups on support areas such as:
 - Project Controls
 - Procurement Procedures
 - Material Management
 - Quality Assurance Practices
- Typical write ups should be prepared in advance for various other parts of the proposal. These will be modified to suit the Request for Proposal (RFP) or inquiry document. Among other these writings include:
 - Introduction
 - Project Organization
 - Schedule
 - Project Controls
 - Compensation

13.3 Proposal Effort for Specific Proposals:

Preparation of the proposal may start as soon as there has been a positive indication that the company will be included in the bid list and preliminary information is available on the project. Early efforts would include:

- Preliminary assignments for the anticipated proposals would be made based upon the schedule for the Request for Proposal (RFP) release and the due date of the proposal. These assignments would include the proposal project manager, the project manager proposed to head the project, and the proposal publication and technical support personnel. In addition, the lead estimator, the lead scheduler, technical personnel, procurement and construction representatives as indicated by the nature of the effort would be selected.
- The preliminary proposal plan schedule and budget should be blocked out. The proposal plan would define the outline of the proposal and the preliminary assignment of the work. The schedule would indicate dates for completion of the preliminary draft, job hours and cost estimates, the final draft dates, the necessary dates for approval, and the publication and delivery dates.
- A rigorous assessment should be made of the technical aspects of the project to identify the company's strengths and weaknesses. Immediate and specific actions should be planned to boost capability where this is required and to develop the personnel and background information to cover these critical areas.

When Request for Proposal (RFP) is received, it is reviewed and a bid/no bid decision is made.

13.4 Proposal Effort:**1. Assignment of Proposal to Team Members:**

As soon as decision to bid has been confirmed, the assignment of team members is finalized.

2. Kick-Off Meeting:

The project manager calls a kick-off meeting, at which the time task assignments and the corresponding schedules are made. At this meeting, technical, legal and compensation considerations are reviewed and assignments of responsibilities are made.

3. Preliminary Review of the Proposal Text:

All material is typed on word processor, with margins for easier editing. Typed drafts should be checked carefully against the original draft to assure that nothing has been inadvertently omitted.

4. Final Review:

When text is essentially in final form and all changes have been incorporated, it is submitted for review of operations management and for final legal review. All major changes from this last text review should be flagged so that the signoff should be obtained quickly.

5. Publication and Signoff**6. Delivery of the Proposal**

13.5 Typical Engineering Procurement and Construction (epc) Proposal Contents:

Following is the summary of the typical contents of cost reimbursable proposal for Engineering, Procurement and Construction services.

1. Introduction and Summary:

The Request for Proposal (RFP) conditions are summarized and general approach to the work by the contractor is indicated.

2. Project Description:

This material is largely taken from the Request for Proposal (RFP). It may also include information that has been obtained by site visits, during pre-bid conference, and in other contacts with the owner or other knowledgeable sources.

3. Scope of Services:

This section details the services the owner will provide. It includes the services that will be performed and the documents that will be produced. All services should be well defined, not opened, even in reimbursable proposals. All of the documents that are to be furnished as part of the services of the contractor should be listed in detail. A brief description of what each will include should also be provided.

4. Work Plan and Schedule:

The project work plan is developed in response to the stated objectives of the owner or as defined by the sales representatives and the objectives of the contracting firm for the specific proposal. It may be presented in graphic form for showing the interrelationship between various activities.

5. Project Organization:

This describes the proposed project organization, and details the responsibilities of each of the key member of the project team. An organization chart depicting the proposed project team will be drawn. The interface with the supplier of technology should be carefully defined, and the technical review responsibilities should be carefully defined.

6. Estimates, Hours, Costs:

All of the information presented in the previous sections of the proposal must be taken into account in preparing the estimates of work. The cost estimates will include salaries of all technical and non – technical personnel, as well as indirect costs such as travel, communication, computer use and reproduction.

7. Compensation:

After the estimates have been reviewed, the commercial terms are finalized by adding those discretionary figures such as burdens, contingencies, overlays and fees required by the format of the bid. This information is presented in the compensation section of the bid.

8. Qualifications:

The qualification section of the proposal contains all relevant material arranged in proper manner to strengthen confidence as to the contractor's capability in the mind of the owner's management. It must always be reviewed to ensure that the information presented is accurate, pertinent and forceful.

13.6 Modifications to the Standard Proposal:

Many owners have a very specific format which requires that the contractor depart from a standard proposal format. It is best to follow the specified format as it will help to simplify the proposal evaluation process in the owner's office.

PROJECT PROPOSAL (CONTD.)

Broad Contents

Common Sections in a Proposal
Organization of winning proposals
Formats of Proposals
Some tips for writing and presenting proposals

14.1 Common Sections in Proposals:

The following is a review of the sections you will commonly find in proposals. Do not assume that each one of them has to be in the actual proposal you write, nor that they have to be in the order they are presented here, plus you may discover that other kinds of information not mentioned here must be included in your particular proposal.

1. Introduction:

Plan the introduction to your proposal carefully. Make sure it caters to all of the following things (but not necessarily in this order) that apply to your particular proposal:

- Indicate that the document to follow is a proposal.
- Refer to some previous contact with the recipient of the proposal or to your source of information about the project.
- Find one brief motivating statement that will encourage the recipient to read on and to consider doing the project.
- Give an overview of the contents of the proposal.

Remember that you may not need *all* of these elements, and some of them can combine neatly into single sentences. The introduction ought to be brisk and to the point and not feel as though it is trudging laboriously through each of these elements.

2. Background on the Opportunity:

Often occurring just after the introduction, the background section discusses what has brought about the need for the project; what problem, what opportunity there is for improving things, what the basic situation is. An owner of pine timberland may want to get the land productive of saleable timber without destroying the ecology.

It is true that the audience of the proposal may know the problem very well, in which case this section might not be needed. Writing the background section still might be useful, however, in demonstrating your particular view of the problem. And, if the proposal is unsolicited, a background section is almost a requirement; you will probably need to convince the audience that the problem or opportunity exists and that it should be addressed.

3. Benefits and Feasibility of the Proposed Project:

Most proposals discuss the advantages or benefits of doing the proposed project. This acts as an argument in favor of approving the project. Also, some proposals discuss the likelihood of the project's success. In the forestry proposal, the proposer is recommending that the landowner make an investment; at the end of the proposal, he

explores the question of what return there will be on that investment, how likely those returns are. In the unsolicited proposal, this section is particularly important as you are trying to "sell" the audience on the project.

4. Description of the Proposed Work (Results of the Project):

Most proposals must describe the finished product of the proposed project. In this course, that means describing the written document you propose to write, its audience and purpose; providing an outline; and discussing such things as its length, graphics, binding, and so forth.) In the scenario you define, there may be other work such as conducting training seminars or providing an ongoing service. Add that too.

5. Method, Procedure, Theory:

In most proposals, you will want to explain how you will go about doing the proposed work, if approved to do it. This acts as an additional persuasive element; it shows the audience you have a sound, well-thought-out approach to the project. Also, it serves as the other form of background some proposals need. Remember that the background section (the one discussed above) focused on the problem or need that brings about the proposal. However, in this section, we will discuss the technical background relating to the procedures or technology you plan to use in the proposed work. For example, in the forestry proposal, the writer gives a bit of background on how timber management is done. Once again, this gives the proposal writer a chance to show that you know what you are talking about, and build confidence in the audience that you are a good choice to do the project.

6. Schedule:

Most proposals contain a section that shows not only the projected completion date but also key milestones for the project. If you are doing a large project spreading over many months, the timeline would also show dates on which you would deliver progress reports. And if you cannot cite specific dates, cite amounts of time or time spans for each phase of the project.

7. Qualifications:

Most proposals contain a summary of the proposing individual's or organization's qualifications to do the proposed work. It is like a mini-resume contained in the proposal. The proposal audience uses it to decide whether you are suited for the project. Therefore, this section lists work experience, similar projects, references, training, and education that show familiarity with the project.

8. Costs, Resources Required:

Most proposals also contain a section detailing the costs of the project, whether internal or external. With external projects, you may need to list your hourly rates, projected hours, costs of equipment and supplies, and so forth, and then calculate the total cost of the complete project. With internal projects, there probably would not be a fee, but you should still list the project costs: for example, hours you will need to complete the project, equipment and supplies you will be using, assistance from other people in the organization, and so on.

9. Conclusions:

The final paragraph or section of the proposal should bring readers back to a focus on the positive aspects of the project (you have just showed them the costs). In the final

section, you can end by urging them to get in touch to work out the details of the project, to remind them of the benefits of doing the project, and maybe to put in one last plug for you or your organization as the right choice for the project.

10. Special Project-Specific Sections:

Remember that the preceding sections are typical or common in written proposals, not absolute requirements. Similarly, some proposals may require other sections not discussed above. Do not let your proposal planning be dictated by the preceding discussion. Always ask yourself what else might my audience need to understand the project, the need for it, the benefits arising from it, my role in it, my qualifications to it, What else might my readers need to be convinced to allow me to do the project? What else do they need to see in order to approve the project and to approve me to do the project?

14.2 Organization of Winning Proposals:

As for the organization of the content of a proposal, remember that it is essentially a sales, or promotional document. Here are the basic steps it goes through:

1. You introduce the proposal, telling the readers its purpose and contents.
2. You present the background – the problem, opportunity, or situation that brings about the proposed project. Get the reader concerned about the problem, excited about the opportunity, or interested in the situation in some way.
3. State what you propose to do about the problem, how you plan to help the readers take advantage of the opportunity, how you intend to help them with the situation.
4. Discuss the benefits of doing the proposed project, the advantages that come from approving it.
5. Describe exactly what the completed project would consist of, what it would look like, how it would work – describe the results of the project.
6. Discuss the method and theory or approach behind that method; enable readers to understand how you will go about the proposed work.
7. Provide a schedule, including major milestones or checkpoints in the project.
8. Briefly list your qualifications for the project; provide a mini-resume of the background you have that makes you right for the project.
9. Now (and only now), list the costs of the project, the resources you will need to do the project.
10. Conclude with a review of the benefits of doing the project (in case the shock from the costs section was too much), and urge the audience to get in touch or to accept the proposal.

Notice the overall logic of the movement through these section: you get them concerned about a problem or interested in an opportunity, then you get them excited about how you will fix the problem or do the project, then you show them what good qualifications you have – *then* hit them with the costs, but then come right back to the good points about the project.

14.3 Format Of Proposals:

Following are the options for the format and packaging of your proposal. It does not matter which you use as long as you use the memorandum format for internal proposals and the business letter format for external proposals.

- **Cover Letter With Separate Proposal:**

In this format, you write a brief "cover" letter and attach the proposal proper after it. The cover letter briefly announces that a proposal follows and outlines the contents of it. In fact, the contents of the cover letter are pretty much the same as the introduction (discussed in

the previous section). Notice, however, that the proposal proper that follows the cover letter repeats much of what you see in the cover letter. This is because the letter may get detached from the proposal or the recipient may not even bother to look at the letter and just dive right into the proposal itself.

- **Cover Memo with Separate Proposal:**

In this format, you write a brief "cover" memo and attach the proposal proper after it. The cover memo briefly announces that a proposal follows and outlines the contents of it. In fact, the contents of the cover memo are pretty much the same as the introduction (discussed in the previous section). This is because the memo may get detached from the proposal or the reader may not even bother to look at the memo and just dive right into the proposal itself.

- **Business-Letter Proposal:**

In this format, you put the entire proposal within a standard business letter. You include headings and other special formatting elements as if it were a report.

- **Memo Proposal:**

In this format, you put the entire proposal within a standard office memorandum. You include headings and other special formatting elements as if it were a report.

If we are in a competitive bid situation, usually price, schedule, financial stability, quality of experience and resources and financing offer (if any) are relevant. However, many contract awards are made on a negotiated basis. While success may depend on some or all of the above features, two others many come into strategic play:

1. Interpersonal relationships with people of the prospective client
2. The written word in the proposal. Conveying the real proposal message with effective writing is essential.

Below is a list of seven key ingredients of a winning proposal.

- i) **Message:**

That we understand the project, the owner's real wants, and are prepared to satisfy them with our resources and company commitment.

- ii) **Response:**

Complete and direct response to the Request for Proposal (RFP) or the bidding documents. The client wrote them, or at least approved them, and expects to see them addressed in their entirety.

- iii) **Disclosure:**

Comprehensive documentation of all relevant company experience. Careful attention to personnel resumes, rewriting them to emphasize pertinent experience.

- iv) **Creativity:**

Something unique or innovative to set us apart from the competition.

- v) **Price:**

Usually but not always a significant factor in competitive proposals on bids.

- vi) **Financing:**

More than ever, an important consideration, even a requirement. Bids are usually adjusted by financing terms offered, so the product of price and financing determines the "bottom line".

- vii) **Style:**

Well composed, concisely written, logically organized, properly referenced, and attractively presented.

In preparing the proposal strategy, all of the homework already accomplished needs to be woven into the plan. Some Request for Proposals (RFPs) (most for engineering work) include an evaluation system to award proposals a number of points in selected categories. Typical evaluation criteria may include a point distribution as shown below:

- Qualification of proposed personnel, particularly the project manager: Up to 50%
- Experience on similar projects: Range of 25-35%
- Proposed work plan and approach: Range of 25-35%

Cost or level of estimated effort in terms of man-hour or man-months may well be the deciding factor. If so, in times of a strong U.S. dollar it very definitely places a U.S. firm at a disadvantage overseas.

Obviously, if evaluation criteria are specified, every effort needs to be made to achieve the maximum possible score.

Various techniques are employed in proposal writing, i.e., getting the message across. Aside from outlines, schedules and tables of contents, one technique, which has come into wide use, is called the “*story board*”.

It employs modules organized for each strategic message intended for the proposal. Each module is composed of:

1. A topical sentence describing the module theme
2. A theme expressing the strategic message in, say 400 –800 words
3. Graphic or artwork to illustrate the theme

Modules from their earlier skeleton form and further developed during the proposal preparation process are posted on the wall of a control room. When finished they tell the complete story.

This technique permits early organization of the proposal contents, allows continuous management overview, directs the tone of the proposal toward its strategic objectives, clearly establishes writing assignments, and produces a balance of content.

A carefully conceived financing package is often a proposal requirement. This subject is covered in separate former oral presentations, in addition to written proposals, sometimes are important steps in the process. However, overseas clients generally are less interested in receiving them than in the United States.

What about post proposal strategies? Continuous contact with the perspective client, in an effort to answer his questions and to further demonstrate our commitment to his project, can be worthwhile. If our proposal was not selected, a postmortem will be of value to determine how we went wrong or how the competition outdid us.

14.4 Some Tips for Writing and Presenting Proposals:

The following tried and tested tips are to encourage the 100%ers to write more proposals and the low raters to take heart and give it another try.

1. **Ask Questions:**
Before starting your proposal, take some time to make sure you know exactly what you are proposing. If you are unclear about any part of the project, ask your potential client a few meaningful questions. If anything seems vague in their description of “what they want”, ask for clarification and then give them a list of possible options as to what you think they might have meant. For your sake, when preparing to give a price, it is important that you and the client both have the same amount of work in mind. Note that if you decide to include a list of questions along with your proposal, include an educated guess as to what their answers would be. Make it clear that your price is based on you having made the correct guesses to the proposed questions and that if anything needs clarifying or if anything is missed, you can adjust your quote accordingly.
2. **Summarize the Project:**
Take all the information on the project that you have received from the client thus far and summarize it briefly, using your own words, in an opening paragraph. This not only helps you get a clearer concept of the project in your own mind but also gives the client confidence that you have given it thought and you understand what they want. It also provides a solid opportunity for them to clarify encase you did not understand.
3. **Break Down the Project into a Nice “To Do” List:**
After your summary, follow-up with a solid “To Do” list, that is very useful for both you and your client. List everything that they have requested so far as well as your standard work on the project. For designers, this would include listing the initial drafts, etc. For programmers, this would include planning the database, building it, etc. Be thorough in your list. It will help give the client a strong sense that you know what you are doing and that you will do the job well. It will also help you make sure nothing slips through the cracks. Use the list in your project updates and cross things off as you move along.
4. **Split the Project into Phases:**
After your “to do” list split the project up into a number of clearly defined phases. It is recommended starting out with a minimum of three. Your first phase might be the “Initial First Draft”. During this phase, you begin work on the project and end the phase by sending the client a first draft for testing and revision. Your next phase, in a simple 3 phase project, could be “Bug Squashing and Customizing”. During this phase the project is tested and revisions are made until the client is happy with the work and it is ready for action. Your last phase is “Finalization”. Once the work is finished, you send them an invoice, ask for referrals, collect payment, and end with a virtual handshake, all parties satisfied with a job well done. Bonus: A useful strategy to keep in mind when it comes to pricing is splitting up a long to-do list into meaningful project phases and then pricing each of the “phases” individually. This can be especially useful for isolating features that require additional time and energy and being sure the client recognizes the work involved when it comes time to give them the price.
5. **Give Your Clients a Timeline:**
Once you have gone over the project phases, let your clients know approximately how long you expect the project to take. Be generous (overestimate if need be, but gently) and then strive to finish up ahead of time. While a project may only take you a few hours to finish up, keep in mind that there will be waiting time between the initial drafts and the finished project as the client reviews the work and provides feedback. If the client is in a rush, let them know exactly when it can be finished and be sure to go over in detail exactly what, if anything needs to be done on their part to make that deadline possible.

6. Estimate Your Time Involved:

While not useful for all project types, giving an estimate of time involved is useful for most and not only gives the client a sense of what to expect and that you know what you are doing, but also helps you know exactly what to plan ahead for. A large design/programming project, for example, with a high dollar amount, can be an excellent opportunity to detail the hours involved in each step of the to-do list. Be generous, but honest. The last thing you want is word getting around that it takes you several hours to do what takes the average freelancer 15 minutes.

7. Use the Multiple Choice Price Strategy:

Now that all the details have been clearly laid out and your client is confident in your understanding of the project and your ability to see it through, it's time to give them the price. Calculate your predicted time involved and be sure that nothing is overlooked. Then, give them the total number of hours along with your standard hourly rate followed by a discounted "flat rate". Let us say you estimate about 5-8 hours involved in the project and your hourly rate is \$40 an hour. Your proposal would then read something like this: "At around 5-8 hours of work, you are welcome to my basic hourly rate of \$40 an hour or a discounted flat rate of \$250." 9 times out of 10 the client will choose the flat rate over the hourly and will be happy with having had the freedom to choose. Note that as an honest freelance artist whose abilities are constantly improving, you will often reach a point where what once took you 5 hours now takes you an hour. Once that happens, the multiple price strategy is no longer needed. Give them your flat rate and do an excellent job. Be sure that, along with your price, you give them your options for accepting payment.

8. Offer a Satisfaction Guarantee:

Once you have given them the price, be sure to include your satisfaction guarantee. Let them know that you are committed to working on the project until they are fully satisfied and then, once they have accepted your proposal, stick to it. There is always the possibility that it can backfire with a client who just does not ever seem to be satisfied (we can talk about dealing with them another day), but the vast majority of the time a solid guarantee will give your clients an extra vote of confidence and help to close the deal. There is always the possibility of a project costing you more time than it is worth, but no matter. Give the project your absolute best and learn everything that you can. Satisfied customers often end up being repeat customers and they are more than worth the time spent on those who may not appreciate your work.

9. End With a Call to Action:

Finally, after all the details have been made clear, and the price and guarantee given, end with "what happens next." Let them know exactly what they need to do to get started. If you require payment upfront, let them know where to send the money. If everything prior has gone well, you now have a client who is excited and eager to see their project come to life and you want to make sure that they know what needs to happen next.

10. Write and Format Professionally:

Nothing says "unprofessional" like a bunch of "misspellings", grammatical errors, and "IM Style" typing. Take the extra time to proof read your proposal and fix any little errors that may have slipped in. Use spacing between your paragraphs and divide your various sections (Project Summary, Timeline, Price Quote, etc.) with subheadings. For extra points, put your proposal up on a password protected page (make sure the password works) within your website. Remember if you are struggling with style or would just like some extra ideas/opinions, put together an example proposal and share it with family and friends along with a request for feedback.

Once the proposal has been accepted and the project complete, be sure to always ask the client if they have any suggestions for how you can improve and do even better work in the future. Ask them if your proposal was clear and ask if you were able, what the deciding factor was in choosing you to do the work. Take note of all you learn and apply it to the next proposal you write. Although not directly related to “proposal writing”, here are two other tips that are worth mentioning:

1. Pre-Screen your Clients:

To save both you and your client’s time and energy, it is important to be sure that they are as informed and as prepared as possible before they contact you. This is where your website can step in and do its job. After they have browsed through your portfolio and decided to go for a price on your services, it is important that you provide a clear path to follow. Create a page specifically for those interested in working with you. Outline the types of projects that you do and the processes that you use. Do not hide your prices. As well as offering an hourly rate and flat rate estimates for various project types, it is better to mention that you are always open to creative negotiations. You can often end up with “free projects” that more than pay what you would have charged them.

2. Respond Quickly:

While not always possible, when you are able to, respond to your prospective and active clients immediately. If you have an expected delay, let them know that you plan to be unavailable. Be punctual with all your appointments and make sure that you meet your deadlines. If you miss a deadline and you are at fault, take a hit on your earnings. This will let the client know that you mean what you say and it will also help you to make sure it does not happen again.

PROJECT PLANNING

Broad Contents

Introduction
Project Planning
Plan of Execution
Information Required for Planning Execution of Projects
Early Stage Documentation by Project Manager

15.1 Introduction:

Planning is done to facilitate later accomplishment. Planning techniques covered here are intended to smooth the path from idea to accomplishment. Project planning is a complicated process to manage project and planning act as map of this process. Map must have sufficient detail to determine what must be done next but simple enough that workers are not lost in welter of minutiae.

Almost all project planning techniques lead to plans that contain same basic elements. They differ only in ways they approach process of planning. At its best, planning is tortuous. It is iterative process yielding better plans from not-so-good plans, and iterative process of improvement seems to take place in fits and starts. Process may be described formally, but it does not occur formally. Bits and pieces of plans are developed by individuals, by formal group meetings, or by formalized planning teams and then improved by other individuals, groups, or teams, and improved again, and again.

15.2 Project Planning:

In order to do successful project management, (whether it is in response to an in-house project or a customer request), it must utilize effective planning techniques. The quantitative and qualitative tools for project planning must be identified. Management must make effective utilization of resources, from a systems point of view.

A systematic plan is required in which the entire company is considered as one large network that is further subdivided into smaller ones. This would ensure effective utilization over several different types of projects.

In this regard, the first step in total program scheduling is to understand the project objectives. These goals may be to:

- Develop expertise in a given area
- To become competitive
- To modify an existing facility for later use
- To keep key personnel employed.

Both implicitly and explicitly, the objectives are generally not independent and are all interrelated.

The following four questions must be considered, once the objectives are clearly defined:

- i) Which functional divisions will assume responsibility for accomplishment of these objectives and the major-element work requirements?
- ii) The required corporate and organizational resources available?

- iii) What are the major elements of the work required to satisfy the objectives, and how are these elements interrelated?
- iv) What are the information flow requirements for the project?

Both the direct as well as the indirect-labor-charging organizational units must accomplish careful planning and analysis, if the project is large and complex. The project organizational structure must be designed to fit the project; work plans and schedules must be established so that maximum allocation of resources can be made; resource costing and accounting systems must be developed; and a management information and reporting system must be established.

Unless all of the necessary information becomes available at project initiation effective total program planning cannot be accomplished. These information requirements are:

- The statement of work (SOW)
- The project specifications
- The milestone schedule
- The work breakdown structure (WBS)

As the name indicates, the statement of work (SOW) is a narrative description of the work to be accomplished. It includes the objectives of the project, a brief description of the work, the funding constraint if one exists, and the specifications and schedule. The schedule is a "gross" schedule and includes such things as the:

- Start date
- End date
- Major milestones
- Written reports (data items)

Report writing is a specialized area. Written reports should always be identified so that if functional input is required, the functional manager will assign an individual who has writing skills. It is no secret who would write the report if the line people did not.

15.3 Planning of Execution:

As described earlier, project planning is a structured sequence of events that lead to a desired set of objectives.

A detailed, written, "**Plan of Execution (P of E)**" for project is drawn up, once project viability has been established and decision to proceed has been made. This plan must show:

- a) Who is to do what
- b) When
- c) How
- d) Major decisions requirements

It is essential that the project objectives must be clearly tied to overall mission of the firm. Senior management defines a firm's:

- Intent in undertaking project
- Scope of project
- Project desired results

In this regard, the Plan of Execution:

- Becomes a vehicle for communication with all stakeholders

- Becomes a prerequisite for detailed scheduling of work
- Helps documentation for preparation of “cost estimates”

Project management plans are more comprehensive than either management plans or project plans. The preparation of plans is a simple, straightforward approach designed to promote and ensure comprehensive project planning. The project management plan is a combination of two plans that are often prepared separately: the traditional management plan, which describes operational management systems and approaches, and the project plan, which includes the work breakdown structure (WBS), logic, schedules, and cost estimates. They reflect awareness that the people, the system, and the detailed planning are all critical to project success.

15.4 Information Required From Planning of Execution:

Following information is required:

1. Type of project
2. Its capacity and location(s)
3. Scope of work to be performed
4. Preliminary cost estimation
5. Site visitation report
6. Preliminary schedule of major objectives
7. Pertinent contract requirements
8. Special design and/or construction requirements
9. Climate restrictions
10. Environmental study, feasibility study reports, etc
11. Proposal document

Following are the basis for Project Manager’s planning endeavors for planning of execution.

- **Existing documents:**
 - Client’s inquiry
 - Proposal (as modified/amended in negotiation period)
 - Contract and preliminary work plans (during proposal preparation)
- **Before Execution Planning:**
Before Execution Planning, project manager is required to provide the complete scope definition of work.

Planning of Execution provide basis to:

- a) Schedules
- b) Detailed cost estimation
- c) Control budget
- d) Quality and performance assurance program

It leads to develop Work Breakdown Structure and integrates work schedule costs into trackable and controllable program. During this phase, performance baselines are also estimated during project planning.

15.5 Early Stage Documentation by Project Manager:

This includes:

1. *Coordination Procedure (CP):*
 - Coordination Procedures or Job Instructions. It includes administrative procedures in projects.

2. *Early Work Schedule (EWS):*
 - This helps in tracking activities requiring immediate action.
 - Cannot wait for release of formal schedules.
 - Early work Schedule (EWS) contains:
 - a) Running list of activities started early
 - b) Name of responsible individuals
 - c) Completion date of an activity.

15.5.1 Emphasis Placed on Early Planning:

As we know that planning does not stop with the initial plan. It is a continuous process which is fine tuned whenever necessary. Many events can potentially adversely affect /disrupt plan targets. In this regard, many a times, corrective actions will be required to restore:

- a) Integrity of schedule
- b) Budget

15.6 Example of Building House to Common “Activities in Each Phase” of Project Planning:

1. Definition Phase:

Problem defined in request document
House need heating, plumbing, lighting, storage etc.

2. Analysis Phase:

Produces functional specifications (deliverable)
Location of ventilators, air conditioner, outlet for phone etc.

3. Design Phase:

System proposed to solve problem
System divided into functional components
Components are interconnected
Expectation: rooms, ventilation, wiring etc.

4. Programming Phase:

Actual work conducted to bring system into being.
Expected: building of house

5. System Test Phase:

Brings pieces together and tests them as whole
House: test plumbing, electricity, roof, etc.

6. Acceptance Phase:

Customer tests complete system for acceptance/ payment
Minor problems are fixed
Major problems require negotiation
Minor problem may include house buyers ask for repairs to cracked plaster, or outlet
Major problem can be two fireplaces vs. one built.

7. Operations, Installation and Use:

House buyer moves in and lives in house
Problems developed/found upon use are fixed during warranty period

Not included in this are:

- a) Maintenance
- b) Upgrades
- c) Extensions

PROJECT PLANNING (CONTD.)

Broad Contents

Steps in General Planning Process
Initial Project Coordination
Project Planning Checklist

16.1 Steps in General Planning Process:

In simple terms, planning is determining what needs to be done, by whom, and by when; in order to fulfill one's assigned responsibility. There are nine major components of the planning phase:

- *Objective:* A goal, target, or quota to be achieved by a certain time
- *Program:* The strategy to be followed and major actions to be taken in order to achieve or exceed objectives
- *Schedule:* A plan showing when individual or group activities or accomplishments will be started and/or completed
- *Budget:* Planned expenditures required to achieve or exceed objectives
- *Forecast:* A projection of what will happen by a certain time
- *Organization:* Design of the number and kinds of positions, along with corresponding duties and responsibilities, required to achieve or exceed objectives
- *Policy:* A general guide for decision making and individual actions
- *Procedure:* A detailed method for carrying out a policy
- *Standard:* A level of individual or group performance defined as adequate or acceptable

Some of these components require additional comment. Forecasting what will happen may not be easy, especially if predictions of environmental reactions are required. For example, planning is customarily defined as strategic, tactical, or operational. Strategic planning is generally for five years or more, tactical can be for one to five years, and operational is the here and now of six months to one year. Although most projects are operational, they can be considered as strategic, especially if spin-offs or follow-up work is promising. Forecasting also requires an understanding of strengths and weaknesses as found in:

- Competitive situation
- Marketing
- Research and development
- Production
- Financing
- Personnel
- Management structure

These factors may be clearly definable, if project planning is strictly operational. However, if strategic or long-range planning is necessary, then the future economic outlook can vary, say, from year to year, and re-planning must be accomplished at regular intervals because the goals and objectives can change.

Because of their uniqueness, the last three factors, policies, procedures, and standards, can vary from project to project. Each project manager can establish project policies, provided that they fall within the broad limits set forth by top management. Policies are predetermined general courses or guides based on the following principles:

- Subordinate policies are supplementary to superior policies.
- Policies are based upon known principles in the operative areas.
- Policies should be definable, understandable, and preferably in writing.
- Policies should be both flexible and stable.
- Policies should be reasonably comprehensive in scope.

It is essential that the project policies must often conform closely to company policies, and are usually similar in nature from project to project. On the other hand, procedures can be drastically different from project to project, even if the same activity is performed. For example, the signing off of manufacturing plans may require different signatures on two selected projects even though the same end-item is being produced.

We can easily say that planning varies at each level of the organization. At the individual level, planning is required so that cognitive simulation can be established before irrevocable actions are taken. At the working group or functional level, planning must include the following:

- Agreement on purpose
- Assignment and acceptance of individual responsibilities
- Coordination of work activities
- Increased commitment to group goals
- Lateral communications

All the organizational or project level, planning must include:

- Recognition and resolution of group conflict of goals
- Assignment and acceptance of group responsibilities
- Increased motivation and commitment to organizational goals
- Vertical and lateral communications
- Coordination of activities between groups

In order for the alternatives and constraints to be fully understood, the logic of planning requires answers to several questions. An outline for a partial list of questions would include:

- Where are we?
- How and why did we get here?
- Is this where we want to be?
- Where would we like to be (in a year, in five years etc.)?
- Where will we go if we continue as before?
- Is that where we want to go?
- How could we get to where we want to go?
- What might prevent us from getting there?
- What might help us to get there?
- Where are we capable of going?
- What do we need to take us where we want to go?
- What is the best course for us to take?
- What are the potential benefits?
- What are the risks?
- What do we need to do?
- When do we need to do it?
- How will we do it?
- Who will do it?
- Are we on course? If not, why?

- What do we need to do to be on course?
- Can we do it?

It is believed that one of the most difficult activities in the project environment is to keep the planning on target.

Following are typical procedures that can assist project managers during planning activities:

- Establish goals before you plan. Otherwise short-term thinking takes over.
- Set goals for the planners. This will guard against the nonessentials and places your effort where there is payoff.
- Stay flexible. Use people-to-people contact, and stress fast response.
- Keep a balanced outlook. Do not overreact, and position yourself for an upturn.
- Welcome top-management participation. Top management has the capability to make or break a plan, and may well be the single most important variable.
- Beware of future spending plans. This may eliminate the tendency to underestimate.
- Test the assumptions behind the forecasts. This is necessary because professionals are generally too optimistic. Do not depend solely on one set of data.
- Do not focus on today's problems. Try to get away from crisis management and fire fighting.
- Reward those who dispel illusions. Reward the first to come forth with bad news.

16.2 **Initial Project Coordination:**

It is crucial that project's objectives be clearly tied to overall mission of firm. Senior management should define firm's intent in undertaking project, outline scope of project, and describe project's desired results. Without clear beginning, project planning can easily go astray. It is also vital that senior manager call and be present at initial coordinating meeting as visible symbol of top management's commitment to project.

At the beginning, meeting is conducted in which, project is discussed in sufficient detail that potential contributors develop general understanding of what is needed. If project is one of many similar projects, meeting will be quite short and routine, sort of "touching base" with other interested units. If project is unique in most of its aspects, extensive discussion may be required.

Whatever the process, outcome must be that:

1. Technical objectives are established (though perhaps not "cast in concrete")
2. Basic areas of performance responsibility are accepted by participants
3. Some tentative schedules and budgets are spelled out. It is important that each individual/unit accepting responsibility for portion of project should agree to deliver, before next project meeting, preliminary but detailed plan about how that responsibility will be accomplished. Such plans should contain descriptions of required tasks, budgets and schedules.

After this, these plans are then reviewed by groups and combined into composite project plan. Composite plan, that is still not completely final, is approved by each participating group, by project manager, and then by senior organizational management. Each subsequent approval hardens plan somewhat, and when senior management has endorsed it, any further changes must be made by processing formal change order. However, if project is not large or complex, informal written memoranda can substitute for change order. Main point is that no significant changes in project are made, without written notice, following top management's approval. Definition of "significant" depends on specific situation and people involved.

It is generally the responsibility of the project manager to task responsibility for gathering necessary approvals and assuring that any changes incorporated into plan at higher levels are

communicated to, and approved by, units that have already signed off on plan. Nothing is as sure to enrage functional unit managers as to find that they have been committed by someone else to alterations in their carefully considered plans without being informed. Violation of this procedure is considered betrayal of trust. Several incidents of this kind occurred in firm during project to design line of children's clothing. Anger at this change without communication was so great that two chief designers resigned and took jobs with competitors.

Project manager should always return to contributing units for consideration and re-approval of plans as modified, because the senior managers are almost certain to exercise their prerogative to change plan. Final, approved result of this procedure is project plan, also known as master plan, or baseline plan.

16.2.1 Outside Clients:

Fundamental planning process is unchanged (except for the fact that specifications cannot be altered without client's permission), when project is to deliver product/service (often referred to as project's deliverables) to outside client(s). Common "planning" problem in these cases is that marketing has promised deliverables that engineering may not know how to produce on schedule that manufacturing may be unable to meet. This sort of problem usually results when various functional areas are not involved in planning process at time original proposal is made to potential client.

In this regard, two objections to such early participation by engineering and manufacturing are likely to be raised by marketing. First sales arm of organization is trained to sell and is expected to be fully conversant with all technical aspects of firm's products/services. Further, salespeople are expected to be knowledgeable about design and manufacturing lead times and schedules. On the other hand, it is widely assumed by marketing (with some justice on occasion) that manufacturing and design engineers do not understand sales techniques, will be argumentative and/or pessimistic about client needs in presence of client, and are generally not "housebroken" when customers are nearby.

Secondly, it is expensive to involve so much technical talent so early in sales process – typically, prior to issuing proposal. It can easily cost firm more than \$10,000 to send five technical specialists on trip to consider potential client's needs. Willingness to accept higher sales costs puts even more emphasis on selection process.

It is usually cheaper, faster and easier to do things right first time than to redo them. Thus, rejoinder to such objections is simple. When product/service is complex system that must be installed in larger, more complex system, it is appropriate to treat sale like project. Sale is also a project and deserves same kind of planning. Great many firms that consistently operate in atmosphere typified by design and manufacturing crises have created their own panics. In fairness, it is appropriate to urge that anyone meeting customers face to face should receive some training in tactics of selling.

For a given project plan, approvals really amount to series of authorizations. Project manager is authorized to direct activities, spend monies (usually within preset limits) request resources and personnel, and start project on its way. Senior management's approval not only signals its willingness to fund and support project, but also notifies subunits in organization that they may commit resources to project.

16.3 Project Planning Checklist:

These are described below for different areas of operations:

- **Construction Planning:**

1. Facility turnover sequence
2. Temporary facilities, offices, warehousing, etc
3. Tool and equipment requirements
4. Labor availability and productivity
5. Work week and productivity impact
6. Climatic affects on field work
7. Field engineering assistance required
8. Extent of subcontracting
9. Field organization and staffing

- **Procurement Planning:**

1. Procurement sources (equipment, materials)
2. Home office versus field procurement
3. Long lead time items
4. Logistical planning

- **Engineering Planning:**

1. Source(s) of technology
2. Codes, specifications and standards to be utilized
3. Utilization of consultants
4. Early work
5. Requisitioning priorities
6. Drawing priorities
7. Vendor data requirements
8. Utilization of scale models
9. Manpower requirements
10. Approval requirements
11. Organization and staffing
12. Utilization of prefabricated modules

- **Quality Control Planning:**

1. Audit of design and equipment for conformance to specifications
2. Checking of calculation and drawings
3. Shop inspection of equipment and fabricated items
4. Certification of materials
5. Certificate of welding procedures
6. Receiving and inspection of equipment and materials
7. Jobsite storage and environmental protection of equipment and materials
8. Construction inspection

- **Financial Planning:**

1. Cash flow requirement
2. Progress payments and billing frequency
3. Impact of financial sources

PROJECT PLANNING (CONTD.)

Broad Contents

Elements of a Project Plan
System Integration

17.1 Elements of a Project Plan:

As we know that the process of developing project plan varies from organization to organization. However, any project plan must contain the following elements:

- **Overview:**

This is short summary of objectives and scope of project. It is directed to top management and contains statement of goals of project; brief explanation of their relationship to firm's objectives, description of managerial structure that will be used for project, and list of major milestones in project schedule.

- **Introduction:**

This contains more detailed statement of general goals noted in overview section. Statement should include profit and competitive aims as well as technical goals.

- **General Approach:**

This section describes both managerial and technical approaches to work. Technical discussion describes relationship of project to available technologies. For example, it might note this project is extension of work done by company for earlier project. Subsection on managerial approach takes note of any deviation from routine procedure – for instance, use of subcontractors for some parts of work.

- **Contractual Aspects:**

This critical section of plan includes complete list and description of all reporting requirements, customer-supplied resources, liaison arrangements, advisory committees, project review and cancellation procedures, proprietary requirements, any specific management agreements (for example, use of subcontractors) as well as technical deliverables and their specifications, delivery schedules, and specific procedures for changing any of above. Completeness is necessity in this section. If in doubt about whether item should be included or not, wise planner will include it.

- **Schedules:**

This section outlines various schedules and lists all milestones events. Estimated time for each task should be obtained from those who will do work. Project master schedule is constructed from those inputs. Responsible person or department head should sign off on final, agreed-on schedule.

- **Resources:**

There are two primary aspects to this section. First is budget. Both capital and expense requirements are detailed by task, which makes this project budget. One-time costs are separated from recurring project costs. Second, cost monitoring and control procedures should be described. In addition to usual routine elements, monitoring and control procedures must be designed to cover special resource requirements for project, such as

special machines, test equipment, laboratory usage or construction, logistics, field facilities, and special materials.

- **Personnel:**

This section lists expected personnel requirements of project. Special skills, types of training needed, possible recruiting problems, legal or policy restrictions on work force composition, and any other special requirement, such as security clearances, should be noted here. (This reference to “security” includes need to protect trade secrets and research targets from competitors as well as need to protect national security). It is helpful to time-phase personnel needs to project needed and in what numbers. These projections are important element of budget, so personnel, schedule, and resources sections can be crosschecked with one another to ensure consistency.

- **Evaluation Methods:**

Every project should be evaluated against standards and by methods established at project's inception. This section contains brief description of procedure to follow in monitoring, collecting, storing, and evaluating history of project.

- **Potential Problems:**

Sometimes it is difficult to convince planners to make serious attempt to anticipate potential difficulties. One or more such possible disasters such as subcontractor default, technical failure, strikes, bad weather, sudden required breakthroughs, critical sequences of tasks, tight deadlines, resource limitations, complex coordination requirements, insufficient authority in some areas, and new complex or unfamiliar tasks are certain to occur. Only uncertainties are which ones will occur and when. In fact, timing of these disasters is not random.

There are times, conditions and events in life of every project when progress depends on subcontractors, or weather, or coordination or resource availability, and plans to deal with unfavorable contingencies should be developed early in project's life cycle. Some project managers disdain this section of plan on grounds that crises cannot be predicted. Further, they claim to be very effective firefighters. It is quite possible that when one finds such project manager, one has discovered arsonist. No amount of current planning can solve current crises, but preplanning may avert some.

These are elements that constitute project plan and are basis for more detailed planning of budgets, schedules, work plan, and general management of project. Once this basic plan is fully developed and approved, it is disseminated to all interested parties.

Below is detailed discussion on some important parts/aspects of a Project Plan.

- **Introduction/Overview:**

The project management plan introduction/overview includes an introduction both to the specific project and to the project management plan document itself. Some background information may be included to set the stage or provide perspective on the information that follows, such as how the project was initiated, who the customer or sponsor is, how the project is funded, or other factors that are important to those who read the plan. Introductions are always short, allowing the reader to move into the plan quickly. Additional external or historical information can be referenced or included in the Appendix.

External factors, such as general or specific economic trends, constraints, or opportunities; political or governmental conditions; population demographics; or internal organizational factors, should be discussed.

- **Mission and Objectives:**

The purpose or mission of the project is stated in one or two paragraphs, followed by a set of concrete objectives. The mission statement is all encompassing, establishing why the project exists. Mission statements can be general or specific. They also reference the customer if the project is being performed under contract or for a third party.

Project objectives are outlined as specific goals to be accomplished and to which status they can be applied. For instance, objectives for a small construction project might include a good location; a modern energy-efficient economic design; a fully furnished facility; a complete set of project documents; compliance with all laws, codes, and requirements; a standard profit margin; and a completion date.

Planning becomes straightforward when objectives are defined for key areas. Objectives can be established for every aspect of the project, including scope of work, organization, management, systems, environment, safety, and overall completion of the project (i.e., final cost and schedule dates). Established objectives in the following areas facilitate detailed planning, systems development, and work performance:

- Technical objectives
- Schedule objectives
- Cost objectives
- Organizational/personnel-related objectives
- Quality objectives
- Environmental safety and health objectives
- Contracting/procurement objectives
- Management system objectives

Well-defined objectives enhance the reliability of subsequent planning. Once objectives are stated in concise terms, they allow for the development of the project scope of work and the work breakdown structure.

- **Work Scope:**

The work scope section of the project management plan demonstrates how well the project is understood.

It includes narrative descriptions of all elements of the project's scope of work. It clearly identifies the products or services to be provided to the customer. The statement of work contains enough information to allow development of the Work Breakdown Structures (WBS), schedules, and cost estimates, as well as assignment of responsibilities.

This section can address the project phases and include special plans associated with those phases, such as the Research and Development plan, engineering/design plans, construction plan, manufacturing plan, facility start-up plan, or transition plan. It may also describe the systems management activities, including systems engineering and integration, to ensure project life cycle perspective. In other words, it shows that the activities necessary to ensure that the design and final products meet customer requirements are all planned and managed properly and can be integrated and operated as intended, and that start up, transition, operation, and completion activities are also planned and managed properly.

To simplify preparation, the work scope can be prepared in outline form, which can then be used to develop the Work Breakdown Structures (WBS). Often the Work Breakdown Structure (WBS) and work scope are prepared in parallel, with the resultant narrative description of the work called a Work Breakdown Structure (WBS) dictionary.

- **Planning Basis:**

The planning basis section provides for the documentation of key approaches, assumptions, requirements, and other factors considered during preparation of the project management plan. The following topics are addressed in this section:

1. ***Project Deliverables/End Products:***

A list of all products, documents, and services to be delivered to the customer over the life of the project is required.

2. ***Requirements:***

Requirements are specifications or instructions that must be followed during project performance.

They may include technical requirements, facilities requirements, data requirements, management requirements, or special instructions. Technical requirements may include codes, standards, laws, engineering or design specifications, models, or examples for mandatory or recommended compliance on the project. When there are mandatory requirements, such as laws, these must be identified and listed, or project performers run the risk of noncompliance and legal prosecution.

Facilities requirements include an initial assessment of types, amount, and quality of facilities needed for the project, along with related utilities, furniture, and equipment.

This provides initial bases for estimating quantities and costs associated with those resources. Overlooking facilities issues during project planning leads to schedule slippages, cost overruns, unhappy project participants, and untold headaches for the project managers. For small projects, facility requirements may not be a big issue; for larger projects, they can be critical.

Functional and operational requirements spell out what the system, facility, or product being produced is intended to do. They provide the basis for the engineering, design, and planning of the system, facility, or product. Where Functional and operational requirements exist, listing or identifying them greatly simplifies and facilitates the design process. Mandatory data requirements, management directives, or special instructions are also identified and documented during the planning process. Special instructions may include directions from the customer or upper management or may be spelled out in contract documents.

3. ***Constraints:***

Constraints may include known technical limitations, financial ceilings, or schedule “drop dead” dates. Technical constraints may be related to state-of-the-art capabilities, interface requirements with other systems, or user-related issues (e.g., software that must run on certain types of personal computers). Financial and schedule constraints can be introduced by the customer and lead-time associated with procured hardware or funding/ budgetary limits.

4. ***Approaches/Strategies:***

The approach or strategies to be utilized can have a major impact on subsequent planning.

For instance, if all project work is to be performed within the parent (host) organization with minimum subcontract support that approach impacts planning of resources and organizational issues. If work is to be “fast-tracked” by overlapping design and construction activities, or by performing more work in parallel, then that approach can be described. Communication of strategies to project participants can be done effectively by devoting several paragraphs to that topic in this section of the project management plan.

5. ***Key Assumptions:***

Every project is planned under some degree of uncertainty. Therefore, assumptions are required to estimate work scope, schedule durations, resource requirements, and cost estimates. Assumptions are also required when defining the management strategies, systems, and procedures to be utilized.

Major assumptions are to be documented because they can have a significant impact on planning and estimating. This is true on all projects, regardless of size. Large projects, which involve numerous participants and major complexities, generally depend on more key assumptions during project planning than smaller projects. The major reason for documenting key assumptions is to provide the project manager with a basis for revising plans when the assumptions are changed (that is, when a customer changes his or her mind).

6. ***Specifically Excluded Scope:***

This subject may be needed to limit the scope of work. It highlights specific and relatively obvious issues, such as documentation, training, or follow-on support, which customers often assume but which cost money and have not been included in the project plan. Clarification of these scoping questions saves headaches later, in some cases even avoiding litigation.

17.2 **Systems Integration:**

Systems integration (sometimes called systems engineering) plays crucial role in performance aspect of project. We are using this phrase to include any technical specialist in science or art of project who is capable of performing role of integrating technical discipline to achieve customer's objectives, and/or integrating project into customer's system.

As such, system integration is concerned with three major objectives:

1. **Performance:**

It is what system does. It includes system design, reliability, quality, maintainability, and reparability. Obviously, these are not separate, independent elements of system, but are highly interrelated qualities. Any of these system performance characteristics is subject to over-design as well as under-design but must fall within design parameters established by client. If client approves, we may give client more than specifications

require simply because we have already designed to some capability and giving client over designed system is faster and less expensive than delivering precisely to specification. At time, esthetic qualities of system may be specified, typically through requirement that appearance of system must be acceptable to client.

2. **Effectiveness:**

Objective is to design individual components of system to achieve desired performance of optimal manner. This is accomplished through following guidelines:

- Require no component performance specifications unless necessary to meet one or more system equipments.
- Every component requirement should be traceable to one or more systems requirements.
- Design components to optimize system performance, not performance of subsystem.

It is not unusual for clients to violate any or all of these seemingly logical dicta. Tolerances specified to far closer limits than any possible system requirement, superfluous “bells and whistles,” and “off shelf” components that do not work well with rest of system are so common they seem to be taken for granted by both client and vendor. Causes of these strange occurrences are probably associated with some combination of inherent distrust between buyer and seller, desire to over-specify in order “to be sure” and feeling that “this part will do just as well”. These attitudes can be softened and replaced with others that are more helpful to process of systems integration.

3. **Cost:**

Systems integration considers cost to be design parameter, and costs can be accumulated in several areas. Added design cost may lead to decreased component costs, leaving performance and effectiveness otherwise unchanged. Added design cost may yield decreased production costs and production cost may be traded off against unit cost for materials. Value engineering (or value analysis) examines all these cost tradeoffs and is important aspect of systems integration. It can be used in any project where relevant cost tradeoffs can be estimated. It is simply consistent and thorough use of cost/effectiveness analysis. For application of value engineering techniques applied to disease control projects.

Systems integration plays major role in success or failure of any project. If risky approach is taken by systems integration, it may delay project. If approach is too conservative, we forego opportunities for enhanced project capabilities or advantageous project economies. Good design will take all these tradeoffs avoid locking project into rigid solution with little flexibility or adaptability in case problems occur later on or changes in environmental demand changes in project performance or effectiveness.

PROJECT PLANNING (CONTD.)

Broad Contents

Sorting Out Projects

Objectives and Reasons of Project Planning

Policies, Procedures and Standards in Projects

18.1 Sorting Out Project:

As we move into consideration of details of project, we need to know exactly what is to be done, by whom, and when. All activities required to complete project must be precisely delineated and coordinated. Necessary resources must be available when and where they are needed, and in correct amounts. Some activities must be done sequentially, but some may be done simultaneously. If large project is to come in on time and within cost, great many things must happen when and how they are supposed to happen. In this section, we propose conceptually simple method to assist in sorting out and planning all this detail.

To accomplish any specified project, several major activities must be completed. First, list them in general order in which they would normally occur. Reasonable number of major activities might be anywhere between two and 20. Break each of these major activities in two to 20 subtasks. There is nothing sacred about these limits. Two is minimum possible breakdown and 20 is about largest number of interrelated items that can be comfortably sorted and scheduled at given level of task aggregation. Second, preparing network from this information is much more difficult if number of activities is significantly greater than 20.

It is important to be sure that all items in list are at roughly same level of task generality. In writing book, for example, various chapters tend to be at same level of generality, but individual chapters are divided into finer detail. Indeed, subdivisions of chapter may be divided into finer detail still. It is difficult to overstate significance of this simple dictum. It is central to preparation of most of planning documents that will be described in this chapter and those that follow.

Some times problem arises because some managers tend to think of outcomes (event) when planning and other think of specific tasks (activities). Many mix two. Problem is to develop list of both activities and outcomes that represents exhaustive, non-redundant set of results to be accomplished (outcomes) and work to be done (activities) in order to complete project.

Procedure proposed here is hierarchical planning system. First, goals must be specified. This will aid planner in identifying set of required activities for goals to be met, project action plan. Each activity has outcome (event) associated with it, and these activities and events can be decomposed into sub-activities and sub-events, which may, in turn, be subdivided again. Project plan is set of these action plans. Advantage of project plan is that it contains all planning information in one document.

Assume, for example, that we have project whose purpose is to acquire and install large machining center in existing plant. In hierarchy of work to be accomplished for installation part of project, we might find such tasks as “Develop plan for preparation of floor site” and “Develop plan to maintain plant output during installation and test period”. These tasks are two of larger set of jobs to be done. Task “. . . preparation of floor site” is subdivided into its elemental parts, including such items as “get specifics on machine center mounting points”. “Check construction specification on plant floor” and “Present final plan for floor preparation for approval”.

Short digression is in order before continuing this discussion on action plans. Actual form action plan takes is not sacrosanct. In some cases, for example, amounts of specific resources required may not be

relevant. On others, “due dates” may be substituted for activity durations. Appearance of action plans differs in different organizations, and may even differ between departments or division of same organization (though standardization of format is usual, and probably desirable in any given firm). In some plans, numbers are used to identify activities; in others, letters. In still others, combinations of letters and numbers used.

Tree diagram can be used to represent hierarchical plan. Professor Andrew Vazsonyi has called this type of diagram *Gozinto Chart* after famous Italian mathematician, Professor Zepartzat, Gozinto, of Vazsonyi’s invention (Readers familiar with Bill of Materials in Materials Requirements Planning (MRP) – system will recognize parallel to nested hierarchical planning).

Objective: Career Day				
Steps	Responsibility	Time (Weeks)	Prec.	Resources
1. Contact Organizations				
a. Print forms	Secretary	6	-	
b. Contact organizations	Program Manager	15	1. A	
c. Collect display information	Office Manager	4	1. B	
d. Gather college particulars	Secretary	4	1. B	
e. Print programs	Secretary	6	1. D	
f. Print participants’ certificates	Graduate Assistant	8	-	

Objective: Career Day				
Steps	Responsibility	Time (Weeks)	Prec.	Resources
2. Banquet and Refreshments				
a. Select guest speaker	Program Manager	14	-	
b. Organize food	Program Manager	3	1. b	Caterer
c. Organize liquor	Director	10	1. b	Dept of Liquor Control
d. Organize refreshment	Graduate Assistant	7	1. b	Purchasing
Objective: Career Day				

Steps	Responsibility	Time (Weeks)	Prec.	Resources
3. Publicity and Promotion				
a. Send invitations	Graduate Assistant	2	-	Word processing
b. Organize gift certificates	Graduate Assistant	5.5	-	
c. Arrange banners	Graduate Assistant	5	1. d	Print shop
d. Contact faculty	Program Manager	1.5	1. d	Word processing
e. Advertise in college paper	Secretary	5	1. d	Newspaper
f. Class announcements	Graduate Assistant	1	3. d	Registrar's office
g. Organize posters	Secretary	4.5	1. d	Print shop

Objective: Career Day				
Steps	Responsibility	Time (Weeks)	Prec.	Resources
4. Facilities				
a. Arrange facility for event	Program Manager	2.5	1. c	
b. Transport materials	Office Manager	.5	4. a	Movers

Table 18.1: Partial Action Plan for College "Career Day"

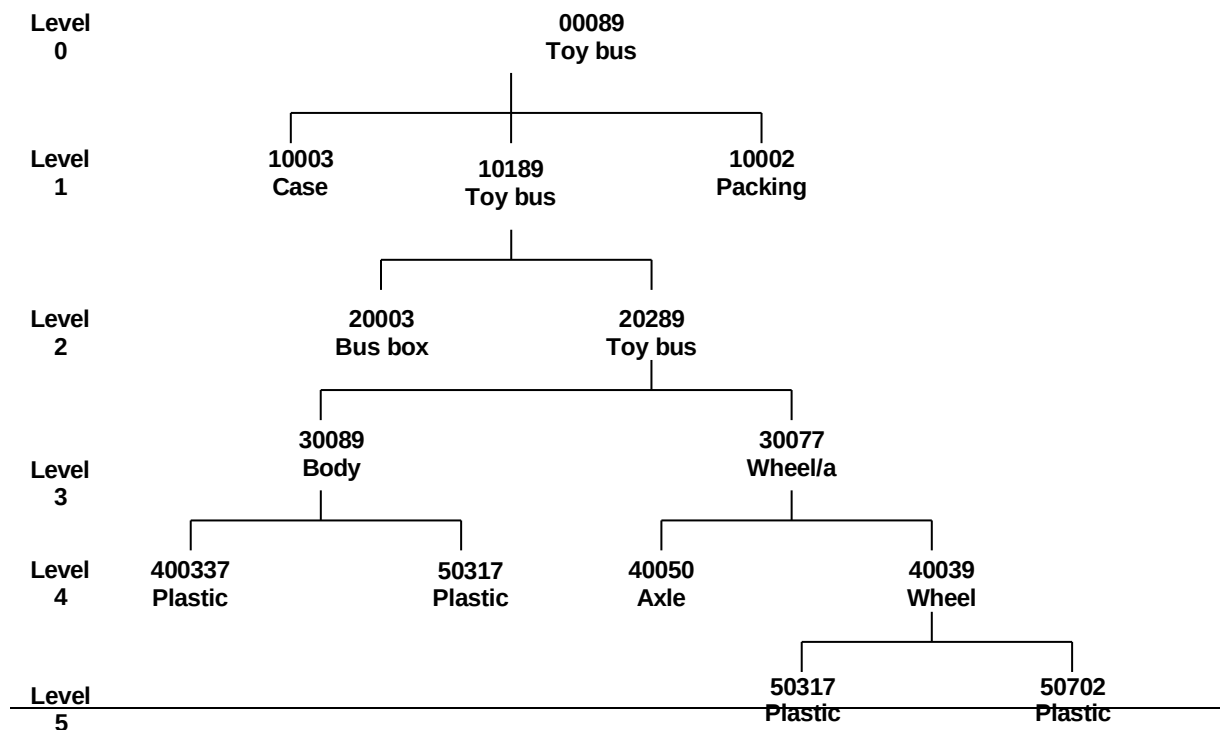


Figure 18.1: Gozinto Chart for Toy Bus

Important of careful planning can scarcely be overemphasized. Slevin developed list of ten factors that should be associated with success in implementation projects. Factors split into strategic and tactical clusters. Of interest here are strategic factors:

- **Project Mission:**
It is important to spell out clearly defined and agreed-upon goals in beginning of project.
- **Top Management Support:**
It is necessary for top managers to get behind project at outset and make clear to all personnel involved that they support successful completion.
- **Project Schedule or Plan:**
Detailed plan of required steps in implementation process needs to be developed, including all resource requirements (money, raw materials, staff and so forth).

At this point, it might be helpful to sum up this section what description of how planning process actually works in may organization. Assume that you as project manager have been given responsibility for developing computer software required to transmit medical X-Ray from one location to another over telephone line. There are several problems that must be solved to accomplish this task. First X-Ray image must be translated into computer language. Second, computerized image must be transmitted and received. Third, image must be displayed (or printed) in way that makes it intelligible to person who must interpret it. You have team of four programmers and couple of assistant programmers as signed to you. You also have specialist in radiology assigned part-time as medical advisor.

S #	Steps	Due Date	Responsible	Precedent
1.	Ajax management advised of changes	24/7	Bob, Van	-
2.	Begin preparing Instat sales dept to sell Ajax consumer Division products effective 1/1/96	24/7	Bob	1
3.	Prepare to create two sales groups: (1) Instat (2) Ajax Builder Group effective 1/1/96	1/8	Bob	1
4.	Advise Instat regional managers of sales division changes	1/8	Bob	2,3
5.	Advise Ajax regional managers of sales division changes	1/8	Van	2,3
6.	Visit Ajax management and plan to discuss merger of operations	1/8	Smith	4,5
7.	Advise Ajax sales personnel and agents	14/8	Smith	6
8.	Visit Instat to coordinate changeover	26/8	Bob Gerard	6
9.	Interview Ajax sales personnel for possible positions	30/8	Instat Regional Manager	7

Table 18.2: **Tabular Action Plan for Ajax-Instat Merger**

Your first action is to meet with programmers and medical advisor in order to arrive at technical requirements for project. From these requirements, project mission statement and detailed specifications will be derived. (Note that original statement of your “responsibility” is too vague to act as acceptable mission statement). Team then develops basic actions needed to achieve technical requirements for project. For example, one technical requirement would be to develop method of measuring density of image at every point on X-Ray and to represent this measurement as numerical input for computer. This is first level of project’s action plan.

Responsibility for accomplishing first level tasks is delegated to project team members who are asked to develop their own action plans for each of first level tasks. These are second level action plans. Individual tasks listed in second level plans are then divided further into their level action plans detailing how each second level task will be accomplished. Process continues until lowest level tasks are perceived as “units” or “packages” of work.

18.2 Objectives and Reasons of Project Planning:

One of the objectives of project planning is to completely define all work required (possibly through the development of a documented project plan) so that it will be readily identifiable to each project participant. This is a necessity in a project environment because:

- If the task is well understood prior to being performed, much of the work can be preplanned.
- If the task is not understood, then during the actual task execution more knowledge is gained that, in turn, leads to changes in resource allocations, schedules, and priorities.
- The more uncertain the task, the greater the amount of information that must be processed in order to ensure effective performance.

These considerations are important in a project environment because each project can be different from the others, requiring a variety of different resources, but having to be performed under time, cost, and performance constraints with little margin for error.

Without proper planning, programs and projects can start off "behind the eight ball" because of poorly defined requirements during the initial planning phase.

There are *four basic reasons for project planning*:

- To eliminate or reduce uncertainty
- To improve efficiency of the operation
- To obtain a better understanding of the objectives
- To provide a basis for monitoring and controlling work

There are involuntary and voluntary reasons for planning. Involuntary reasons can be internally mandatory functions of the organizational complexity and an organizational lag in response time; or they can be externally correlated to environmental fluctuations, uncertainty, and discontinuity. The voluntary reasons for planning are attempts to secure efficient and effective operations.

Planning is decision making based upon futurity. It is a continuous process of making entrepreneurial decisions with an eye to the future, and methodically organizing the effort needed to carry out these decisions. Furthermore, systematic planning allows an organization to set goals. The alternative to systematic planning is decision making based on history. This generally results in reactive management leading to crisis management, conflict management, and fire fighting.

18.3 Policies, Procedures and Standards:

A **policy** is a deliberate plan of action to guide decisions and achieve rational outcome(s). The term may apply to government, private sector organizations and groups, and individuals. Presidential executive orders, corporate privacy policies, and parliamentary rules of order are all examples of policy.

A **procedure** is a specification of series of actions, acts or operations, which have to be executed in the same manner in order to always obtain the same result in the same circumstances (for example, emergency procedures). Less precisely speaking, this word can indicate a sequence of activities, tasks, steps, decisions, calculations and processes, that when undertaken in the sequence laid down produces the described result, product or outcome. A procedure usually induces a change.

Standards in the context related to technologies and industries, is the process of establishing a technical specification, called a standard, among competing entities in a market, where this will bring benefits without hurting competition. It can also be viewed as a mechanism for optimizing economic use of scarce resources such as forests, which are threatened by paper manufacture.

18.3.1 Categories of Planning:***Strategic Planning:***

Strategic planning produces fundamental decisions and actions that shape and guide what an organization is, what it does, and why it does it. It requires broad scale information gathering, an exploration of alternatives, and an emphasis on the future implications of present decisions. Top-level managers engage chiefly in strategic planning or long range planning. They answer such questions as "What is the purpose of this organization?" "What does this organization have to do in the future to remain competitive?" Top-level managers clarify the mission of the organization and set its goals. The output needed by top management for long range planning is summary reports about finances, operations, and the external environment.

Tactical Plans:

Top-level managers set very general, long-term goals that require more than one year to achieve. Examples of long-term goals include long-term growth, improved customer service, and increased profitability. Middle managers interpret these goals and develop tactical plans for their departments that can be accomplished within one year or less. In order to develop tactical plans, middle management needs detail reports (financial, operational, market, external environment). Tactical plans have shorter time frames and narrower scopes than strategic plans. Tactical planning provides the specific ideas for implementing the strategic plan. It is the process of making detailed decisions about what to do, who will do it, and how to do it.

Operational Plans:

Supervisors implement operational plans that are short term and deal with the day-to-day work of their team. Short-term goals are aligned with the long-term goals and can be achieved within one year. Supervisors set standards, form schedules, secure resources, and report progress. They need very detailed reports about operations, personnel, materials, and equipment. The supervisor interprets higher management plans as they apply to his or her unit. Thus, operational plans support tactical plans. They are the supervisor's tools for executing daily, weekly, and monthly activities. An example is a budget, which is a plan that shows how money will be spent over a certain period of time. Other examples of planning by supervisors include scheduling the work of employees and identifying needs for staff and resources to meet future changes. Resources include employees, information, capital, facilities, machinery, equipment, supplies, and finances. Operational plans include policies, procedures, methods, and rules.

Policies, procedures, and standards vary from project to project due to the uniqueness of every project. Every Project Manager can establish project policies, within broad limits set by the top management.

Although project managers have the authority and responsibility to establish project policies and procedures, they must fall within the general guidelines established by top management. Guidelines can also be established for planning, scheduling, controlling, and communications.

PROJECT PLANNING (CONTD.)**Broad Contents**

Identifying Strategic Project Variables

19.1 Identifying Strategic Project Variables:

The project manager must continually monitor the external environment in order to develop a well-structured program that can stand up under pressure (for long-range or strategic projects). These environmental factors play an integral part in planning. The project manager must be able to identify and evaluate these strategic variables in terms of the future posture of the organization with regard to constraints on existing resources.

As we know that in the project environment, strategic project planning is performed at the horizontal hierarchy level, with final approval by upper-level management. There are three basic guidelines for strategic project planning:

- It is extremely important that upper-level management maintain a close involvement with project teams, especially during the planning phase.
- Successful strategic planning must define the authority, responsibility, and roles of the strategic planning personnel.
- Strategic project planning is a job that should be performed by managers, not for them.

In order to ensure the success of the project, all members of the horizontal team must be aware of those strategic variables that can influence the success or failure of the project plan. The analysis begins with the environment, subdivided as internal, external, and competitive, as shown below:

- *Internal Environment*
 - Management skills
 - Resources
 - Wage and salary levels
 - Government freeze on jobs
 - Minority groups
 - Layoffs
 - Sales forecasts
- *External Environment*
 - Legal
 - Political
 - Social
 - Economic
 - Technological
- *Competitive Environment*
 - Industry characteristics
 - Company requirements and goals
 - Competitive history
 - Present competitive activity
 - Competitive planning

- Return on investment
- Market share
- Size and variety of product lines

- *Competitive Resources*

It is important to note here that once the environmental variables are defined, the planning process continues with the following:

- Identification of company strengths and weaknesses
- Understanding personal values of top management
- Identification of opportunities
- Definition of product market
- Identification of competitive edge
- Establishment of goals, objectives, and standards
- Identification of resource deployment

At the program level, complete identification of all strategic variables is not easily obtainable.

However, internal, or operating, variables are readily available to program personnel by virtue of the structure of the organization. The external variables are normally tracked under the perceptive eyes of top management. This presents a challenge for the organization of the system. In most cases, those in the horizontal hierarchy of a program are more interested in the current operational plan than in external factors and tend to become isolated from the environment after the program begins, losing insight into factors influencing the rapidly changing external variables in the process. Proper identification of these strategic variables requires that communication channels be established between top management and the project office.

It is essential that the top-management support must be available for identification of strategic planning variables so that effective decision making can occur at the program level. The participation of top management in this regard has not been easy to implement. Many top-level officers consider this process a relinquishment of some of their powers and choose to retain strategic variable identification for the top levels of management.

It is important to note here that the systems approach to management does not attempt to decrease top management's role in strategic decision-making. The maturity, intellect, and wisdom of top management cannot be replaced. Ultimately, decision-making will always rest at the upper levels of management, regardless of the organizational structure.

Therefore, identification and classification of the strategic variables are necessary to establish relative emphasis, priorities, and selectivity among the alternatives, to anticipate the unexpected, and to determine the restraints and limitations of the program. Universal classification systems are nonexistent because of the varied nature of organizations and projects. However, variables can be roughly categorized as internal and external, as shown in Table 19.1 below.

TABLE STRATEGIC PLANNING VARIABLES IN THE TIRE INDUSTRY

Internal	External
• Operating • Product changes • Volume (economies of scale) • Wages vs. automation • R&D • Legal • Product quality • Union and safety considerations • Economic • Market indicators • Division of market • Production runs (timing) • Pricing/promotion policy • Sociopolitical • Allocation of resources • Raw material price/availability • Feasibility of exporting • Productivity levels	• Operating • Customer requirements • Capacity of plants • Borrowing expenses • Technological advances • Legal • OSHA noise levels • Product liabilities • DoT requirements • Economic • Forecast of industry • Inventory (on hand/dealers) • Steel and chemical output • Competition • Sociopolitical • Produce what is profitable • Primarily third world • Threat of imports • Stability of free market

Table 19.1: Strategic Planning Variables in the Tire Industry

PROJECT PLANNING (CONTD.)

Broad Contents

Life Cycle Phases
 Responsibilities of Key Players
 Problems in Objective Setting

20.1 Life-Cycle Phases:

To describe it further, project planning takes place at two levels. The first level is the corporate cultural approach; the second method is the individual's approach. The corporate cultural approach breaks the project down into life-cycle phases, such as those shown in Table 20.1. The life-cycle phase approach is *not* an attempt to put handcuffs on the project manager but to provide a methodology for uniformity in project planning. Many companies, including government agencies, prepare checklists of activities that should be considered in each phase. These checklists are for consistency in planning. The project manager can still exercise his own planning initiatives within each phase.

TABLE LIFE-CYCLE PHASE DEFINITIONS

Engineering	Manufacturing	Computer Programming	Construction
• Start-up • Definition • Main • Termination	• Formation • Buildup • Production • Phase-out • Final audit	• Conceptual • Planning • Definition and design • Implementation • Conversion	• Planning, data gathering and procedures • Studies and basic engineering • Major review • Detail engineering • Detail engineering/construction overlap • Construction • Testing and commissioning

Table 20.1: Life-Cycle Phase Definitions

In addition to this, the second benefit of life-cycle phases is control. At the end of each phase there is a meeting between the project manager, sponsor, senior management, and even the customer, to assess the accomplishments of this life-cycle phase and to get approval for the next phase. These meetings are often called critical design reviews, "on-off ramps," and "gates." In some companies, these meetings are used to firm up budgets and schedules for the follow-on phases. In addition to monetary considerations, life-cycle phases can be used for manpower deployment and equipment/facility utilization. Some companies go so far as to prepare project management policy and procedure manuals where all information is subdivided according to life-cycle phasing. Life-cycle phase decision points eliminate the problem where project managers do not ask for phase funding, but rather ask for funds for the whole project before the true scope of the project is known. Several companies have even gone so far as to identify the types of decisions that can be made at each end-of-phase review meeting. They include:

- Proceed with the next phase based on an approved funding level
- Proceed to the next phase but with a new or modified set of objectives

- Postpone approval to proceed based on a need for additional information
- Terminate project

For instance, consider a company that utilizes the following life-cycle phases:

- Conceptualization
- Feasibility
- Preliminary planning
- Detail planning
- Execution
- Testing and commissioning

As the name suggests, the conceptualization phase includes brainstorming and common sense and involves two critical factors:

1. Identify and define the problem, and
2. Identify and define potential solutions

All ideas are recorded and none are discarded in a brainstorming session. The brainstorming session works best if there is no formal authority present and if the time duration is no more than thirty to sixty minutes. Sessions over sixty minutes in length will produce ideas that may begin to resemble science fiction.

The second phase, that is the feasibility study phase, considers the technical aspects of the conceptual alternatives and provides a firmer basis on which to decide whether to undertake the project.

Note that the purpose of the feasibility phase is to:

- Plan the project development and implementation activities.
- Estimate the probable elapsed time, staffing, and equipment requirements.
- Identify the probable costs and consequences of investing in the new project.

If practical, the feasibility study results should evaluate the alternative conceptual solutions along with associated benefits and costs. The objective of this step is to provide management with the predictable results of implementing a specific project and to provide generalized project requirements. This, in the form of a feasibility study report, is used as the basis on which to decide whether to proceed with the costly requirements, development, and implementation phases.

Moving ahead with the life-cycle, the third life-cycle phase is either preliminary planning or "defining the requirements." This is the phase where the effort is officially defined as a project. In this phase, we should consider the following:

- General scope of the work
- Objectives and related background
- Contractor's tasks
- Contractor end-item performance requirements
- Reference to related studies, documentation, and specifications
- Data items (documentation)
- Support equipment for contract end-item
- Customer-furnished property, facilities, equipment, and services
- Customer-furnished documentation
- Schedule of performance
- Exhibits, attachments, and appendices

20.2 Responsibilities of Key Players:

We know that planning simply does not happen by itself. Companies that have histories of successful plans also have employees who fully understand their roles in the planning process. Good up-front planning may not eliminate the need for changes, but may reduce the number of changes required. The responsibilities of the major players are as follows:

1. **Project manager will define:**
 - Goals and objectives
 - Major milestones
 - Requirements
 - Ground rules and assumptions
 - Time, cost, and performance constraints
 - Operating procedures
 - Administrative policy
 - Reporting requirements
2. **Line manager will define:**
 - Detailed task descriptions to implement objectives, requirements, and milestones
 - Detailed schedules and manpower allocations to support budget and schedule
 - Identification of areas of risk, uncertainty, and conflict
3. **Senior management (project sponsor) will:**
 - Act as the negotiator for disagreements between project and line management
 - Provide clarification of critical issues
 - Provide communication link with customer's senior management

Remember that successful planning requires that project, line, and senior management are in agreement with the plan.

20.3 Problems in Objective Setting:

It is not possible to satisfy all objectives every time. At this point, management must prioritize the objectives as to which are strategic and which are not. Typical problems with developing objectives include:

- Project objectives/goals are not agreeable to all parties.
- Project objectives are too rigid to accommodate changing
- Insufficient time exists to define objectives well.
- Objectives are not adequately quantified.
- Objectives are not documented well enough.
- Efforts of client and project personnel are not coordinated.
- Personnel turnover is high.

PROJECT PLANNING (CONTD.)

Broad Contents

The Statement of Work (SOW)

Guideline for Preparing Statement of Work (SOW)

21.1 The Statement of Work (Sow):

As already mentioned in Lecture 15, the Statement of Work (SOW) is a narrative description of the work required for the project. The complexity of the Statement of Work (SOW) is determined by the desires of top management, the customer, and/or the user groups. For projects internal to the company, the Statement of Work (SOW) is prepared by the project office with input from the user groups. The reason for this is that user groups tend to write in such scientific terms that only the user groups understand their meaning. Since the project office is usually composed of personnel with writing skills, it is only fitting that the project office prepares the Statement of Work (SOW) and submit it to the user groups for verification and approval.

In case of projects external to the organization, as in competitive bidding, the contractor may have to prepare the Statement of Work (SOW) for the customer because the customer may not have a team of people trained in its preparation. In this case, as before, the contractor would submit the Statement of Work (SOW) to the customer for approval. It is also quite common for the project manager to rewrite a customer's Statement of Work (SOW) so that the contractor's line managers can price out the effort.

As far as a competitive bidding environment is concerned, the reader should be aware of the fact that there are two Statements of Works (SOWs)— the Statement of Work (SOW) used in the proposal and a “Contract Statement of Work” (CSOW). There might also be a proposal “Work Breakdown Structure” (WBS) and a “Contract Work Breakdown Structure” (CWBS). Special care must be taken by contract and negotiation teams that all discrepancies between the Statement of Work (SOW)/ Work Breakdown Structure (WBS) and Contract Statement of Work (CSOW)/ Contract Work Breakdown Structure (CWBS) are discovered, or additional costs may be incurred. A good (or winning) proposal is *no guarantee* that the customer or contractor understands the Statement of Work (SOW). For large projects, fact-finding is usually required before final negotiations because it is *essential* that both the customer and the contractor understand and agree on the Statement of Work (SOW), what work is required, what work is proposed, the factual basis for the costs, and other related elements. In addition, it is imperative that there be agreement between the final Contract Statement of Work (CSOW) and Contract Work Breakdown Structure (CWBS).

It is important to note that the Statement of Work (SOW) preparation is not as easy as it sounds. Consider the following:

- The Statement of Work (SOW) says that you are to conduct a *minimum* of fifteen tests to determine the material properties of a new substance. You price out twenty tests just to "play it safe." At the end of the fifteenth test, the customer says that the results are inconclusive and that you must run another fifteen tests. The cost overrun is \$40,000.
- The Navy gives you a contract in which the Statement of Work (SOW) states that the prototype must be tested in "water." You drop the prototype into a swimming pool to test it. Unfortunately, the Navy's definition of "water" is the Atlantic Ocean, and it costs you \$1 million to transport all of your test engineers and test equipment to the Atlantic Ocean.

- You receive a contract in which the Statement of Work (SOW) says that you must transport goods across the country using "aerated" boxcars. You select boxcars that have open tops so that air can flow in. During the trip, the train goes through an area of torrential rains, and the goods are ruined. The customer wanted boxcars that were aerated from below. The court is currently deciding who should be blamed for misinterpretation of the word "aerated."

These three examples show that misinterpretations of the Statement of Work (SOW) can result in losses of hundreds of millions of dollars a year. Common causes of misinterpretation are:

- Mixing tasks, specifications, approvals, and special instructions
- Using imprecise language ("nearly," "optimum," "approximately," etc.)
- No pattern, structure, or chronological order
- Wide variation in size of tasks
- Wide variation in how to describe details of the work
- Failing to get third-party review

Note that misinterpretations of the statement of work can and will occur no matter how hard the quest for perfection during the definition phase. The result is creeping scope, or, as one telecommunications company calls it, "creeping elegance." The best way to control creeping scope is with a good definition of the requirements up front. Unfortunately, this is not always possible.

For example, in some industries, such as aerospace, defense, and Management Information System, creeping scope had become a way of life until recently. In the Information Technology Group of a major appliance manufacturer, the project manager made it clear that she would not accept any scope changes once the definition of the requirement (prepared by the user group) was completed. Midway through the project, the user group tried to change the requirements. The project manager refused to accept the changes and, against the wishes of the user group, put all requests for changes into a follow-on enhancement project that would be budgeted for and scheduled *after* the initial project was completed. When the initial project was completed and installed at the user's location, the users stated that they could live with the original package, and the enhancement project was neither funded nor approved.

Keeping the above-mentioned factors in view, today, both private industry and government agencies are developing manuals on SOW preparation.

21.2 Statement of Work (Sow) Preparation Guidelines:

1. Firstly, every Statement of Work (SOW) that exceeds two pages in length should have a table of contents conforming to the Contract Work Breakdown Structure (CWBS) coding structure. There should rarely be items in the Statement of Work (SOW) that are not shown on the Contract Work Breakdown Structure (CWBS); however, it is not absolutely necessary to restrict items to those cited in the CWBS.
2. For the preparation of Statement of Work (SOW), clear and precise task descriptions are essential. The Statement of Work (SOW) writer should realize that his or her efforts will have to be read and interpreted by persons of varied background (such as lawyers, buyers, engineers, cost estimators, accountants, and specialists in production, transportation, security, audit, quality, finance, and contract management). A good Statement of Work (SOW) states precisely the product or service desired. The clarity of the Statement of Work (SOW) will affect administration of the contract, since it defines the scope of work to be performed. Any work that falls outside that scope will involve new procurement with probable increased costs.

3. One of the most important things to keep in mind when writing a Statement of Work (SOW) is the most likely effect the written work will have upon the reader. Therefore, every effort must be made to avoid ambiguity. All obligations of the government should be carefully spelled out. If approval actions are to be provided by the government, set a time limit. If Government-Furnished Equipment (GFE) and/or services, etc., are to be provided, state the nature, condition, and time of delivery, if feasible.
4. It is essential to remember that any provision that takes control of the work away from the contractor, even temporarily, may result in relieving the contractor of responsibility.
5. Use active rather than passive terminology in specifying requirements. Say that the contractor shall conduct a test rather than that a test should be conducted. In other words, when a firm requirement is intended, use the mandatory term "shall" rather than the permissive term "should."
6. Always remember to limit abbreviations to those in common usage. Provide a list of all pertinent abbreviations and acronyms at the beginning of the Statement of Work (SOW). When using a term for the first time, spell it out and show the abbreviation or acronym in parentheses following the word or words.
7. When it is important to define a division of responsibilities between the contractor, other agencies, etc., a separate section of the Statement of Work (SOW) (in an appropriate location) should be included and delineate such responsibilities.
8. Do not forget to include procedures. When immediate decisions cannot be made, it may be possible to include a procedure for making them (e.g., "as approved by the contracting officer," or "the contractor shall submit a report each time a failure occurs).
9. Do not over-specify. Depending upon the nature of the work and the type of contract, the ideal situation may be to specify results required or end-items to be delivered and let the contractor propose his best method.
10. It is important to describe requirements in sufficient detail to assure clarity, not only for legal reasons, but also for practical application. It is easy to overlook many details. It is equally easy to be repetitious. Beware of doing either. For every piece of deliverable hardware, for every report, for every immediate action, do not specify that something be done "as necessary." Rather, specify whether the judgment is to be made by the contractor or by the government. Be aware that these types of contingent actions may have an impact on price as well as schedule. Where expensive services, such as technical liaison, are to be furnished, do not say, "as required." Provide a ceiling on the extent of such services, or work out a procedure (e.g., a level of effort, pool of man-hours) that will ensure adequate control.
11. Avoid incorporating extraneous material and requirements. They may add unnecessary cost. Data requirements are common examples of problems in this area. Screen out unnecessary data requirements, and specify only what is essential and when. It is recommended that data requirements be specified separately in a data requirements appendix or equivalent.
12. Do not repeat detailed requirements or specifications that are already spelled out in applicable documents. Instead, incorporate them by reference. If amplification, modification, or exceptions are required, make specific reference to the applicable portions and describe the change.

In addition to the guidelines, some preparation documents also contain ***checklists for Statement of Work (SOW) preparation***. A checklist is furnished below to provide considerations that Statement of Work (SOW) writers should keep in mind in preparing statements of work:

1. Is the Statement of Work (SOW), when used in conjunction with the preliminary Contract Work Breakdown Structure (CWBS), specific enough to permit a contractor to make a tabulation and summary of manpower and resources needed to accomplish each SOW task element?

2. Are specific duties of the contractor stated so he will know what is required, and can the contracting officer's representative, who signs the acceptance report, tell whether the contractor has complied?
3. Are all parts of the Statement of Work (SOW) so written that there is no question as to what the contractor is obligated to do, and when?
4. When it is necessary to reference other documents, is the proper reference document described? Is it properly cited? Is all of it really pertinent to the task, or should only portions be referenced? Is it cross-referenced to the applicable Statement of Work (SOW) task element?
5. Are any specifications or exhibits applicable in whole or in part? If so, are they properly cited and referenced to the appropriate Statement of Work (SOW) element?
6. Are directions clearly distinguishable from general information?
7. Is there a time-phased data requirement for each deliverable item? If elapsed time is used, does it specify calendar or work days?
8. Are proper quantities shown?
9. Have headings been checked for format and grammar? Are subheadings comparable? Is the text compatible with the title? Is a multi decimal or alphanumeric numbering system used in the Statement of Work (SOW)? Can it be cross-referenced with the Contract Work Breakdown Structure (CWBS)?
10. Have appropriate portions of procurement regulations been followed?
11. Has extraneous material been eliminated?
12. Can Statement of Work (SOW) task/contract line items and configuration item breakouts at lower levels be identified and defined in sufficient detail so they can be summarized to discrete third-level Contract Work Breakdown Structure (CWBS) elements?
13. Have all requirements for data been specified separately in a data requirements appendix or its equivalent?
14. Have all extraneous data requirements been eliminated?
15. Are security requirements adequately covered if required?
16. Has its availability to contractors been specified?

Lastly, but most importantly, there should be a management review of the Statement of Work (SOW) preparation interpretation. During development of the Statement of Work, the project manager should ensure adequacy of content by holding frequent reviews with project and functional specialists to determine that technical and data requirements specified do conform to the guidelines herein and adequately support the common system objective. The Contract Work Breakdown Structure (CWBS)/ Statement of Work (SOW) (CWBS/SOW) matrix should be used to analyze the Statement of Work (SOW) for completeness. After all comments and inputs have been incorporated, a final team review should be held to produce a draft Statement of Work (SOW) for review by functional and project managers. Specific problems should be resolved and changes made as appropriate. A final draft should then be prepared and reviewed with the program manager, contracting officer, or with higher management if the procurement is a major acquisition. The final review should include a briefing on the total Request for Proposal (RFP) package. If other program offices or other Government agencies will be involved in the procurement, obtain their concurrence also.

WORK BREAKDOWN STRUCTURE

Broad Contents

Introduction

Characteristics of various levels of Work Breakdown Structure (WBS)

Characteristics of Work Package

Guidelines for Work Breakdown Structure (WBS) by Contractor

Criteria for Developing Work Breakdown Structure (WBS)

Work Breakdown Structure (WBS) Decomposition Problems

Uses of Work Breakdown Structure (WBS)

22.1 Introduction:

In order to successfully accomplish both contract and corporate objectives, a plan is required that defines all effort to be expended, assigns responsibility to a specially identified organizational element, and establishes schedules and budgets for the accomplishment of the work. The preparation of this plan is the responsibility of the program manager, who is assisted by the program team assigned in accordance with program management system directives. The detailed planning is also established in accordance with company budgeting policy before contractual efforts are initiated.

Keeping this in view, in planning a project, the project manager must structure the work into small elements that are:

- Manageable, in that specific authority and responsibility can be assigned
- Independent, or with minimum interfacing with and dependence on other ongoing elements
- Integratable so that the total package can be seen
- Measurable in terms of progress

After project requirements definition, the first major step in the planning process is the development of the Work Breakdown Structure (WBS). A Work Breakdown Structure (WBS) is a product-oriented family tree subdivision of the hardware, services, and data required to produce the end product. The Work Breakdown Structure (WBS) is structured in accordance with the way the work will be performed and reflects the way in which project costs and data will be summarized and eventually reported. Preparation of the Work Breakdown Structure (WBS) also considers other areas that require structured data, such as scheduling, configuration management, contract funding, and technical performance parameters. It is the single most important element because it provides a common framework from which:

- Total program can be described as a summation of subdivided elements
- Planning can be performed
- Costs and budgets can be established
- Time, cost, and performance can be tracked
- Objectives can be linked to company resources in a logical manner
- Schedules and status-reporting procedures can be established
- Network construction and control planning can be initiated
- Responsibility assignments for each element can be established

Note that the Work Breakdown Structure (WBS) acts as a vehicle for breaking the work down into smaller elements, thus providing a greater probability that every major and minor activity will be accounted for.

Although a variety of Work Breakdown Structure (WBS) exist, the most common is the six-level indented structure shown as Figure 22.1 below:

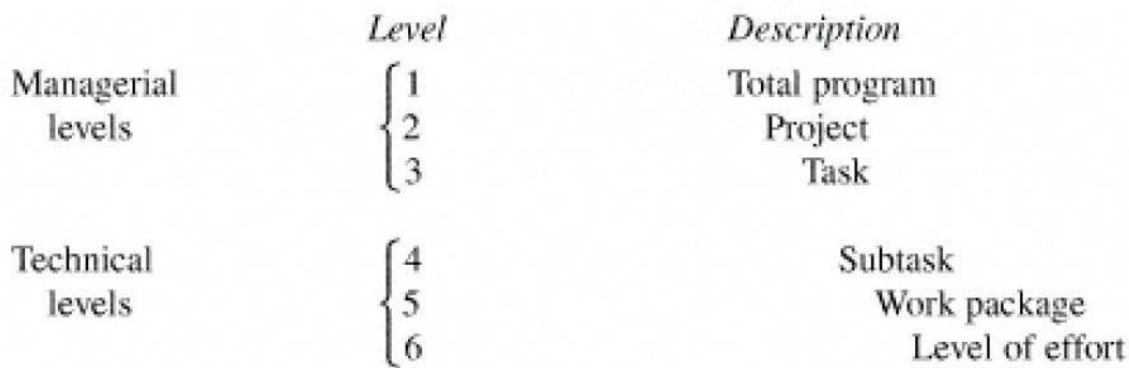


Figure 22.1: Six-Level Indented Structure

As the figure shows, Level 1 is the total program and is composed of a set of projects. The summation of the activities and costs associated with each project must equal the total program. Each project, however, can be broken down into tasks, where the summation of all tasks equals the summation of all projects, which, in turn, comprises the total program. The reason for this subdivision of effort is simply ease of control. Program management therefore, becomes synonymous with the integration of activities, and the project manager acts as the integrator, using the work breakdown structure as the common framework.

It is important that careful consideration must be given to the design and development of the Work Breakdown Structure (WBS). It can be used to provide the basis for the following:

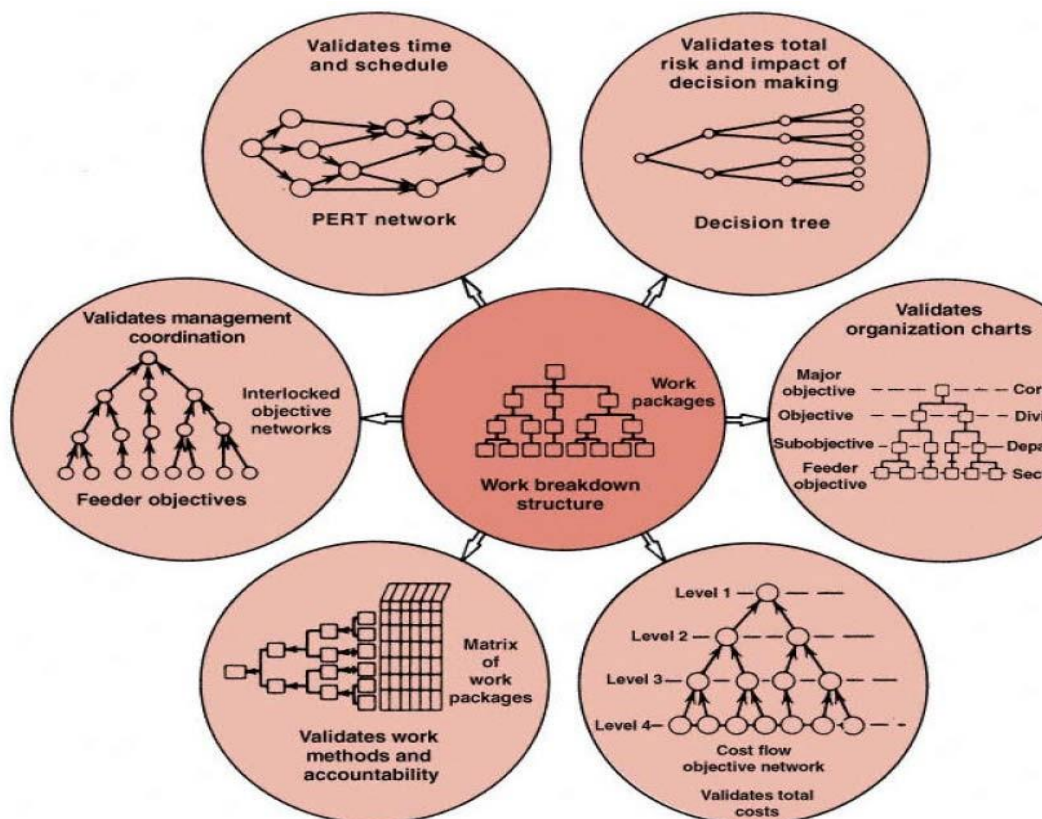


Figure 22.2: Work Breakdown Structure (WBS) for Objective Control and Evaluation

- Responsibility matrix
- Network scheduling
- Costing
- Risk analysis
- Organizational structure
- Coordination of objectives
- Control (including contract administration)

22.2 Characteristics of Various Levels of the Work Breakdown Structure (WBS):

As depicted in Figure 22.1 (above), the upper three levels of the Work Breakdown Structure (WBS) are normally specified by the customer (if part of a Request for Proposal (RFP)/Request for Quotation (RFQ) (i.e. RFP/RFQ) as the summary levels for reporting purposes. The lower levels are generated by the contractor for in-house control. Each level serves a vital purpose: Level 1 is generally used for the authorization and release of all work, budgets are prepared at level 2, and schedules are prepared at level 3. Certain characteristics can now be generalized for these levels:

- Firstly, The top three levels of the Work Breakdown Structure (WBS) reflect integrated efforts and should not be related to one specific department. Effort required by departments or sections should be defined in subtasks and work packages.
- The summation of all elements in one level must be the sum of all work in the next lower level.
- Each element of work should be assigned to one and only one level of effort. For example, the construction of the foundation of a house should be included in one project (or task), not extended over two or three. (At level 5, the work packages should be identifiable and homogeneous.)
- The level at which the project is managed is generally called the work package level. Actually, the work package can exist at any level below level one.
- The Work Breakdown Structure (WBS) must be accompanied by a description of the scope of effort required, or else only those individuals who issue the Work Breakdown Structure (WBS) will have a complete understanding of what work has to be accomplished. It is common practice to reproduce the customer's statement of work as the description for the Work Breakdown Structure (WBS).
- It is often the best policy for the project manager, regardless of his technical expertise, to allow all of the line managers to assess the risks in the Work Breakdown Structure (WBS). After all, the line managers are usually the recognized experts in the organization.

It is normally the duty of the project managers to manage at the top three levels of the Work Breakdown Structure (WBS) and they prefer to provide status reports to management at these levels also. Some companies are trying to standardize reporting to management by requiring the top three levels of the Work Breakdown Structure (WBS) to be the same for every project, the only differences being in levels 4–6. For companies with a great deal of similarity among projects, this approach has merit. For most companies, however, the differences between projects make it almost impossible to standardize the top levels of the Work Breakdown Structure (WBS).

As shown in the Figure 22.1 (above), the work package is the critical level for managing a Work Breakdown Structure (WBS). However, it is possible that the actual management of the work packages are supervised and performed by the line managers with status reporting provided to the project manager at higher levels of the Work Breakdown Structure (WBS).

To explain them further, work packages are natural subdivisions of cost accounts and constitute the basic building blocks used by the contractor in planning, controlling, and measuring contract performance. A work package is simply a low-level task or job assignment. It describes the work to be accomplished by a specific performing organization or a group of cost centers and serves as a vehicle for monitoring and reporting progress of work. Documents that authorize and assign work to a performing organization are designated by various names throughout industry.

Here, it is important to know what a work package is. *"Work package" is the generic term used in the criteria to identify discrete tasks that have definable end results.* Ideal work packages are 80 hours and less than 2–4 weeks. However, this may not be possible on large projects.

It is not necessary that work package documentation contain complete, stand-alone descriptions. Supplemental documentation may augment the work package descriptions. However, the work package descriptions must permit cost account managers and work package supervisors to understand and clearly distinguish one work package effort from another. In the review of work package documentation, it may be necessary to obtain explanations from personnel routinely involved in the work, rather than requiring the work package descriptions to be completely self-explanatory.

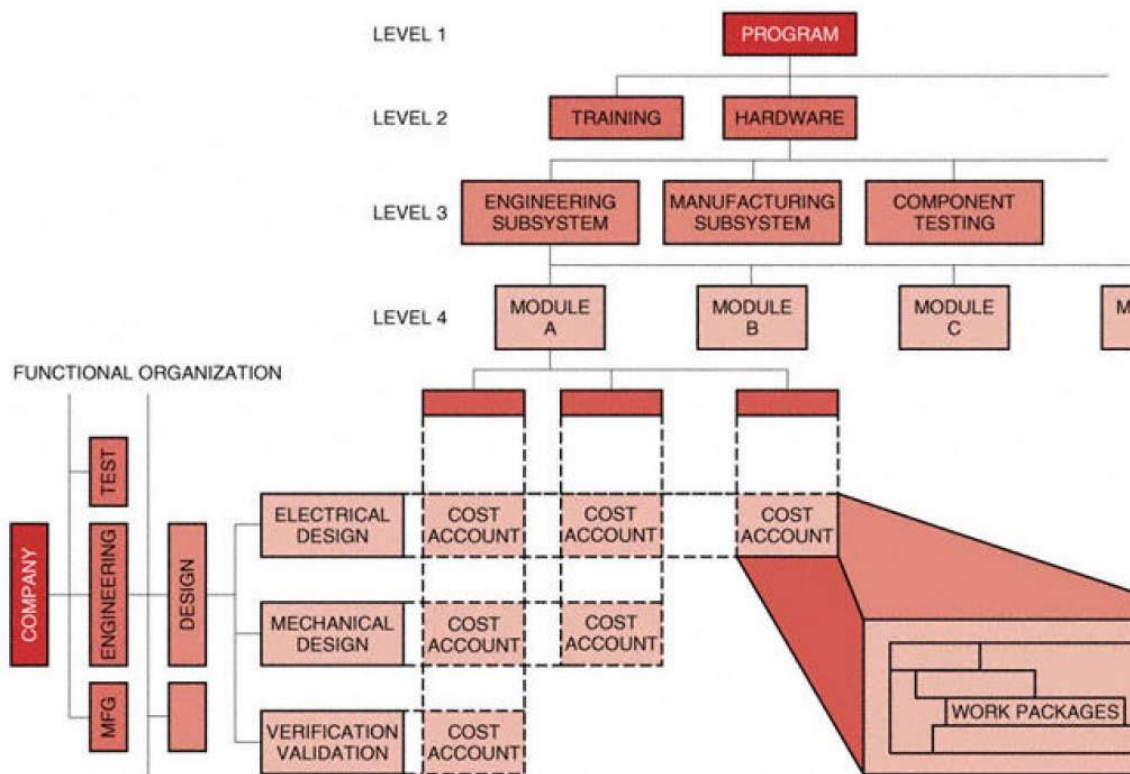


Figure 22.3: The cost account intersection

The desirability of having short-term work packages is a key feature from the standpoint of evaluation accomplishment. This requirement is not intended to force arbitrary cutoff points simply to have short-term work packages. Work packages should be natural subdivisions of effort planned according to the way the work will be done. However, when work packages are relatively short, little or no assessment of work-in-process is required and the evaluation of status is possible mainly on the basis of work package completions. The longer the work packages, the more difficult and subjective the work-in-process assessment becomes unless the packages are subdivided by objective indicators such as discrete milestones with pre-assigned budget values or completion percentages.

Keeping this in view, in setting up the Work Breakdown Structure (WBS), tasks should:

- Have clearly defined start and end dates
- Be usable as a communications tool in which results can be compared with expectations
- Be estimated on "total" time duration, not when the task must start or end
- Be structured so that a minimum of project office control and documentation (that is, forms) is necessary

22.3 Characteristics of Work Package:

In case of large projects, planning will be time phased at the work package level of the Work Breakdown Structure (WBS). The work package has the following characteristics:

- Represents units of work at the level where the work is performed
- Clearly distinguishes one work package from all others assigned to a single functional group
- Contains clearly defined start and end dates that are representative of physical accomplishment
- Specifies a budget in terms of dollars, man-hours, or other measurable units
- Limits the work to be performed to relatively short periods of time to minimize the work-in process effort

The following table (table 22.1) shows a simple Work Breakdown Structure (WBS) with the associated numbering system following the work breakdown. The first number represents the total program (in this case, it is represented by 01), the second number represents the project, and the third number identifies the task. Therefore, number 01-03-00 represents project 3 of program 01, whereas 01-03-02 represents task 2 of project 3. This type of numbering system is not standard; each company may have its own system, depending on how costs are to be controlled.

TABLE 22.1. WORK BREAKDOWN STRUCTURE FOR NEW PLANT CONSTRUCTION AND START-UP

Program: New Plant Construction and Start-up	01 -00-00
Project 1: Analytical Study	01 -01-00
Task 1: Marketing/Production Study	01 -01-01
Task 2: Cost Effectiveness Analysis	01 -01-02
Project 2: Design and Layout	01 -02-00
Task 1: Product Processing Sketches	01 -02-01
Task 2: Product Processing Blueprints	01 -02-02
Project 3: Installation	01 -03-00
Task 1: Fabrication	01 -03-01
Task 2: Setup	01 -03-02
Task 3: Testing and Run	01 -03-03
Project 4: Program Support	01 -04-00
Task 1: Management	01 -04-01
Task 2: Purchasing Raw Materials	01 -04-02

Table 22.1: Work Breakdown Structure (WBS) for New Plant Construction and Start-Up

By now we can say that the preparation of the work breakdown structure is not easy. The Work Breakdown Structure (WBS) is a communications tool, providing detailed information to different levels of management. If it does not contain enough levels, then the integration of activities may prove difficult. If too many levels exist, then unproductive time will be made to have the same number of levels for all projects, tasks, and so on.

It is vital that each major work element should be considered by itself. Remember, the Work Breakdown Structure (WBS) establishes the number of required networks for cost control.

In case of many programs, the customer establishes the Work Breakdown Structure (WBS).

22.4 Guidelines for WBS by Contractor:

To explain this, we take the example of a contractor who is required to develop a Work Breakdown Structure (WBS). He must consider certain guidelines. A partial list is as follows:

- Complexity and technical requirements of the program (i.e., the statement of work)
- Program cost
- Time span of the program
- Contractor's resource requirements
- Contractor's and customer's internal structure for management control and reporting
- Number of subcontracts

Remember that applying these guidelines serves only to identify the complexity of the program. These data must then be subdivided and released, together with detailed information, to the different levels of the organization. The Work Breakdown Structure (WBS) should follow specified criteria because, although the program office performs preparation of the Work Breakdown Structure (WBS), the actual work is performed by the doers, not the planners. Both the doers and the planners must be in agreement as to what is expected.

22.5 Criteria for Developing Work Breakdown Structure (WBS):

Following is a sample listing of criteria for developing a Work Breakdown Structure (WBS):

- The Work Breakdown Structure (WBS) and work description should be easy to understand.
- All schedules should follow the Work Breakdown Structure (WBS).
- No attempt should be made to subdivide work arbitrarily to the lowest possible level. The lowest level of work should not end up having a ridiculous cost in comparison to other efforts.
- Since scope of effort can change during a program, every effort should be made to maintain flexibility in the Work Breakdown Structure (WBS).
- The Work Breakdown Structure (WBS) can act as a list of discrete and tangible milestones so that everyone will know when the milestones were achieved.
- Level of the Work Breakdown Structure (WBS) can reflect the "trust" you have in certain line groups.
- Work Breakdown Structure (WBS) can be used to segregate recurring from nonrecurring costs.
- Most Work Breakdown Structure (WBS) elements (at the lowest control level) range from 0.5 to 2.5 percent of the total project budget.

22.6 Work Breakdown Structure (WBS) Decomposition Problems:

Misconceptions prevail with almost every thing. There is a common misconception that the Work Breakdown Structure (WBS) decomposition is an easy task to perform. In the development of the Work Breakdown Structure (WBS), the top three levels or management levels are usually roll-up levels.

Preparing templates at these levels is becoming common practice. However, at levels 4–6 of the Work Breakdown Structure (WBS), templates may not be appropriate. There are the following reasons for this:

- Firstly, breaking the work down to extremely small and detailed work packages may require the creation of hundreds or even thousands of cost accounts and charge numbers. This could increase the management, control, and reporting costs of these small packages to a point where the costs exceed the benefits. Although a typical work package may be 200–300 hours and approximately two weeks in duration, consider the impact on a large project, which may have more than one million direct labor hours.
- Breaking the work down to small work packages can provide accurate cost control if, and only if, the line managers can determine the costs at this level of detail. Line managers must be given the right to tell project managers that costs *cannot* be determined at the requested level of detail.
- The Work Breakdown Structure (WBS) is the basis for scheduling techniques such as the Arrow Diagramming Method and the Precedence Diagramming Method. At low levels of the Work Breakdown Structure (WBS), the interdependencies between activities can become so complex that meaningful networks cannot be constructed.

To cater to the above-mentioned problems, one solution is to create "hammock" activities, which encompass several activities where exact cost identification cannot or may not be accurately determined. Some projects identify a "hammock" activity called management support (or project office), which includes overall project management, data items, management reserve, and possibly procurement. The advantage of this type of hammock activity is that the charge numbers are under the *direct* control of the project manager.

In addition to this, there is a common misconception that the typical dimensions of a work package are approximately 80 hours and less than two weeks to a month. Although this may be true on small projects, this would necessitate millions of work packages on large jobs and this may be impractical, even if line managers could control work packages of this size.

Cost analysis down to the fifth level is advantageous, from a cost control point of view. However, it should be noted that the cost required to prepare cost analysis data to each lower level might increase exponentially, especially if the customer requires data to be presented in a specified format that is not part of the company's standard operating procedures. The level-5 work packages are normally for in-house control only. Some companies bill customers separately for each level of cost reporting below level 3.

Another aspect is that the Work Breakdown Structure (WBS) can be subdivided into sub objectives with finer divisions of effort as we go lower into the Work Breakdown Structure (WBS). By defining sub objectives, we add greater understanding and, it is hoped, clarity of action for those individuals who will be required to complete the objectives. Whenever work is structured, understood, easily identifiable, and within the capabilities of the individuals, there will almost always exist a high degree of confidence that the objective can be reached.

Also, the Work Breakdown Structure (WBS) can be used to structure work for reaching such objectives as lowering cost, reducing absenteeism, improving morale, and lowering scrap

factors. The lowest subdivision now becomes an end-item or sub-objective, not necessarily a work package as described here.

Since we are describing project management, therefore, for the remainder of the text we will consider the lowest level as the work package.

22.7 Uses of Work Breakdown Structure (WBS):

It is important to remember that once the Work Breakdown Structure (WBS) is established and the program is "kicked off," it becomes a very costly procedure to either add or delete activities, or change levels of reporting because of cost control. Many companies do not give careful forethought to the importance of a properly developed Work Breakdown Structure (WBS), and ultimately they risk cost control problems downstream. One important use of the Work Breakdown Structure (WBS) is that it serves as a cost control standard for any future activities that may follow on or may just be similar. One common mistake made by management is the combining of direct support activities with administrative activities. For example, the department manager for manufacturing engineering may be required to provide administrative support (possibly by attending team meetings) throughout the duration of the program. If the administrative support is spread out over each of the projects, a false picture is obtained as to the actual hours needed to accomplish each project in the program. If one of the projects should be canceled, then the support man-hours for the total program would be reduced when, in fact, the administrative and support functions may be constant, regardless of the number of projects and tasks.

It is quite often that the Work Breakdown Structure (WBS) accompanying customer Request for Proposals (RFPs), contains much more scope of effort as specified by the statement of work than the existing funding will support. This is done intentionally by the customer in hopes that a contractor may be willing to "buy in." If the contractor's price exceeds the customer's funding limitations, then eliminating activities from the Work Breakdown Structure (WBS) must reduce the scope of effort. By developing a separate project for administrative and indirect support activities, the customer can easily modify his costs by eliminating the direct support activities of the canceled effort.

Lastly, we should also discuss the usefulness and applicability of the Work Breakdown Structure (WBS) system. Many companies and industries have been successful in managing programs without the use of work breakdown structures, especially on repetitive-type programs.

WORK BREAKDOWN STRUCTURE

BROAD CONTENTS

Preparation Guides for Work Breakdown Structure (WBS)
Checklists for Preparing Work Breakdown Structure (WBS)
Methods for Structuring Work Breakdown Structure (WBS)
Why Do Plans Fail?

23.1 Preparation Guides for Work Breakdown Structure (WBS):

We have already discussed the preparation guides for the Statement of Work (SOW). Similarly there are several preparation guides for the Work Breakdown Structure (WBS). These are as follows:

- Firstly, develop the Work Breakdown Structure (WBS) structure by subdividing the total effort into discrete and logical sub elements. Usually a program subdivides into projects, major systems, major subsystems, and various lower levels until a manageable -size element level is reached. Wide variations may occur, depending upon the type of effort (e.g., major systems development, support services, etc.). Include more than one cost center and more than one contractor if this reflects the actual situation.
- It is important to check the proposed Work Breakdown Structure (WBS) and the contemplated efforts for completeness, compatibility, and continuity.
- Determine that the Work Breakdown Structure (WBS) satisfies both functional (engineering/ manufacturing/ test) and program/project (hardware, services, etc.) requirements, including recurring and nonrecurring costs.
- Remember to check to determine if the Work Breakdown Structure (WBS) provides for logical subdivision of all project work.
- Establish assignment of responsibilities for all identified effort to specific organizations.
- Finally, check the proposed Work Breakdown Structure (WBS) against the reporting requirements of the organizations involved.

23.2 Checklists for Preparing Work Breakdown Structure (WBS):

In addition to the preparation guides, there are also checklists that can be used in the preparation of the Work Breakdown Structure (WBS):

- Focus to develop a preliminary Work Breakdown Structure (WBS) to not lower than the top three levels for solicitation purposes (or lower if deemed necessary for some special reason).
- Remember to assure that the contractor is required to extend the preliminary Work Breakdown Structure (WBS) in response to the solicitation, to identify and structure all contractor work to be compatible with his organization and management system.
- Following negotiations, the Contract Work Breakdown Structure (CWBS) included in the contract should not normally extend lower than the third level.
- It is essential to assure that the negotiated Contract Work Breakdown Structure (CWBS) structure is compatible with reporting requirements.
- Assure that the negotiated Contract Work Breakdown Structure (CWBS) is compatible with the contractor's organization and management system.

- Review the Contract Work Breakdown Structure (CWBS) elements to ensure correlation with the following:
 - The specification tree
 - Contract line items
 - End-items of the contract
 - Data items required
 - Work statement tasks
 - Configuration management requirements
- Also, define Contract Work Breakdown Structure (CWBS) elements down to the level where such definitions are meaningful and necessary for management purposes (WBS dictionary).
- Clearly specify reporting requirements for selected Contract Work Breakdown Structure (CWBS) elements if variations from standard reporting requirements are desired.
- Always assure that the Contract Work Breakdown Structure (CWBS) covers measurable effort, level of effort, apportioned effort, and subcontracts, if applicable.
- Lastly, Assure that the total costs at a particular level will equal the sum of the costs of the constituent elements at the next lower level.

In case of simple projects, the Work Breakdown Structure (WBS) can be constructed as a "tree diagram" or according to the logic flow. The tree diagram can follow the work or even the organizational structure of the company (i.e., division, department, section, unit). The second method is to create a logic flow and cluster certain elements to represent tasks and projects. In the tree method, lower-level functional units may be assigned to one, and only one.

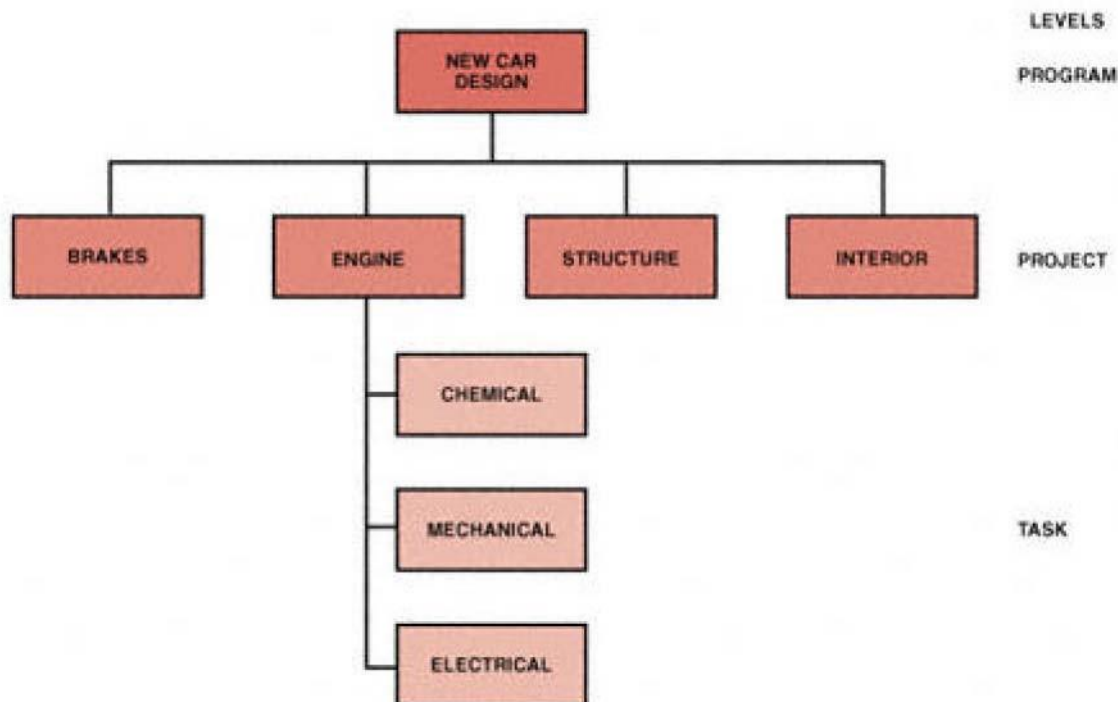


Figure 23.1: Work Breakdown Structure (WBS) Elements

23.3 Methods for Structuring Work Breakdown Structure (WBS):

It is seen that a tendency exists today to develop guidelines, policies, and procedures for project management, but not for the development of the Work Breakdown Structure (WBS). Since it must have flexibility built into it, the tendency is to avoid limiting the way the Work

Breakdown Structure (WBS) must be developed. Some companies have been marginally successful in developing a "generic" methodology for levels 1, 2, and 3 of the Work Breakdown Structure (WBS). In other words, the top three levels of the Work Breakdown Structure (WBS) are the same for all projects. The differences appear in levels 4, 5, and 6.

The following table 23.1 shows the three most common methods for structuring the Work Breakdown Structure (WBS):

Level	Method		
	Flow	Life Cycle	Organization
Program	Program	Program	Program
Project	System	Life cycle	Division
Task	Subsystem	System	Department
Subtask	People	Subsystem	Section
Work package	People	People	People
Level of effort	People	People	People

Table 23.1: Three Common Methods for Structuring the WBS

As the table shows, the flow method breaks the work down into systems and major subsystems. This method is well suited for projects less than two years in length. For longer-duration projects, we use the life-cycle method, which is similar to the flow method. The organization method is used for projects that may be repetitive or require very little integration between functional units.

23.4 Why Do Plans Fail?

Planning is not perfect, no matter how hard we try, and sometimes plans fail. Typical reasons why plans fail include:

- Corporate goals are not understood at the lower organizational levels.
- Plans encompass too much in too little time.
- Financial estimates are poor.
- Plans are based on insufficient data.
- No attempt is made to systematize the planning process.
- Planning is performed by a planning group.
- No one knows the ultimate objective.
- No one knows the staffing requirements.
- No one knows the major milestone dates, including written reports.
- Project estimates are best guesses, and are not based on standards or history.
- Not enough time is given for proper estimating.
- No one bothers to see if there would be personnel available with the necessary skills.
- People are not working toward the same specifications.
- People are consistently shuffled in and out of the project with little regard for schedule.

Now the question arises, why do these situations occur, and who should be blamed? If corporate goals are not understood, it is because corporate executives are negligent in providing the necessary strategic information and feedback. If a plan fails because of extreme optimism, then the responsibility lies with both the project and line managers for not assessing risk. Project managers should ask the line managers if the estimates are optimistic or pessimistic, and expect an honest answer. Erroneous financial estimates are the responsibility of the line manager. If the

project fails because of a poor definition of the requirements, then the project manager is totally at fault.

It is important that the project managers must be willing to accept failure. Sometimes, a situation occurs that can lead to failure, and the problem rests with either upper-level management or some other group. As an example, consider the major utility company with a planning group that prepares budgets (with the help of functional groups) and selects projects to be completed within a given time period. A project manager on one such project discovered that the project should have started "last month" in order to meet the completion date. In cases like this, project managers will not become dedicated to the projects unless they are active members during the planning and know what assumptions and constraints were considered in development of the plan.

In some cases, sometimes, the project manager is part of the planning group and as part of feasibility study is asked to prepare, with the assistance of functional managers, a schedule and cost summary for a project that will occur three years downstream, if it is approved at all. Suppose that three years downstream the project is approved. How does the project manager get functional managers to accept the schedule and cost summary that they themselves prepared three years before? It cannot be done, because technology may have changed, people may be working higher or lower on the learning curve, and salary and raw material escalation factors are inaccurate.

Small mistake accumulate to cause big damage. Sometimes project plans fail because simple details are forgotten or overlooked. Examples of this might be:

- Neglecting to tell a line manager early enough that the prototype is not ready and that rescheduling is necessary.
- Neglecting to see if the line manager can still provide additional employees for the next two weeks because it was possible to do so six months ago.

In addition to this, sometimes plans fail because the project manager "bites off more than he can chew," and then something happens, such as his becoming ill. Even if the project manager is effective at doing a lot of the work, overburdening is unnecessary. Many projects have failed because the project manager was the only one who knew what was going on and then got sick.

SCHEDULES AND CHARTS

BROAD CONTENTS

Detailed Schedules and Charts
Guidelines for Preparation of Schedules
Preparation Sequence of Schedules
Master Production Scheduling
Definition of Master Production Schedule (MPS)
Objectives of Master Production Schedule (MPS)
Program Plan

24.1 Detailed Schedules and Charts:

The first major requirement of the program office after the program goes ahead is the scheduling of activities.

If the activity is not too complex, the program office normally assumes full responsibility for activity scheduling. For large programs, functional management input is required before scheduling can be completed.

Depending on program size and contractual requirements, it is not unusual for the program office to maintain, at all times, a program staff member whose responsibility is that of a scheduler. This individual continuously develops and updates activity schedules to provide a means of tracking program work. The resulting information is then supplied to the program office personnel, functional management, and team members, and, last but not least, is presented to the customer.

Note that the activity scheduling is probably the single most important tool for determining how company resources should be integrated so that synergy is produced. Activity schedules are invaluable for projecting time-phased resource utilization requirements as well as providing a basis for visually tracking performance.

In many cases, most programs begin with the development of schedules so that accurate cost estimates can be made. The schedules serve as master plans from which both the customer and management have an up-to-date picture of operations.

24.2 Guidelines for Preparation of Schedules:

Regardless of the projected use or complexity, certain guidelines should be followed in the preparation of schedules. These are as follows:

- Firstly, all major events and dates must be clearly identified. If the customer supplies a statement of work, those dates shown on the accompanying schedules must be included. If for any reason the customer's milestone dates cannot be met, the customer should be notified immediately.
- The exact sequence of work should be defined through a network in which interrelationships between events can be identified.
- Schedules should be directly relatable to the Work Breakdown Structure (WBS). If the Work Breakdown Structure (WBS) is developed according to a specific sequence of work, then it becomes an easy task to identify work sequences in schedules using the same

numbering system as in the Work Breakdown Structure (WBS). The minimum requirement should be to show where and when all tasks start and finish.

- All schedules must identify the time constraints and, if possible, should identify those resources required for each event.

Here we see that although these four guidelines relate to schedule preparation, they do not define how complex the schedules should be. Before preparing schedules, three questions should be considered:

- How many events or activities should each network have?
- How much of a detailed technical breakdown should be included?
- Who is the intended audience for this schedule?

In this regard, most organizations develop multiple schedules: summary schedules for management and planners and detailed schedules for the doers and lower-level control. The detailed schedules may be strictly for interdepartmental activities. Program management must approve all schedules down through the first three levels of the work breakdown structure. For lower-level schedules (that is, detailed interdepartmental), program management may or may not request a sign of approval.

The need for two schedules is clear. In larger complicated projects, planning and status review by different echelons are facilitated by the use of detailed and summary networks. Higher levels of management can view the entire project and the interrelationships of major tasks without looking into the detail of the individual subtasks. Lower levels of management and supervision can examine their parts of the project in fine detail without being distracted by those parts of the project with which they have no interface.

One of the most difficult problems to identify in schedules is a *hedge position*. A hedge position is a situation in which the contractor may not be able to meet a customer's milestone date without incurring a risk, or may not be able to meet activity requirements following a milestone date because of contractual requirements.

24.3 Preparation Sequence of Schedules:

For almost every activity detailed schedules are prepared. It is the responsibility of the program office to marry all of the detailed schedules into one master schedule to verify that all activities can be completed as planned.

According to the sequence, the program office submits a request for detailed schedules to the functional managers then prepare summary schedules, detailed schedules, and, if time permits, interdepartmental schedules. Each functional manager then reviews his schedules with the program office. The program office, together with the functional program team members, integrates all of the plans and schedules and verifies that all contractual dates can be met.

Note that before the schedules are submitted to publications, rough drafts of each schedule and plan should be reviewed with the customer. This procedure accomplishes the following:

- Verifies that nothing has fallen through the cracks
- Prevents immediate revisions to a published document and can prevent embarrassing moments
- Minimizes production costs by reducing the number of early revisions
- Shows customers early in the program that you welcome their help and input into the planning phase

Once the document is published, it should be distributed to all program office personnel, functional team members, functional management, and the customer.

The exact method of preparing the schedules is usually up to the individual performing the activity.

However, the program office must approve all schedules. The schedules are normally prepared in a format that is suitable to both the customer and contractor and is easily understood by all. The schedules may then be used in-house as well as for customer review meetings, in which case the contractor can "kill two birds with one stone" by tracking cost and performance on the original schedules.

In addition to the detailed schedules, the program office, with input provided by functional management, must develop organization charts. The organizational charts tell all active participants in the project who has responsibility for each activity. The organizational charts display the formal (and often the informal) lines of communication.

Linear responsibility charts (LRCs) are also established by the program office. In spite of the best attempts by management, many functions in an organization may overlap between functional units.

The management might also wish to have the responsibility for a certain activity given to a functional unit that normally would not have that responsibility. This is a common occurrence on short duration programs where management desires to cut costs and red tape.

Importantly, care must be taken that project personnel do not forget the reason why the schedule was developed.

Summing this up, the primary objective of detailed schedules is usually to coordinate activities into a master plan in order to complete the project with the:

- Best time
- Least cost
- Least risk

The objective can be constrained by the following obvious reasons:

- Calendar completion dates
- Cash or cash flow restrictions
- Limited resources
- Approvals

In addition to this, there are also secondary objectives of scheduling:

- Studying alternatives
- Developing an optimal schedule
- Using resources effectively
- Communicating
- Refining the estimating criteria
- Obtaining good project control
- Providing for easy revisions

24.4 Master Production Scheduling:

We know that master production scheduling is not a new concept. Earliest material control systems used a "quarterly ordering system" to produce a *Master Production Schedule (MPS)* for plant production.

This system uses customer order backlogs to develop a production plan over a three-month period. The production plan is then exploded manually to determine what parts must be purchased or manufactured at the proper time. However, rapidly changing customer requirements and fluctuating lead times, combined with a slow response to these changes, can result in the disruption of master production scheduling.

24.5 Master Production Schedule (MPS) Definition:

Before going into the details, it is important to know what a Master Production Schedule (MPS) is. A *Master Production Schedule (MPS)* is a statement of what will be made, how many units will be made, and when they will be made. It is a production plan, not a sales plan. The Master Production Schedule (MPS) considers the total demand on a plant's resources, including finished product sales, spare (repair) part needs, and interplant needs. The Master Production Schedule (MPS) must also consider the capacity of the plant and the requirements imposed on vendors. Provisions are made in the overall plan for each manufacturing facility's operation. All planning for materials, manpower, plant, equipment, and financing for the facility is driven by the master production schedule.

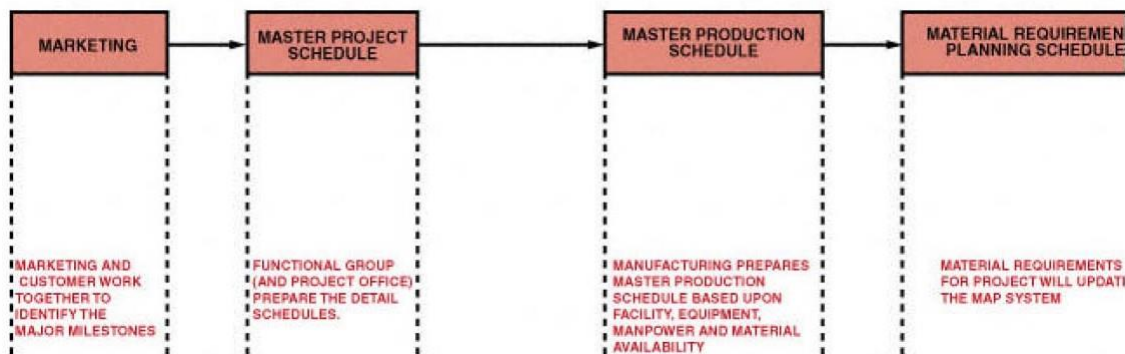


Figure 24.1: Material Requirements Planning Interrelationships

24.6 Objectives of the Master Production Schedule (MPS):

Following are the objectives of Master Production Schedule (MPS):

- To provide top management with a means to authorize and control manpower levels, inventory investment, and cash flow.
- To coordinate marketing, manufacturing, engineering, and finance activities by a common performance objective.
- To reconcile marketing and manufacturing needs
- To provide an overall measure of performance
- To provide data for material and capacity planning

Therefore, the development of a Master Production Schedule (MPS) is a very important step in a planning cycle. It directly ties together personnel, materials, equipment, and facilities as shown in the figure above. Master Production Schedule (MPS) also identify key dates to the customer, should he wish to visit the contractor during specific operational periods.

24.7 Program Plan:

Documented planning in the form of a program plan is fundamental to the success of any project. In an ideal situation, the program office can present the functional manager with a copy of the program plan and simply say, "accomplish it." The concept of the program plan came

under severe scrutiny during the 1960s when the Department of Defense required all contractors to submit detailed planning to such extremes that many organizations were wasting talented people by having them serve as writers instead of doers. Since then, because of the complexity of large programs, requirements imposed on the program plan have been eased.

In case of large and often complex programs, customers may require a program plan that documents all activities within the program. The program plan then serves as a guideline for the lifetime of the program and may be revised as often development programs require more revisions to the program plan than manufacturing or construction programs). The program plan provides the following framework:

- Eliminates conflicts between functional managers
- Eliminates conflicts between functional management and program management
- Provides a standard communications tool throughout the lifetime of the program. (It should be geared to the work breakdown structure.)
- Provides verification that the contractor understands the customer's objectives and requirements
- Provides a means for identifying inconsistencies in the planning phase
- Provides a means for early identification of problem areas and risks so that no surprises occur downstream

Note that the development of a program plan can be time-consuming and costly. The input requirements for the program plan depend on the size of the project and the integration of resources and activities. All levels of the organization participate. The upper levels provide summary information, and the lower levels provide the details. The program plan, like activity schedules, does not preclude departments from developing their own planning.

One of the key features of the program plan is that it must identify how the company resources will be integrated. Finalization of the program is an iterative process similar to the sequence of events for schedule preparation, shown in the figure 24.2 below. Since the program plan must explain the events in the figure, additional iterations are required, which can cause changes in a program.

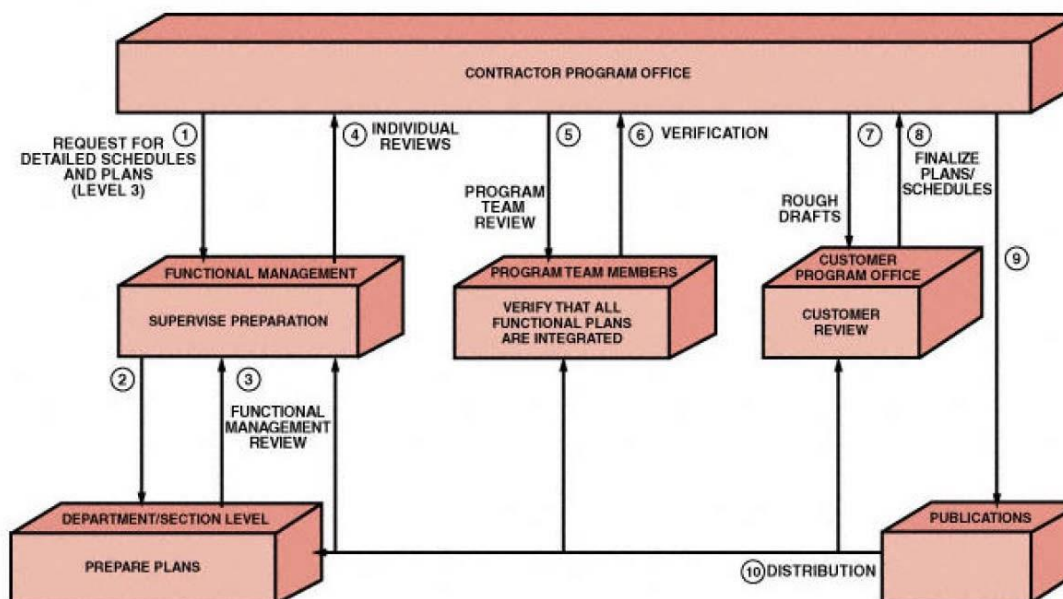


Figure 24.2: Preparation Sequence for Schedules and Program Plans

Thus, we say that the program plan is a standard from which performance can be measured, not only by the customer, but also by program and functional management as well. The plan serves

as a cookbook for the duration of the program by answering the following questions for all personnel identified with the program:

- What will be accomplished?
- How will it be accomplished?
- Where will it be accomplished?
- When will it be accomplished?
- Why will it be accomplished?

The answers to these questions force both the contractor and the customer to take a hard look at:

- Program requirements
- Program management
- Program schedules
- Facility requirements
- Logistic support
- Financial support
- Manpower and organization

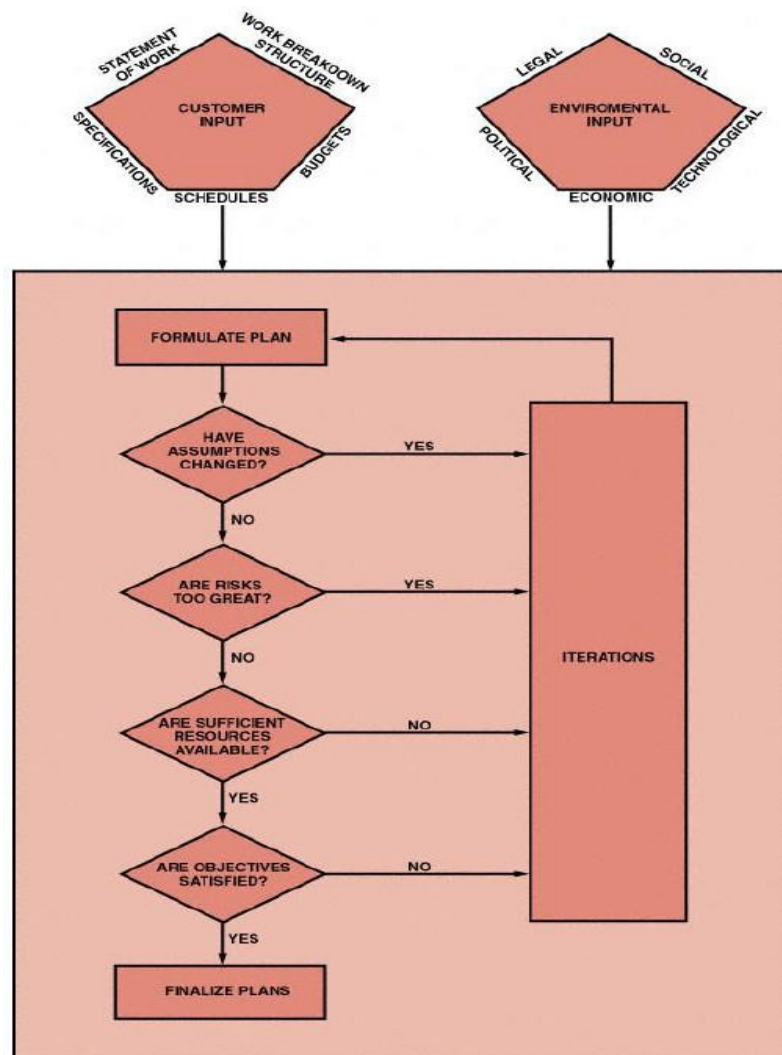


Figure 24.3: Iterations for the Planning Process

In addition to this, the program plan is more than just a set of instructions. It is an attempt to eliminate crisis by preventing anything from "falling through the cracks." The plan is documented and approved by both the customer and the contractor to determine what data, if

any, are missing and the probable resulting effect. As the program matures, the program plan is revised to account for new or missing data. The most common reasons for revising a plan are:

- "Crashing" activities to meet end dates
- Trade-off decisions involving manpower, scheduling, and performance
- Adjusting and leveling manpower requests

Usually the maturity of a program implies that crisis will decrease. Unfortunately, this is not always the case.

The makeup of the program plan may vary from contractor to contractor. Most program plans can be subdivided into four main sections:

- i) Introduction
- ii) Summary and conclusions
- iii) Management
- iv) Technical

The complexity of the information is usually up to the discretion of the contractor, provided that customer requirements, as may be specified in the statement of work, are satisfied.

To begin with, the **introductory** section contains the definition of the program and the major parts involved. If the program follows another, or is an outgrowth of similar activities, this is indicated, together with a brief summary of the background and history behind the project.

The second section that is the **summary and conclusion** section identifies the targets and objectives of the program and includes the necessary "lip service" on how successful the program will be and how all problems can be overcome. This section must also include the program master schedule showing how all projects and activities are related. The total program master schedule should include the following:

- An appropriate scheduling system (bar charts, milestone charts, network, etc.)
- A listing of activities at the project level or lower
- The possible interrelationships between activities (can be accomplished by logic networks, critical path networks, or PERT networks)
- Activity time estimates (a natural result of the item above)

As already mentioned, the summary and conclusion chapter is usually the second section in the program plan so that upper-level customer management can have a complete overview of the program without having to search through the technical information.

The third section, that is the **management** section of the program plan contains procedures, charts, and schedules as follows:

- The assignment of key personnel to the program is indicated. This usually refers only to the program office personnel and team members, since under normal operations these will be the only individuals interfacing with customers.
- Manpower, planning, and training are discussed to assure customers that qualified people will be available from the functional units.
- A linear responsibility chart might also be included to identify to customers the authority relationships that will exist in the program.

There exist some situations in which the management section may be omitted from the proposal. For a follow-up program, the customer may not require this section if management's positions are unchanged.

In addition to this, the management sections are also not required if the management information was previously provided in the proposal or if the customer and contractor have continuous business dealings.

The fourth section that is the **technical** section may include as much as 75 to 90 percent of the program plan, especially if the effort includes research and development. The technical section may require constant updating as the program matures. The following items can be included as part of the technical section:

- Detailed breakdown of the charts and schedules used in the program master schedule, possibly including schedule/cost estimates.
- Listing of the testing to be accomplished for each activity. (It is best to include the exact testing matrices.)
- Procedures for accomplishment of testing. This might also include a description of the key elements in the operations or manufacturing plans as well as a listing of the facility and logistic requirements.
- Identification of materials and material specifications. (This might also include system specifications.)
- An attempt to identify the risks associated with specific technical requirements (not commonly included). This assessment tends to scare management personnel who are unfamiliar with the technical procedures, so it should be omitted if at all possible.

Therefore, the program plan contains a description of all phases of the program. For many programs, especially large ones, detailed planning is required for all major events and activities.

The following Table 24.1 identifies the type of individual plans that may be required in place of a (total) program plan. However, the amount of detail must be controlled, for too much paperwork can easily inhibit successful management of a program.

TABLE 24.1. TYPES OF PLANS

Type of Plan	Description
Budget	How much money is allocated to each event?
Configuration management	How are technical changes made?
Facilities	What facilities resources are available?
Logistics support	How will replacements be handled?
Management	How is the program office organized?
Manufacturing	What are the time-phase manufacturing events?
Procurement	What are my sources? Should I make or buy? If vendors are not qualified, how shall I qualify them?
Quality assurance	How will I guarantee specifications will be met?
Research/development	What are the technical activities?
Scheduling	Are all critical dates accounted for?
Tooling	What are my time-phased tooling requirements?
Training	How will I maintain qualified personnel?
Transportation	How will goods and services be shipped?

Table 24.1: Types of Plans

Once agreed on by the contractor and customer, the program plan is then used to provide program direction. This is shown in the figure 24.4 below. If the program plan is written clearly, then any functional manager or supervisor should be able to identify what is expected of him.

Note that the program plan should be distributed to each member of the program team, all functional managers and supervisors interfacing with the program, and all key functional personnel. The program plan does not contain all of the answers, for if it did, there would be no need for a program office. The plan serves merely as a guide.

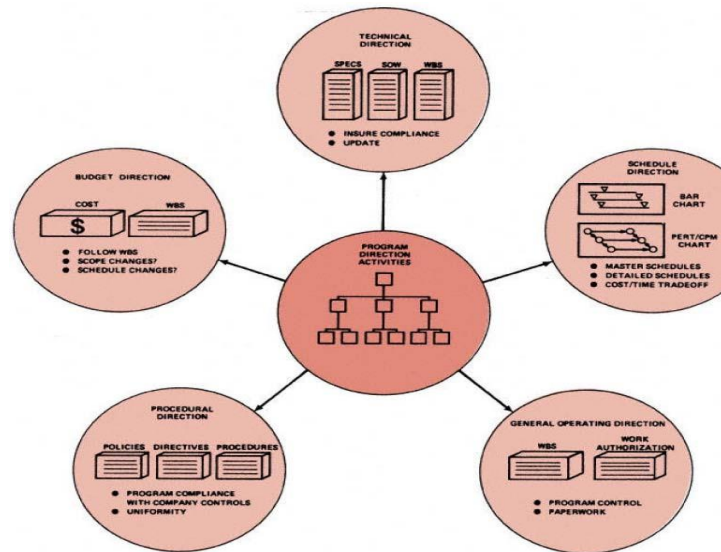


Figure 24.4: Program Direction Activities

Here we conclude with a final note that the program plan may be specified contractually to satisfy certain requirements as identified in the customer's statement of work. The contractor retains the right to decide how to accomplish this, unless, of course, this is also identified in the Statement of Work (SOW). If the Statement of Work (SOW) specifies that quality assurance testing will be accomplished on fifteen end-items from the production line, then fifteen is the minimum number that must be tested. The program plan may show that twenty-five items are to be tested. If the contractor develops cost overrun problems, he may wish to revert to the Statement of Work (SOW) and test only fifteen items. Contractually, he may do this without informing the customer. In most cases, however, the customer is notified, and the program is revised.

TOTAL PROJECT PLANNING

BROAD CONTENTS

Total Project Planning
Project Charter
Management Control
Project Manager–Line Manager Interface
Project Fast Tracking
Configuration Management

25.1 Total Project Planning:

Planning is one of the most significant functions of management. The difference between good project manager and poor project manager is often described in one word: planning. Unfortunately, people have a poor definition of what project planning actually involves. Project planning involves planning for:

- Schedule development
- Budget development
- Project administration
- Leadership styles (interpersonal influences)
- Conflict management

With reference to this, the first two items involve the quantitative aspects of planning. Planning for project administration includes the development of the Linear Responsibility Chart (LRC).

We know that although each project manager has the authority and responsibility to establish project policies and procedures, they must fall within the general guidelines established by top management. Guidelines can also be established for planning, scheduling, controlling, and communications.

Note that the Linear Responsibility Chart (LRC) can result from customer-imposed requirements above and beyond normal operations. For example, the customer may require as part of his quality control requirements that a specific engineer supervise and approve all testing of a certain item, or that another individual approve all data released to the customer over and above program office approval. Customer requirements similar to those identified above require Linear Responsibility Charts (LRCs) and can cause disruptions and conflicts within an organization.

There are several key factors that affect the delegation of authority and responsibility both from upper-level management to project management, and from project management to functional management. These key factors include:

- Maturity of the project management function
- Size, nature, and business base of the company
- Size and nature of the project
- Life cycle of the project
- Capabilities of management at all levels

Once agreement has been reached on the project manager's authority and responsibility, the results may be documented to delineate that role regarding:

- Focal position
- Conflict between the project manager and functional managers
- Influence to cut across functional and organizational lines
- Participation in major management and technical decisions
- Collaboration in staffing the project
- Control over allocation and expenditure of funds
- Selection of subcontractors
- Rights in resolving conflicts
- Input in maintaining the integrity of the project team
- Establishment of project plans
- Provisions for a cost-effective information system for control
- Provisions for leadership in preparing operational requirements
- Maintenance of prime customer liaison and contact
- Promotion of technological and managerial improvements
- Establishment of project organization for the duration
- Elimination of red tape

In addition to this, documenting the project manager's authority is necessary in some situations because:

- All interfacing must be kept as simple as possible.
- Project manager must have the authority to "force" functional managers to depart from existing standards and possibly incur risk.
- Gaining authority over those elements of a program that are not under the project manager's control is essential. This is normally achieved by earning the respect of the individuals concerned.
- The project manager should not attempt to fully describe the exact authority and responsibilities of the project office personnel or team members. Problem solving rather than role definition should be encouraged.

In most cases, although documenting project authority is undesirable, it may be a necessary prerequisite, especially if project initiation and planning require a formal project chart. Power and authority are often discussed as though they go hand in hand. Authority comes from people above you, perhaps by delegation, whereas power comes from people below you. You can have authority without power or power without authority.

Most individuals maintain position power in a traditional organizational structure. The higher up you sit, the more power you have. But in project management, the reporting level of the project might be irrelevant, especially if a project sponsor exists. In project management, the project manager's power base emanates from his:

- Expertise (technical or managerial)
- Credibility with employees
- Sound decision-making ability

Keeping in view its significance, the last item is usually preferred. If the project manager is regarded as a sound decision maker, then the employees normally give the project manager a great deal or power over them.

Here it is important to discuss leadership. Leadership styles refer to the interpersonal influence modes that a project manager can use. Project managers may have to use several different leadership styles, depending on the makeup of the project personnel. Conflict management is

important because if the project manager can predict what conflicts will occur and when they are most likely to occur, he may be able to plan for the resolution of the conflicts through project administration. The object, of course, is to develop a project plan that shows complete distribution of resources and the corresponding costs. The project manager begins with a coarse (arrow diagram) network and then decides on the Work Breakdown Structure (WBS). The Work Breakdown Structure (WBS) is essential to the arrow diagram and should be constructed so that reporting elements and levels are easily identifiable.

For each element in the Work Breakdown Structure (WBS), eventually there will be an arrow diagram and detailed chart. If there exists too much detail, the project manager can refine the diagram by combining all logic into one plan and can then decide on the work assignments. There is a risk here that, by condensing the diagrams as much as possible, there may be a loss of clarity. All the charts and schedules can be integrated into one summary-level figure. This can be accomplished at each Work Breakdown Structure (WBS) level until the desired plan is achieved.

Moving ahead, finally, project, line, and executive management must analyze other internal and external variables before finalizing these schedules. A partial listing of these variables includes:

- Introduction or acceptance of the product in the marketplace
- Present or planned manpower availability
- Economic constraints of the project
- Degree of technical difficulty
- Manpower availability
- Availability of personnel training
- Priority of the project

In small companies and projects, certain items in the figure 25.1 below may be omitted, such as the Linear Responsibility Chart (LRC).

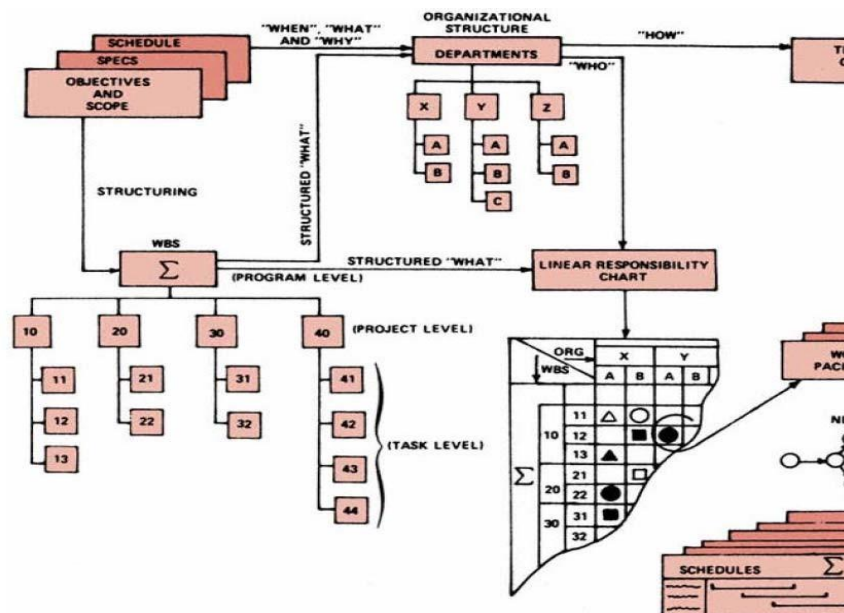


Figure 25.1: Project Planning

25.2 The Project Charter:

Initially, the original concept behind the project charter was to document the project manager's authority and responsibility, especially for projects implemented away from the home office. Today, the project charter has been expanded to become more of an internal legal document

identifying to the line managers and his personnel not only the project manager's authority and responsibility, but also the management- and/or customer-approved scope of the project.

In theoretical terms, the sponsor prepares the charter and affixes his/her signature, but in reality, the project manager may prepare it for the sponsor's signature. At a minimum, the charter should include:

- Identification of the project manager and his/her authority to apply resources to the project
- The business purpose that the project was undertaken to address, including all assumptions and constraints
- Summary of the conditions defining the project

What is a “charter”? It is a "legal" agreement between the project manager and the company. Some companies supplement the charter with a "contract" that functions as an agreement between the project and the line organizations.

Recently, within the last two years or so, some companies have converted the charter into a highly detailed document containing:

- The scope baseline/scope statement
- Scope and objectives of the project (Statement of Work (SOW))
- Specifications
- Work Breakdown Structure (template levels)
- Timing
- Spending plan (S-curve)
- Management plan
- Resource requirements and man loading (if known)
- Résumés of key personnel
- Organizational relationships and structure
- Responsibility assignment matrix
- Support required from other organizations
- Project policies and procedures
- Change management plan
- Management approval of above

The project charter may function as the project plan when it contains a scope baseline and management plan. This is not really an effective use of the charter, but it may be acceptable on certain types of projects for internal customers.

25.3 Management Control:

It is essential that careful management control must be established because the planning phase provides the fundamental guidelines for the remainder of the project. In addition, since planning is an ongoing activity for a variety of different programs, management guidelines must be established on a company-wide basis in order to achieve unity and coherence.

Note that all functional organizations and individuals working directly or indirectly on a program are responsible for identifying, to the project manager, scheduling and planning problems that require corrective action during both the planning cycle and the operating cycle. The program manager bears the ultimate and final responsibility for identifying requirements for corrective actions.

For this purpose, management policies and directives are written specifically to assist the program manager in defining the requirements. Without clear definitions during the planning phase, many projects run off in a variety of directions.

In this regard, many companies establish planning and scheduling management policies for the project and functional managers, as well as a brief description of how they should interface.

25.4 The Project Manager–Line Manager Interface:

Good project planning, as well as other project functions, requires a good working relationship between the project and line managers. The utilization of management controls does not necessarily guarantee successful project planning. At this interface:

- The project manager answers the following questions:
 - What is to be done? (Using the Statement of Work, Work Breakdown Structure)
 - When will the task be done? (Using the summary schedule)
 - Why will the task be done? (Using the Statement of Work)
 - How much money is available? (Using the Statement of Work)
- The line manager answers the following questions:
 - How will the task be done? (i.e., technical criteria)
 - Where will the task be done? (i.e., technical criteria)
 - Who will do the task? (i.e., staffing)

Furthermore, project managers may be able to tell line managers "how" and "where," provided that the information appears in the Statement of Work (SOW) as a requirement for the project. Even then, the line manager can take exception based on his technical expertise.

The following figures 25.2 and 25.3, that is, “The Brick Wall” and “Modified Brick Wall” respectively, show what can happen when project managers overstep their bounds. In Figure 25.2 below, the manufacturing manager built a brick wall to keep the project managers away from his personnel because the project managers were telling his line people how to do their job. In Figure 25.3 “Modified Brick Wall”, the subproject managers (for simplicity's sake, equivalent to project engineers) would have, as their career path, promotions to Assistant Project Managers (A.P.Ms). Unfortunately, the Assistant Project Managers still felt that they were technically competent enough to give technical direction, and this created havoc for the engineering managers.

In view of this, the simplest solution to all of these problems is for the project manager to provide the technical direction *through* the line managers. After all, the line managers are supposedly the true technical experts.

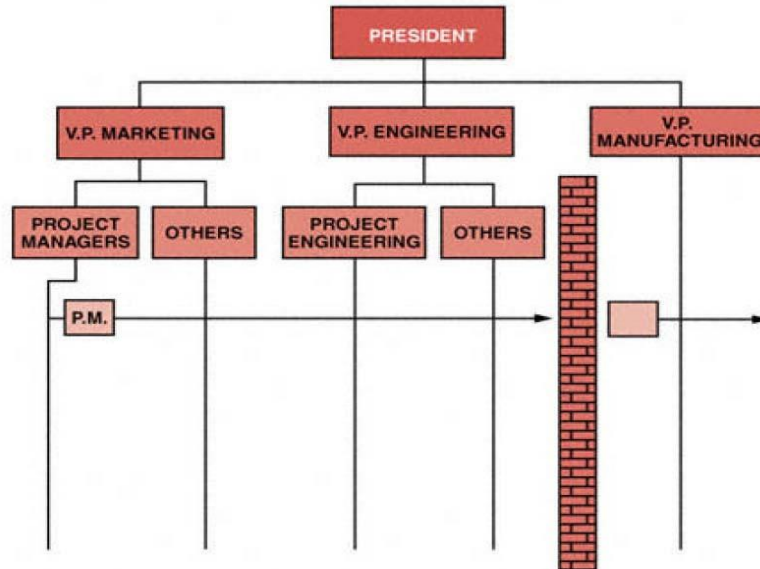


Figure 25.2: The Brick Wall

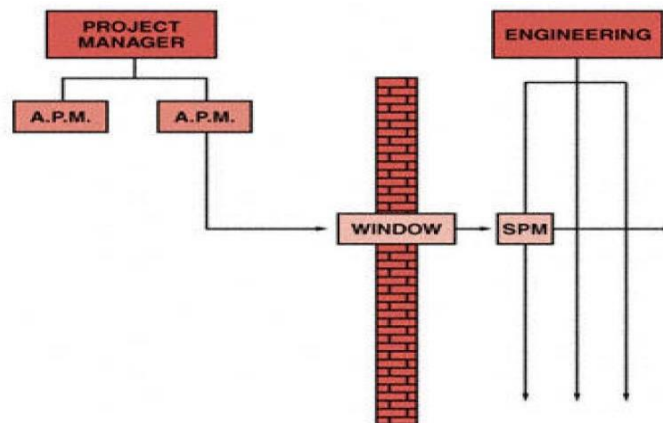


Figure 25.3: Modified Brick Wall

25.5 Project Fast-Tracking:

No matter how well we plan, sometimes something happens that causes havoc on the project. Such is the case when either the customer or management changes the project's constraints. Consider Figure 25.4 “The information explosion” and let us assume that the execution time for the construction of the project is one year. To prepare the working drawings and specifications down through level 5 of the Work Breakdown Structure (WBS) would require an additional 35 percent of the expected execution time, and if a feasibility study is required, then an additional 40 percent will be added on. In other words, if the execution phase of the project is one year, then the entire project is almost two years.

Let us now assume that management wishes to keep the end date fixed but the start date is delayed because of lack of adequate funding. How can this be accomplished *without* sacrificing the quality?

What should be the answer to it? The answer is to fast-track the project. Fast-tracking a project means that activities that are normally done in series are done in parallel. An example of this is when construction begins before detail design is completed.

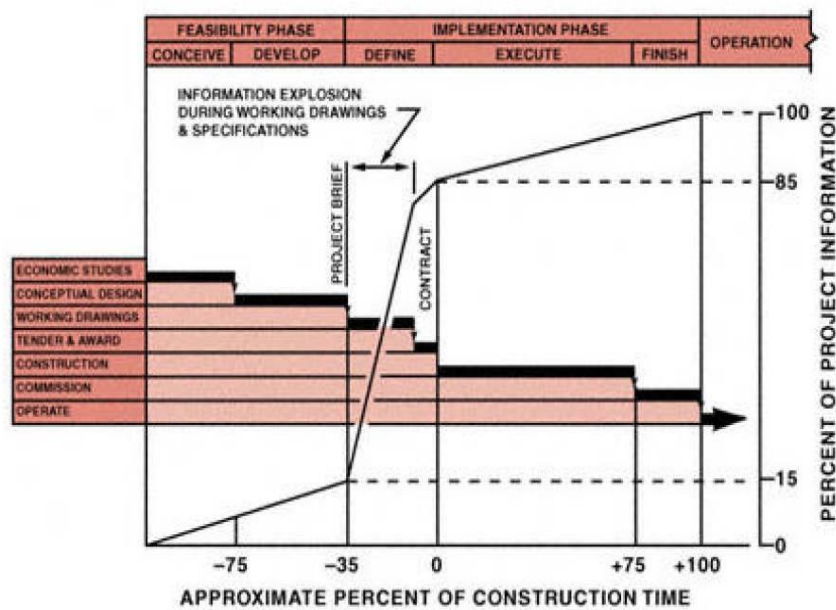


Figure 25.4: The Information Explosion

Now the question arises as to how would this help. Fast-tracking a job can accelerate the schedule but requires that additional risks be taken. If the risks materialize, then either the end date will slip or expensive rework will be needed. Almost all project driven companies fast-track projects. The danger, however, is when fast-tracking becomes a way of life on all projects.

25.6 Configuration Management:

Configuration management or configuration change control is one of the most critical tools employed by a project manager. As projects progress downstream through the various life-cycle phases, the cost of engineering changes can grow boundlessly. It is not uncommon for companies to bid on proposals at 40 percent below their own cost hoping to make up the difference downstream with engineering changes. It is also quite common for executives to "encourage" project managers to seek out engineering changes because of their profitability.

What is configuration management? It is a control technique, through an orderly process, for formal review and approval of configuration changes. If properly implemented, configuration management provides:

- Appropriate levels of review and approval for changes
- Focal points for those seeking to make changes
- A single point of input to contracting representatives in the customer's and contractor's office for approved changes

At a minimum, the configuration control committee should include representation from the customer, contractor, and line group initiating the change. Discussions should answer the following questions:

- What is the cost of the change?
- Do the changes improve quality?
- Is the additional cost for this quality justifiable?
- Is the change necessary?
- Is there an impact on the delivery date?

As we know that changes cost money. Therefore, it is imperative that configuration management be implemented correctly. The following steps can enhance the implementation process:

- Define the starting point or "baseline" configuration
- Define the "classes" of changes
- Define the necessary controls or limitations on both the customer and contractor
- Identify policies and procedures, such as:
 - Board chairman
 - Voters/alternatives
 - Meeting time
 - Agenda
 - Approval forums
 - Step-by-step processes
 - Expedition processes in case of emergencies

It is essential to know that effective configuration control pleases both customer and contractor. Overall benefits include:

- Better communication among staff
- Better communication with the customer
- Better technical intelligence
- Reduced confusion for changes
- Screening of frivolous changes
- Providing a paper trail

Lastly, but importantly, it must be understood that configuration control, as used here, is not a replacement for design review meetings or customer interface meetings. These meetings are still an integral part of all projects.

PROJECT SCOPE MANAGEMENT

BROAD CONTENTS

Scope

Difference between Scope, Objectives and Goals

Difference between Business Case, Project Charter and Scope Document

Scope Creep

Project Scope Management

26.1 Scope:

Scope is what the project contains or delivers. When starting to plan the scope of the project, think about the big picture first. At this level it is best to concentrate on major deliverables and not get bogged down with detail.

26.1.1 : Why is Scope Important?

Scope of a project is the sum total of all of a project's products and their requirements or features.

Sometimes the term scope is used to mean the totality of work needed to complete a project.

In traditional project management, the tools to describe a project's scope (product) are the product breakdown structure and product descriptions. The primary tool to describe a project's scope is the Work Breakdown Structure (WBS).

Extreme project management advocates the use of user stories, feature lists and feature cards to describe a project's scope (product-deliverable).

If requirements are not completely defined and described and if there is no effective change control in a project, scope or requirements creep may ensue.

26.2 Difference Between Scope (In/Deferred/Out), Objectives and Goals:

Goals and objectives are what the business wants to achieve through this project. Goals and objectives define WHY the client wants to undertake the project.

Scope defines the size of the project. Scope can include such areas as:

- a) Departments
- b) Geographic locations
- c) Deliverables
- d) Features and functions

Often scope is limited by schedule and budget constraints.

Something *in scope* will be included in the current release or stage. Something *deferred* will be delivered in a later release. Something *out of scope* will not be included in the project. It is

important to explicitly identify items out of scope to reduce misunderstandings which can generate conflict and hard feelings.

26.3 Difference Between Business Case, Project Charter and Scope Document?

A *business case* is usually prepared before project approval. If you are a contractor, your proposal would be similar a business case.

A *project charter* providing the project manager with formal authorization to proceed with the project is issued to a team by the project sponsor before the project starts.

Project scope document defines the project scope. It should be attached to the business case and to the project charter. The project scope will be refined as you proceed through the project.

Scope is bound to change, and this is to be expected. As the detail becomes clearer, more complications creep in. These are not foreseeable at the start and hopefully we build in a contingency for what we cannot see.

26.4 Scope Creep:

Scope creep (also called *requirement creep*, *feature creep*, and sometimes *kitchen sink syndrome*) in project management refers to uncontrolled changes in a project's scope. This phenomenon can occur when the scope of a project is not properly defined, documented, or controlled. It is generally considered a negative occurrence to be avoided.

Typically, the scope increase consists of either new products or new features of already approved product designs, without corresponding increases in resources, schedule, or budget. As a result, the project team risks drifting away from its original purpose and scope on unplanned additions, and also because of one's tendency to focus on only one dimension of project.

Therefore, scope creep can also result in a project team overrunning its original budget and schedule. As the scope of a project grows, more tasks must be completed at the same time and cost frame as original series of project tasks.

Scope creep can be a result of:

- Poor change control
- Lack of proper initial identification of what is required to bring about the project objectives.
- Weak project manager or executive sponsor
- Poor communication between parties.

Scope creep is a risk in most projects. Most mega projects fall victim to scope creep. Scope creep often results in cost overrun.

26.4.1 Features (Technology) Scope Creep Management:

Features (Technology) Scope Creep Management occurs when the scope creep is introduced by technologists adding features not originally contemplated. It is developed by technologists, for *customer pleasing* or *technical gold-plating* purposes where features are added to project (IT) by technologists causing scope creep.

Customer-pleasing scope creep occurs when the desire to please the customer through additional product features adds more work to the current project rather than to a new project proposal. It results from an organization and/or individual whose ultimate goal

is to please customer while acting reluctant to reject proposed changes in requirement of project.

Gold-plating scope creep occurs when technologists augment the original requirements because of a bias toward "technical perfectionism" or because the initial requirements were insufficiently clear or detailed. It is different, and is a result of technologists adding substance or additions to original requirements, because of lack of details in initial business' requirements.

26.4.2 Scope Management Plan:

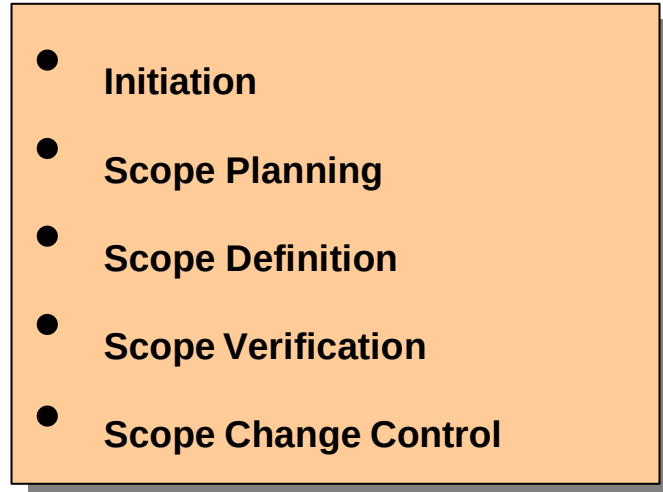
It is one of the major scope communication documents. The Project Scope Management Plan documents how the project scope will be defined, managed, controlled, verified and communicated to the project team and stakeholders/customers. It also includes all work required to complete the project.

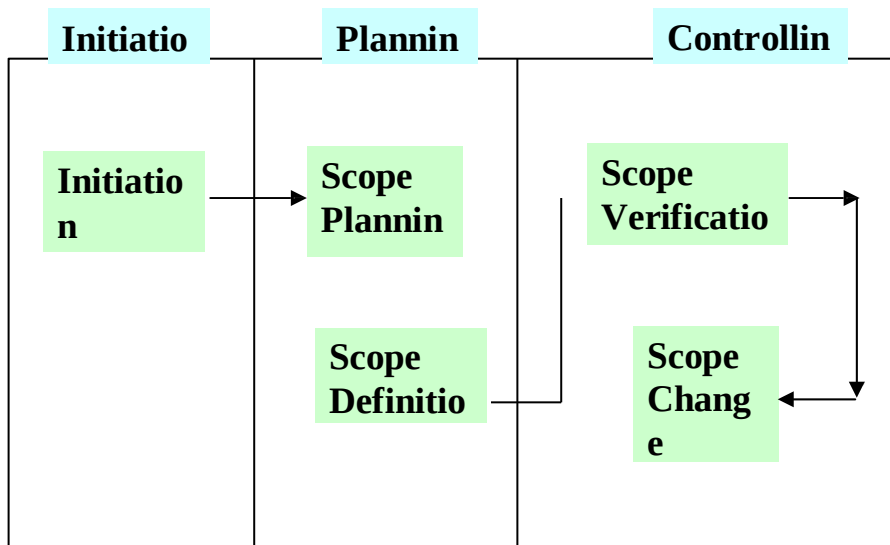
The documents are used to control what is in and out of the scope of the project by the use of a Change Management system. Items deemed out of scope go directly through the change control process and are not automatically added to the project work items.

The Project Scope Management plan is included in as one of the sections in the overall project management plan. It can be very detailed and formal or loosely framed and informal depending on the communication needs of the project.

26.5 Project scope management:

Processes used to identify all the work required to successfully complete the project.





- **Product Scope:**
This refers to the features and functions that are to be included in a product or service. Successful completion of product scope is measured against the requirements.
- **Project Scope:**
This refers to the work that must be done to deliver the product with specified features and functions. Successful completion of project scope is measured against the plan.

26.5.1 Scope Initiation:

Formal authority that a project exists and recognizing that it should continue its next phase.

- Appointment of project team
- Introduction
- Needs identification
- Market research
- Opportunity studies
- Political input
- Tendering
- Project objectives and constraints
- Characteristics of objectives
- Strategic plan and objectives
- Constraints
- Project cost limit
- Performance measures
- Additional input to project selection and initiation

26.5.1.1 Project Charter:

The project charter is the document that formally recognizes existence of a project. It refers to the business need the project is addressing. It describes the products to be delivered. It gives project manager the authority to apply organizational resources to project activities.

26.5.2 Scope Planning:

It is a written statement that includes:

- Project justification
- Major deliverables
- Project objectives

It refers to the criteria used to determine if the project or phase has been completed successfully.

Scope planning is defining and managing the project scope influences the project's overall success. Each project requires a careful balance of tools, data sources, methodologies, processes and procedures, and other factors to ensure that the effort expended on scoping activities is commensurate with the project's size, complexity, and importance.

26.5.2.1 Scope Management Plan:

The project scope management plan provides guidelines on how project scope will be defined, documented, verified, managed, and controlled by the project management team.

Scope management plan describes:

- How scope changes will be identified and classified.
- How scope changes will be integrated into the project.
- Expected stability of the project.

26.5.3 Scope Definition:

This is where we get down to detail. It provides the detailed information for the Scope Plan, often called the *Scope Definition Document*. It provides the basis for estimating cost, time and resources, performance measurement and responsibilities.

Generally the scope definition document is presented in list format but development of the document requires some brainstorming activities that are best done with the key stakeholders and the project team involved.

26.5.3.1 Developing Preliminary and Detailed Project Scope Statement:

The project scope statement is the definition of the project – what needs to be accomplished.

The *preliminary project scope statement* is developed from the information provided by the initiator or sponsor. The project management team in the scope definition process further refines the *preliminary project scope statement into the project scope statement*. The project scope statement content will vary depending upon the application area and complexity of the project. During subsequent phases of multi-phase projects the Preliminary Project Scope Statement process validates and refines, if required, the project scope defined for that phase.

The preparation of a *detailed project scope statement* is critical to project success and builds upon the major deliverables, assumptions, and constraints that are documented during project initiation in the preliminary project scope statement. During planning, the project scope is defined and described with greater specificity because more information about the project is known.

Stakeholder needs, wants, and expectations are analyzed and converted into requirements. The assumptions and constraints are analyzed for completeness, with additional assumptions and constraints added as necessary. The project team and other stakeholders, who have additional insight into the preliminary project scope statement, can perform and prepare the analyses.

Defining what project scope means is critical. We have all been in the meetings where two or three people leave with different impressions of the discussion. Creating a project scope statement is a key way to ensure everyone is on the same page. The Project Scope Statement defines the project scope and what needs to be accomplished to meet the project's objectives.

- **Value of Sound Scope Statement:**

With a sound scope statement, one can clearly understand the project details, deliverables and its boundaries. Product description helps to explain and understand the details for accomplishing objectives. It is essential to be sensitive to customer's constraints, assumptions, budgetary restrictions as well as definite limitations. Thus, it is necessary to follow project scope to have concrete decision making ability during the project. As a result of this, the team involved begins to identify risks and issues that could cause any delay in the project. Also, any scope deviations must be communicated immediately to all stakeholders including customers.

26.5.3.2 Inputs to Defining Project Scope:

The five inputs to defining project scope are:

1. **Organizational Process Assets:**
Organizational process assets provide information about standards that the company has already set in place—standards that are likely to be applied to every project. This information is re-used when creating the Project Scope Statement.
2. **Project Charter:**
The project charter authorizes the existence of the project. It outlines the project objectives, which project managers need to detail further in the Project Scope Statement.
3. **Preliminary Project Scope Statement:**
The Preliminary Project Scope Statement provides a description of the major project deliverables, project objectives, project assumptions, project constraints, and a statement of work.

4. **Project Scope Management Plan:**
The Project Scope Management Plan provides a description of how the stated project objectives will be developed within the detailed Project Scope Statement.
5. **Approved Change Requests:**
Change request which are agreed-upon and documented amendments to project scope. Approved change requests will ultimately be added to the Project Scope Statement.

26.5.3.3 Outputs to Defining Project Scope:

The project scope statement describes, in detail, the project's deliverables and the work required to create those deliverables. The project scope statement also provides a common understanding of the project scope among all project stakeholders and describes the project's major objectives. It also enables the project team to perform more detailed planning, guides the project team's work during execution, and provides the baseline for evaluating whether requests for changes or additional work are contained within or outside the project's boundaries.

1. Scope Statement:

The degree and level of detail to which the project scope statement defines what work will be performed and what work is excluded can determine how well the project management team can control the overall project scope. Managing the project scope, in turn, can determine how well the project management team can plan, manage, and control the execution of the project.

The detailed project scope statement includes, either directly or by reference to other documents:

- **Project Objectives:** Project objectives include the measurable success criteria of the project. Projects may have a wide variety of business, cost, schedule, technical, and quality objectives. Project objectives can also include cost, schedule, and quality targets.
- **Product Scope Description:**
It describes the characteristics of the product, service, or result that the project was undertaken to create. These characteristics will generally have less detail in early phases and more detail in later phases as the product characteristics are progressively elaborated. While the form and substance of the characteristics will vary, the scope description should always provide sufficient detail to support later project scope planning.
- **Project Requirements:**
It describes the conditions or capabilities that must be met or possessed by the deliverables of the project to satisfy a contract, standard, specification, or other formally imposed documents. Stakeholder analyses of all stakeholder needs,

wants, and expectations are translated into prioritized requirements.

- **Project Boundaries:**
Identifies generally what is included within the project. It states explicitly what is excluded from the project, if a stakeholder might assume that a particular product, service, or result could be a component of the project.
- **Project Deliverables:**
Deliverables include both the outputs that comprise the product or service of the project, as well as ancillary results, such as project management reports and documentation. Depending on the project scope statement, the deliverables may be described at a summary level or in great detail.
- **Product Acceptance Criteria:**
It defines the process and criteria for accepting completed products.
- **Project Constraints:**
Lists and describes the specific project constraints associated with the project scope that limits the team's options. For example, a predefined budget or any imposed dates (schedule milestones) that are issued by the customer or performing organization are included. When a project is performed under contract, contractual provisions will generally be constraints. The constraints listed in the detailed project scope statement are typically more numerous and more detailed than the constraints listed in the project charter.
- **Project Assumptions:**
Lists and describes the specific project assumptions associated with the project scope and the potential impact of those assumptions if they prove to be false. Project teams frequently identify, document, and validate assumptions as part of their planning process. The assumptions listed in the detailed project scope statement are typically more numerous and more detailed than the assumptions listed in the project charter.
- **Initial Project Organization:**
The members of the project team, as well as stakeholders, are identified. The organization of the project is also documented.
- **Initial Defined Risks:**
Identifies the known risks.
- **Schedule Milestones:**
The customer or performing organization can identify milestones and can place imposed dates on those schedule milestones. These dates can be addressed as schedule constraints.
- **Fund Limitation:**