Arba Minch University
Institute of Technology (AMiT)
Faculty of Civil Engineering
Construction Planning and Management
Lecture Notes

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ARBA MINCH, ETHIOPIA

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1 INTRODUCTION

1.1 Construction Industry

The Construction Industry can be categorized into three major sectors; namely, Transport and Communication (Road, Railway, Airway, and Telecommunication related physical works); Water Works and Energy; and Buildings and Other Physical Infrastructures. Accordingly, their capital budget requirements vary extensively depending on the focus the economical trend requires for the nation development.

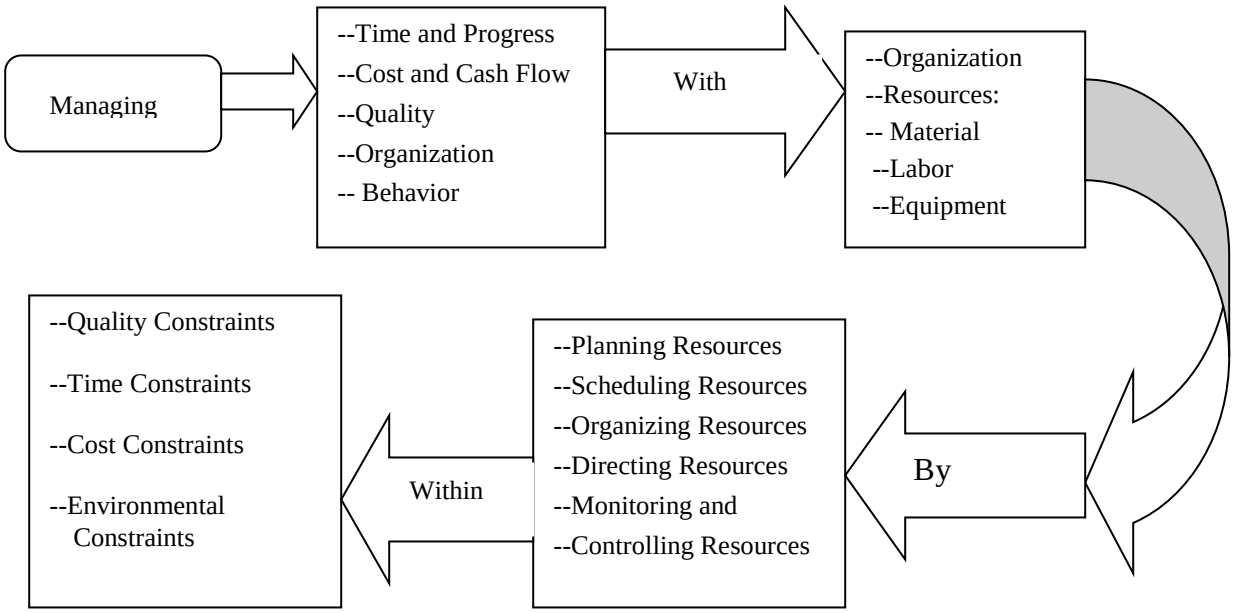
The construction industry is at the same time regarded as both a profession and business. It is a profession that it works for an improved service. It is a composition of multi-disciplinary experts all geared towards specific objectives. The construction industry is at the same time a business that it works for a fair and reasonable profit.

The goals and objectives of the construction industry depend upon the entity. Goals are the ultimate targets having relevance to needs of society, individual or enterprise. Objectives are quantitative and/or qualitative elements that brings about the predetermined goals. The goal of a road project might be to improve accessibility between two junctions while its objectives are building the gravel road, culverts, drainage etc. A client, be it a government body, a public or private agency undertakes development facilities such as housing, roads, power plants with certain motives or long term aims. A corporate body (Engineering consulting firms or Contractors) may aim at making profit and meeting growth needs of organization, diversifying corporate activities, engaging idle resources, staying in business etc to meet the predefined corporate and business level strategies. However as viewed form planners and economists, the construction industry is evaluated based on the benefits and contribution it would offer to the society with respect to the development and growth strategies to be achieved in a national level.

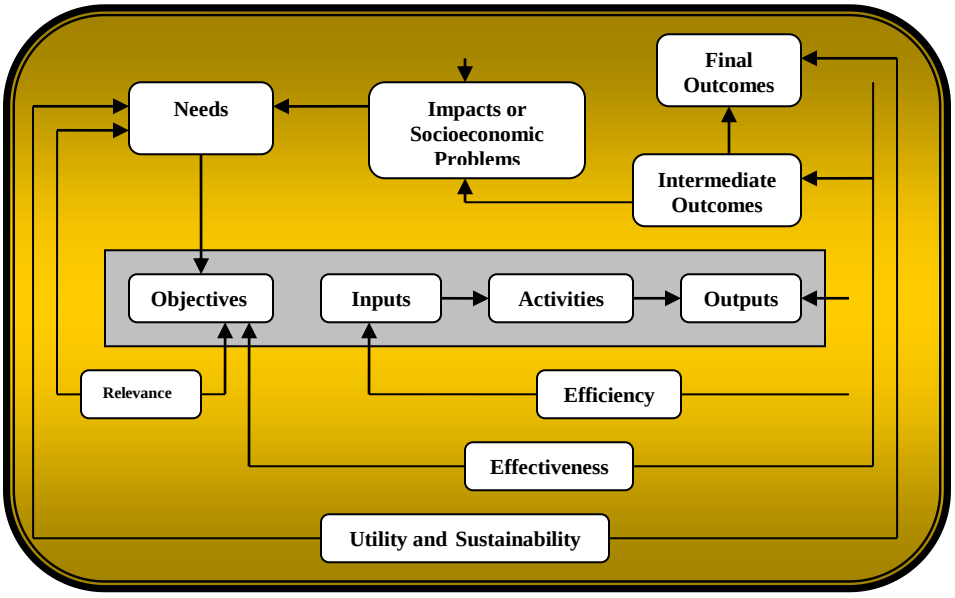
On the other hand, the achievements of these goals and objectives are always constrained with various factors.

- Involves many skills and are largely non-repetitive in nature,
- Scarcity of resources in our world,
    - Land availability
    - Time
    - Finance
    - Material
    - Labor/ Manpower
    - Equipment
- Environmental requirements,
- Access to infrastructure (roads, water, energy),
- Technological know-how and workmanship.

Project management involves effective planning and optimized use of resources as well as careful consideration of the above mentioned constraints headed by project manager so as to successfully accomplish the defined objectives.



Construction Management deals with the coordination and organization of the resources leading to achieve construction missions and objectives by respecting defined sets of constraints. The Construction Management in its mission to fulfill objectives would constitute the following performance indicators, which its success and failure are determined.



1. **Relevance**: Response to needs and priorities
2. **Efficiency**: Delivery in terms of cost, time and quality as per specification
3. **Effectiveness**: Achievement of the common goal
4. **Sustainability**: Continuation of its relevance

1.2 Why Construction Management?

Construction and the ability to build things has transcend from the most ancient human skills of the Primary age to the modern ages of Industrialization and Information. During the whole of Primary age, the construction industry has largely related to talents of human beings on how to construct shelters and small roads and river improvements. Generally speaking, the focus during this age is largely on fulfilling humans' basic needs and major figurative and monumental ones.

As the number of humans' enlarge and their demands become more, a need to fulfill such demands amass and in short period of time pressed human beings to search for alternatives in order to live peacefully for their co-existence. This leads to creating appropriate technology that develop progressively in line with increasing productivity. This brought the development of society into the Industrialization age where mass production for assembly is becoming possible. This brought different approaches to construction methods and their completion times.

This period has mainly created conscious way of technology improvements for first mass production followed by quality enhancement and productivity issues. Subsequently, the concept of competition such that time, quality and cost values were starting to govern. The development of technology and the concepts of competitions opened a considerable role for management functions such as planning, implementing and controlling cycles.

The information age which made most cumbersome mathematical calculations simple and that brought and revealed many more complex factors involved in construction processes enhanced the way how construction activities need to be managed. As a result, Management functions have enlarged and become more important for the construction industry competitiveness and development.

Management is defined as the art of arranging and/or organizing various activities, operating equipment and group of people in a suitable manner to create systematic operation with continuity to achieve a common goal. As construction is also one of the industries which need the proper systematic coordination of activities, materials, labor and operating equipment, therefore managing such industry is necessary.

Management can also be defined as the use of people and other resources to accomplish objectives. That is, management by necessity involves the creation of an environment in which people can use resources to reach stated goal. It also involves the implementation of the function of management:- planning, organizing, implementing and controlling. These functions are the very essence of management.

In our world construction resources are scarce, hard to obtain easily and becoming expensive every day in spite of the fact that their demand is high. It is this reality which obliged us to utilize them efficiently and effectively. In other words, that is the basic reason why construction industry needs to be managed and professionalism in construction management assumes special significance.

Construction Management is necessary to insure:

- proper planning and organization of the works,
- the effective use of resources,
- the completion of works within estimated budget and specified time,
- in time delivery and utilization of materials,
- the necessary quality of the work,
- proper usage of equipment and latest methods of construction and technology,
- evolving a reputation for high quality of workmanship,
- controlling over the contract agreed upon and specification,
- motivating people to work to their best and creating an organization that works as a team,
- in taking sound decisions at the lowest practical management level through delegation of authorities,
- proper communication and reporting of the works executed,
- the provisions of safe and satisfactory working conditions for all workers,
- monitoring of the works to be executed against planning,
- proper sequence of flow of construction, and
- proper coordination of the resources to create an organization that works as wholesome to fulfill the objectives.

1.3 Construction Management to COTM Professionals

Construction Technology and Management is a composition of two key words namely: Technology and Management. While Technology refers to the methods or procedures of techniques used to make the best result, Management is the coordination and administration of many components such as Stakeholders and their relationships; Resources; Processes and their combined performances for getting things done successfully. Construction Project Management is to coordinate and administer all components including the technology and safety and health requirements in order to successfully accomplish projects based on performance criteria that include Relevance, Efficiency, Effectiveness, Utility and Sustainability and Impact.

Construction Technology and Management Professionals are those who could oversee the overall processes of construction projects from their inception to their use and disposal stages. That is; the observance, assessment and fulfillment of the overall relevance, efficiency, effectiveness, utility, sustainability and impact of a construction project to the society at large and to the client and users in particular. All other professionals are experts in the field whose contribution are very vital but

are particulars in the process of the Construction Project Development, Implementation and Operation. Construction Management involves unifying the efforts of various disciplines in the process towards a common goal for which COTM professional are required to develop the necessary competency levels of management. These include knowledge under the following:

- Time Management,
- Cost Management
- Quality Management
- Human Resource Management
- Financial Management
- Development Management
- Procurement & Contract Management

This course is focused with only the principles and fundamental concepts of the body of knowledge with the details and particulars to be dealt in the coming courses of Management.

2 GENERAL MANAGEMENT

2.1 Theory & Development

General Management is a broad area dealing with wider aspects of managing an ongoing organization and temporal activities which covers the following among other topics:

- Property Management
- Production & Distribution Management
- Organization Management
- Resources Management
- Project Management
- Strategic Management
- Stakeholders(Relationships) Management
- Process / Result Management
- Information Management
- Research & Development (Knowledge)
- Performance Management, and
- Network Management

These aspects have developed over centuries conceptually and in the management Practice. In its wider sense, management is required for getting the task done. That is; Management is the process of administering and coordinating resources effectively and efficiently and in an effort to achieve the goals of the organization (Pamela, et al; 1995). Efficiency and Effectiveness of management depends very much on how well the available resources are utilized to accomplish the intended objective.

With advancing technological and changing human behavioral aspects, management is increasingly becoming more complex and requires considerable training, practical experience and updating on the latest information of developments in the field. Like other disciplines, management thoughts have been enriched by many contributors of earlier practitioners in the field. Such contributions are developed to form the **Management Theory and Its Development**. Management theories the world over has both theoretical and applied contributors. These contributions can be classified as follows;

1. Early contributions
2. Industrial era contributions
3. Classical contributions
4. Behavioral contributions
5. Quantitative contributions
6. Contingency Perspectives, and
7. Recent Contributions

Early contributions: Most management thinkers in the 18th century classify management as applicable to only business or industry related discipline. This indicates that the management thought to the construction industry has been considered long ago. But historical evidences show that people were more concerned with the management of organizations such as the state, church, military, tribes, household, etc. These include:

- record keeping in 5000 BC,
- importance of planning, organizing, and controlling in 4000 BC,

- universality of management by 2000 BC,
- specialization in 350 BC,
- staff organization in military campaign in 330 BC,
- traits of a leader and/or a manager in 900 and 1100 AD, etc.

Industrial era contributions: The movement of manufacturing to a factory system during the mid 1700's had significant contributions to management theories. This era is customarily called industrial revolution era. In this era three major contributions can be identified, these are; *Human Resources Management*, *Scientific Management* and *Importance & initiatives for Management Training*.

1. Human Resources Management: **Robert Owen** (1771-1858), A successful factory manager in UK advocated improved management in human resources would result in higher returns of investments than in machinery and equipment. He attempted *to limit the working hours*, *using a silent monitor to encourage productivity*, and *to establish villages of cooperation* – Start and recognition of Workers' Association.
2. Scientific Management: **Charles Babbage** (1792-1871), Who was an early pioneer in areas that we now call as scientific management. He produced the first calculator he called it as the difference machine and a rudimentary computer he called it analytical machine. Besides, Babbage published his views on management and manufacturing processes including the concept of division of labor as a necessary aspect for developed economic systems. He also proposed observational procedures for studying manufacturing operations. Babbage believed that management and employee interests were closely linked to each other.
3. Management Training: **Andrew Ure** and **Charles Duprin** believed in management training that they educate managers of many factories for offsetting factory systems problems.

Classical contributions: The classical contributions towards the management thoughts includes two general features, these are *Administrative theories*, and *Developed Scientific Management concepts*. The two major contributions are best represented by the work of Henri Fayol and Fredric W. Taylor.

Henri Fayol (1841-1925) is known for the first general administrative theory developer of management. The basis of Fayol's theory was much depends on the industrial undertakings consisted of six separate activities or functions;

- technical (production, adaptation)
- commercial (exchange)
- financial (search for & optimal use)
- accounting (stocktaking, balance sheets)
- security (protection - property & persons), and
- managerial (planning, organizing, command, coordination, control)

Fayol concentrated on the management theory and developed the first general theory of management with the identification of fourteen basic principles:

- Division of work or labor,
- Authority and Responsibility,

- Discipline,
- Unity of Command,
- Unity of Direction,
- Subordination of individual interest to the general interest,
- Remuneration,
- Centralization,
- Scalar chain or line of authority,
- Order,
- Equity,
- Stability of tenure of personnel,
- Initiative, and
- Esprit De Corps or Union is Strength.

Frederick W. Taylor (1856 - 1915) is credited for the development of scientific management and outlined four principles:

1. Develop a science for each element of work, replacing the old rule of thumb,
2. Scientifically select and then train, teach and develop the workers,
3. Cooperate with the workers so as to insure all the work to be carried out in accordance with the principles of the science that was developed, and
4. provide equal division of work and responsibility to the management and the workers.

He developed five basic features of scientific management as well. These are;

1. Organizational and technical improvements
2. Provision of planning department
3. Use of experienced foremen
4. Time study to determine the rate at which a job should be done, and
5. An incentive wage system.

Behavioral contributions: The behavioral contributions in management thought essentially base their theory on human behavior which is a complex subject but as the most vital aspect of management. The behaviorist believes that those involved in the organization are the prime determinants of the organizational and managerial effectiveness. The great diversity of the behavioral contributions makes it impossible to discuss all of its contributors. But for the purpose of this part two behaviorist are dealt:

Abraham H. Maslow (1908-1970) theorized that people are driven by several needs, not just one and developed a hierarchy of human needs. These are:

- Physical and physiological needs,
- Safety and security needs,
- Love or social needs,
- Ego or status needs, and
- Self actualization, realizations & fulfillment.

Physical needs are related to food, clothing and shelter. Safety needs include insurance, job security, retirement benefits, etc. Social needs include the need to express themselves to associate with others, etc. Ego needs involve the provision of status in the job. Self actualization can be expressed by a phrase "what a man can be he must be."

Quantitative contributions: The quantitative contributions consists major branches in decision theory and management science. Although the diversity of the branches makes precise definitions difficult, the contributions are generally characterized by attempts to systematize the decision making process

using mathematics, statistics and other quantitative techniques. This use of mathematical models and quantitative techniques to solve managerial problems is often called operational research or management science. The Quantitative approach has four characteristics; Decision – Making focus; Measurable Criteria; Quantitative Model and Use of Computers.

Contingency Theory: Contingency theory often called situational management is an approach to management that emphasizes adjusting managerial actions and styles to the specific circumstances of the situation confronting the organization. Simply the management actions and styles should be dependent upon the circumstances of the situation confronting the manager. Environmental factors such as public opinion, employee and management attitudes might have impact on the decision making process.

Recent Contributions: A wide range of industrial, commercial and governmental organizations has adopted project management to handle their many and various projects. Unfortunately many projects are facing time and cost overruns due to environmental constraints and poor project management systems. This is true in the case of construction industries as well. Besides, the fact that construction projects:

- involve almost all industries and sectors in realizing their infra structural needs
- use wide variety of resources and their scarcity
- exhibit fierce competition nationally and globally
- decrease their profit margins to its lowest bottom

and the human, cultural and ecological aspects makes their management complex, risk undertaking, and working in an uncertain environment.

The Construction industry is the major and direct beneficiary of innovations from the field of General and Project Management. For effective and efficient accomplishment of construction projects and to increase their probability to success, project management concepts are undoubtedly necessary. The Professional Construction Management (PCM) itself is young and still is not widely assimilated into the construction industry. An attempt is made here, therefore, to review the salient features of Project Management concepts with focus on new ones that are relevant to the construction industry and identify how PCM can benefit from them.

A constant challenge faced by today's project management is change. On the one hand change represents growth, opportunity and development, and yet on the other hand change represents threat, disorientation, and upheaval. All management concepts would admit that there is no single prescription or formula possible for successes of projects. However, by applying the various new project management concepts, most, if not all, present problems can be solved.

These problems are further intensified with the size and complexity of construction projects. In such a context, traditional project management principles and tools alone are proving inadequate assistance to achieve and sustain improvements in the management of construction projects.

These facts, therefore, necessitate the creation and application of new project management principles. The present paper considers the following new project management principles: *Total quality management (TQM), Management by projects (MBP), Business process re-engineering (BPR), Value engineering/ management (VE/ VM), and Concurrent engineering (CE).*

Total Quality Management (TQM)

A typical definition for TQM is:

> A cooperative form of doing business that relies on the talents and capabilities of labor and management, using teamwork, to continually improve quality, economy and productivity, to complete satisfaction and delight of the customer. (Sharad and Sulimani, 1994)

This definition embodies three basic ingredients of TQM: ***participative management and teamwork; continuous process improvement; and customer satisfaction and delight*** (Sharad and Taher, 1998). Arditi and Gunaydin also identified the factors that affect quality in each phase of the construction process as accepted elements of the TQM. TQM concepts first developed for the manufacturing industries in Japan and wide spread all over the world mainly due to its application resulted in increased productivity, decreased product cost, and improved product reliability. In the construction industry quality is defined as meeting the requirements of the designers, constructors, regulatory agencies and the owner. Quality can be characterized by meeting the requirements of:

- the *owner,* including functional adequacy, completion on time and with in budget, and life cycle costs including operation and maintenance
- the *design professionals,* including provision of well defined scope of work, budget to assemble and use a qualified, trained and experienced staff, budget to obtain adequate field information prior to design, provisions for timely decisions by owner and design professionals, and contract to perform necessary work at a fair fee with adequate time allowances
- the *constructors,* including provision of contract plans, specification, and other documents prepared in sufficient detail to permit the constructor and prepare priced proposal, timely decisions by the owner and design professional on authorization and processing of change orders, fair and timely interpretation of contract requirements from field design and inspection staff, and contract for performance of work on a reasonable schedule which permits a reasonable profit, and
- the *regulatory agencies*, including public safety and health, environmental considerations, protection of public property, and conformance to applicable laws, regulations, codes and policies. (Arditi & Gunaydin, 1997)

These concepts are also applicable and very vital to the construction industry. This is because, attainment of acceptable levels of quality in the construction industry has long been a problem and considerable expenditures of time, money and resources, both human and material, are wasted each year because of inefficient or non-existent quality management procedures. Both approaches (Sharad & Sulimani and Arditi & Gunaydin) agree and are similar in principle. And therefore, it is

argued and believed that TQM application to the construction industry are necessary and useful to tackle most, if not all, quality problems.

Management by Projects (MBP)

Management by projects is a way, an outlook, and an attitude cultivated to treat any trade of work, undertaking, scheme, assignment or a set of activities, as a project. What is immediately implied or called for by accepting a trade of work as a project is: *identified scope; required completion time; estimate of cost and other resources inclusive of manpower; economic quality performance; and review of the work done with follow-up of some kind* (Taher & Sharad, 1998).

MBP provided the basis to carry out a business like a project, with a systematized process of planning, executing and controlling. A project is unique in its character and has a definite beginning and end together with a completed product of an acceptable quality and economy. This is what essentially distinguishes Management by projects from general or corporate management. Professional Construction Management (PCM) is essentially the management of construction projects, which is analogous, if not synonymous, with MBP as applied to the construction industry. Planning and scheduling, cost estimating-budgeting-monitoring-forecasting, contract administration, quality control/assurance, progress measurement and reporting, and human aspects like teamwork are all as relevant to PCM as they are regular features of MBP methodology. MBP, therefore; provides the essential project orientation for managing construction, and advocates employing the project management tools and techniques.

Business Process Re-engineering (BPR)

BPR is defined as:

> An organizational improvement methodology that focuses on redesigning organizational processes 'from the ground up', using information technology to integrate work, increase consistency, and dramatically shorten process cycle times. (Mattinsly, 1994).

BPR advocates 'radical improvement', rather than 'continuous improvement', of processes for better ultimate performance. Key features of BPR includes *rapid thinking, creating new scenario, simplify processes, information technology to reintegrate works, fewer skilled employees, and flatter organization.* BPR is often criticized for its radical approach, it pays great dividends when successful, what matter is when and under what conditions it is necessary.

Obviously, It involves risks, such as: investments in complex information system; potential damage to organizational culture, and reduced motivation of the few remaining employees. However, it provides several benefit including simpler and shorter processes, fewer but highly skilled employees, flatter and more efficient organization, and lower structural costs.

Value Engineering / Management (VE / VM)

Value Engineering is a systematic study of project requirements using a multi-disciplined team to identify and eliminate unnecessary costs and poor performance by using functions (Sievert, 1991).

Analysis of functicons is the foundation of value engineering using a project team approach. Value engineering provides an effective environment for the project team to cooperate, communicate, resist premature decision-making that can result in unnecessary costs, and an organized and expedient system for extracting information from owners and users to make effective project decisions.

Accordingly, Sievert developed a job plan approach to the project team for effective application of VE consisting of five phases: *Information, Creativity, Evaluation, Development and presentation, and Implementation*. And he suggested that VE can be applied during any phase of the project cycle. But he strongly emphasized that the greatest return on the value engineering investment can be expected when the value study is initiated during the planning and programming phase of a project, where the ability to influence costs is greatest. As a result, I agree with Sievert that, it is to the advantage of all parts in the construction industry, if project plans are starting with the right information after VE study is completed. This can be exemplified by the following illustration.

Oftentimes owners commit substantial funds and resources to a construction project prior to defining the specific need for the project, program requirements and cost management procedures. It is a risky business and the result could be cost and time overruns, quality control problems, changes, disputes or an end product that does not function as intended. Construction projects integrate the principles of multi-dimensional professions: business administration, engineering know-how, communication skills, and behavioral sciences.

It is of no value therefore, if the project result does not meet the customers' requirements regardless of its price. Besides, as change and modification are facts of management, plans must be made not only to provide us with the management of change, but also with the insurance that this constant change is used to our advantage (Mudge, 1989 in Sievert's article). This major advantage to us is the removal of unwanted and unnecessary factors from our business environment. Value engineering facilitates planning for a positive course of action to remove these factors, and bring in better results at total lower costs.

Concurrent Engineering (CE)

Concurrent engineering is defined as:

> A systematic approach to the integrated, concurrent design and their related processes, including manufacturing and support. This approach is intended to cause developers from the outset, to consider all elements of the product life-cycle from conception through disposal including quality, cost, schedule, and user requirements. (Winner, 1988)

CE bases its concepts on the development of Partnership, Design-and-Construct, Build-Own-Operate-Transfer (BOOT), Design-Build-Finance-Operate (DBFO) and Management Contracting and Construction Management methods of Procurement. In achieving customer requirements and project objectives and effectiveness,). Gabriel, 1997 has a similar approach to CE project management method that he called a lean project management. The lean management enables

client interests to be represented without communication delays. CE is conceptually an effort to effectively integrate all aspects of product development, by performing simultaneously a variety of activities that used to be done sequentially.

The construction process has been heavily criticized for its fragmented approach towards the delivery of construction projects. This has affected project effectiveness in as much as traditional practices do not effectively encourage the integration, coordination and communication between participants. This inhibits the scope for creativity and innovation throughout the project cycle. CE has great potential in overcoming these problems and may significantly improve the way in which construction projects are realized, specifically in eliminating the procurement gap existed between design and construction. This gap contributed to major behavioral, cultural and organizational differences between project individuals and groups, and perhaps most of all, the communication process. Therefore, CE is expected to satisfy the need for procurement strategy that can effectively coordinate and integrate individuals and groups for construction projects leading to inter-organizational communication and team building to thrive and become a normal practice.

2.2 Management Functions

The purpose of managing is to achieve the most utilization of human, material and monetary resources by the establishment of decision making and communication processes designed to accomplish specific objectives. The establishment of an effective operating organization is one of the principal functions of management. The main tasks of Management are outlined below:

2.2.1 Planning: Conducted by performing *Project Analysis Review* and *Site Organization*.
Planning involves deciding in advance what is to be done, how and in what order it is to be done in order to achieve the objectives. Planning aims at deciding upon the future course of action. A plan shows the committed course of action. Schedule depicts when the planned activities are to be carried, it puts the plan on calendar date scale. In brief planning and scheduling involves the following:

- Crystallizing objectives,
- Collecting and synthesizing information and data of the project,
- Developing the alternative courses of action within specified constraints,
- Comparing alternatives in terms of objectives feasibility and consequences,
- Selecting and scheduling the optimum course of action,
- Establishing policies, procedures, methods, programs, systems, standards and budgets for accomplishing project objectives.
- Look for potential problems and issues and recommend solutions to management for resolution.

2.2.2 Organizing: is the process of establishing a structural relationship among functions of people so as to formulate effective machinery for streamlining the achievement of assigned objectives. 'Authority', 'responsibility' and 'duty' are terms useful to the discussion of organization principle.

Authority may be defined as the ability to act or to make a decision without the necessity of obtaining approval from a superior, however may be delegated to others.

Responsibility implies accountability for an assigned function or duty. Although responsibility may be assigned to sub-ordinates, this in no way serves to relieve the supervisor of his prime accountability.

A duty is a specifically assigned task that cannot be relegated to another.

The mere act of making a formalized analysis of the necessary tasks, how they relate to the company as a whole, and who is responsible for each task creates a clear understanding of who, what, when and how. An organizational plan removes confusion, Indecision, buck-passing, duplicated efforts and neglected duties. The following steps should be followed in the development of an effective organization plan:

- The individual positions of authority and responsibility must be identified and the duties of each participant be defined,
- Arrange positions into an integrated functional structure showing lines of supervision,
- Allocate logistic and resources,
- Establish structural relationship to secure coordination.

Organizational charts:

Organizational charts represent the company's organizational structure in pictorial form, showing every position of responsibility and all lines of supervision and authority. The organization chart is a particularly efficient way in which to clearly establish in mind of;

- each individual involved his position within the overall company,
- the identities of his supervisors and those whom his supervises,
- the exact nature of his duties,
- clearly indicate who is responsible for what.

There is no single best structure, and the one selected for any organization will have its own se of benefits and challenges. Interestingly many large, well-known companies change structures frequently as their environments change.

Centralized and decentralized structure:

The number of employees reporting to each manager represents manager's **span of control.** Centralized structures are characterized by:

- tall organizations with a narrow span of control,
- managers exercise relatively high degree of control over their subordinates,
- authority tends to be relatively centralized,
- foster more effective coordination and communication,

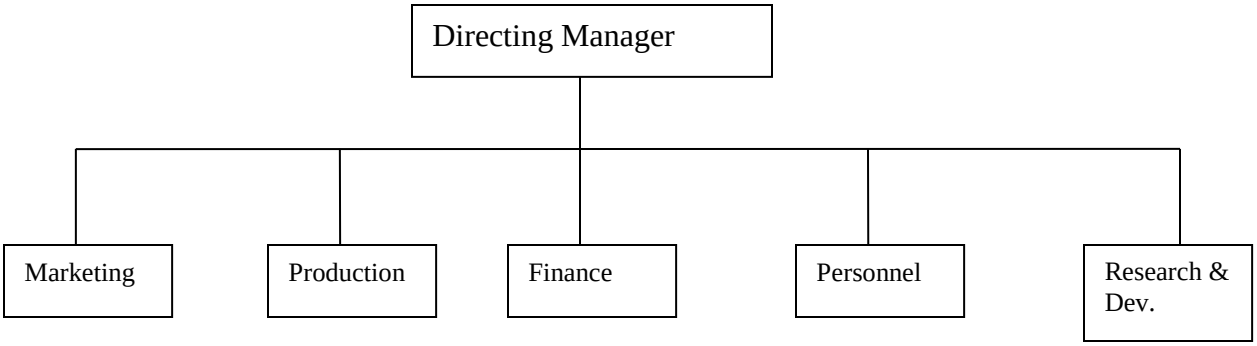
- Planning and its execution are relatively easy,
- Suited for environments that are relatively stable and predictable.

Decentralized structures are characterized by:

- Flat organization with few levels in its hierarchies and a wide span of control from top to bottom,
- Administrative costs tend to be less,
- Gives managers at various levels more authority, and increase satisfaction and motivation,
- Best suited to more dynamic environments.

Functional Structure:

A form of organizational structure whereby each subunit of the organization engages in firm wide activities related to a particular function such as marketing, human resources, finance or production.



Advantages: due to group specialists,

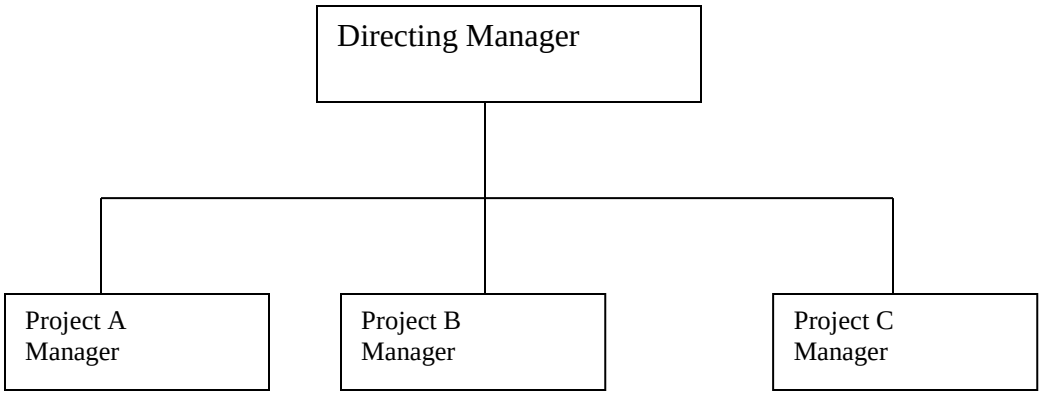
- Foster economies of scale
- Address cost and quality very well

Disadvantages:

- Conflict and disputes among the departments when firm performance declines.
- Communication and coordination among the departments are often difficult

Product Line/Division Structure or Geographical divisional Structure

It divides the organization activities into self contained entities, each responsible for marketing, production, finance, personnel etc.



Each product line director is solely responsible for the development and support of all products within its domain.

Advantages:

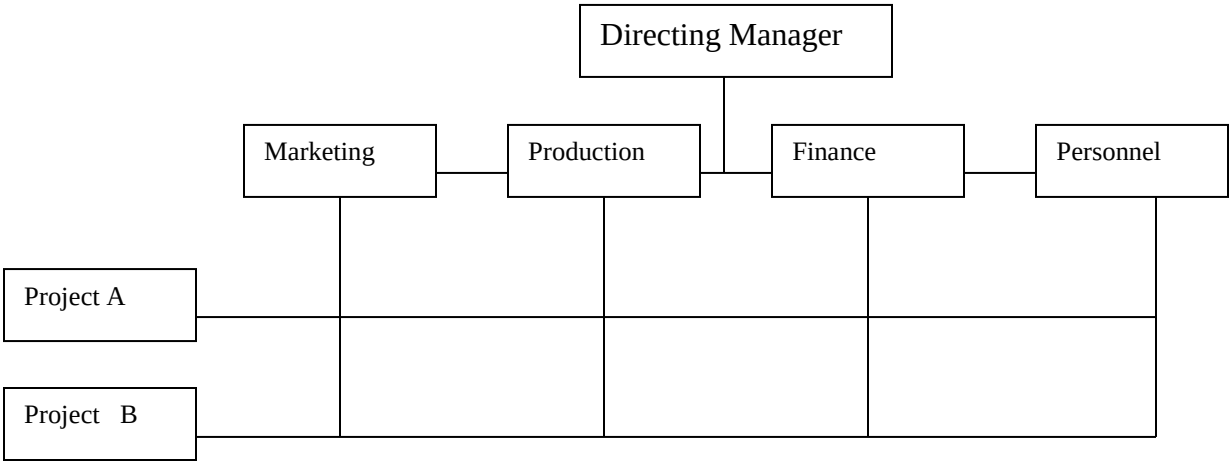
- A well defined organizational units headed by a manger accountable for its revenue and expenditures,
- Pinpointing the responsibilities for profits and loss is easier.

Disadvantages:

- The coordination of activities at headquarters is more difficult,
- Product managers tend to compete for common resources instead of working together for the best interest of the company,
- The total personnel expense for manufacturing is likely higher due to the higher number of departments working similar activities.

Matrix Organizational Structures

It is a form of organizational structure that combines the functional and product/geographical divisional structures. Demands for quality and price may pull an organization toward the functional end, whereas demands for service and speed may pull an organization toward the divisional end. To address those demands, top managers may settle to position the organization to achieve both characters.



2.2.3 Staffing /Procuring

It implies managing and keeping manned (persons must be assigned to each of the positions created in the organization structure) and providing them the right quality resources at the right time. These resources include people, materials, machinery and cash. The connected project management tasks include the following:

- Preparing resource procurement schedules,
- Developing specifications for required resources,
- Deciding appropriate sources of procurement,
- Budgeting resources and arranging approvals and purchases,
- Preventing wastage during resource handling at site
- Supplying on time required quality and quantity of resources to project construction.

2.2.4 Directing/ Communicating

The proper functioning of the business depends upon an intra-organization exchange of information on many kinds. Directing implies the following tasks:

- Providing effective leadership,
- Motivating participants behavior,
- Communicating instructions and orders such as
    - the superintendents must be kept advised of contract changes such as drawing revisions and change orders,
    - subcontractors must be consulted about project planning and be informed of their part in the construction schedule,
    - procurement people must keep the yard and the projects aware of the delivery status of materials,

- information about job accidents must be conveyed from the projects to company management, etc.

2.2.5 Controlling

It involves monitoring of the performance and applying corrective measures incase of deviations from plan. The process of control includes:

- evolving systems for generating performance data:
  - Time control
  - Cost control
  - Quality control
- Monitoring data received and formulating corrective options,
- Applying corrective measures to meet the schedule,
- Re-planning whenever necessary.

2.3 Managerial Roles

According to widely known references, Henry Mintzberg brought forward three primarily managerial roles: Interpersonal, Informational and Decision Making Roles (Table …).

Interpersonal Roles	These roles are related to formal authority base of managers.
Figurehead	Roles related to ceremonial in nature.
Leadership	Roles related to ensuring achievement of goals.
Liaison	Roles related to communication with internal and external stakeholders to develop favorable relationships and networks.
Informational Roles	These roles are related to availing sufficient information to carryout jobs effectively. Because they are information centers for information and communication source.
Monitor	Roles related to scanning internal and external environments of their organizations for selecting useful information.
Disseminator	Roles related to sharing and distributing useful information to employees.
Spokesperson	Roles related to information communications to external stakeholders.
Decision Roles	These roles are related to processing information to reach conclusions.
Entrepreneur	Roles related to initiating new developments.
Disturbance Handler	Roles related to conflict resolution and problem solving.
Resources Allocator	Roles related to distribution and assignment of different resources to projects.
Negotiator	Roles related to win comparative & competitive advantages to achieve goals.

Besides, recent trends enlarged managerial roles due to changed environments such as:

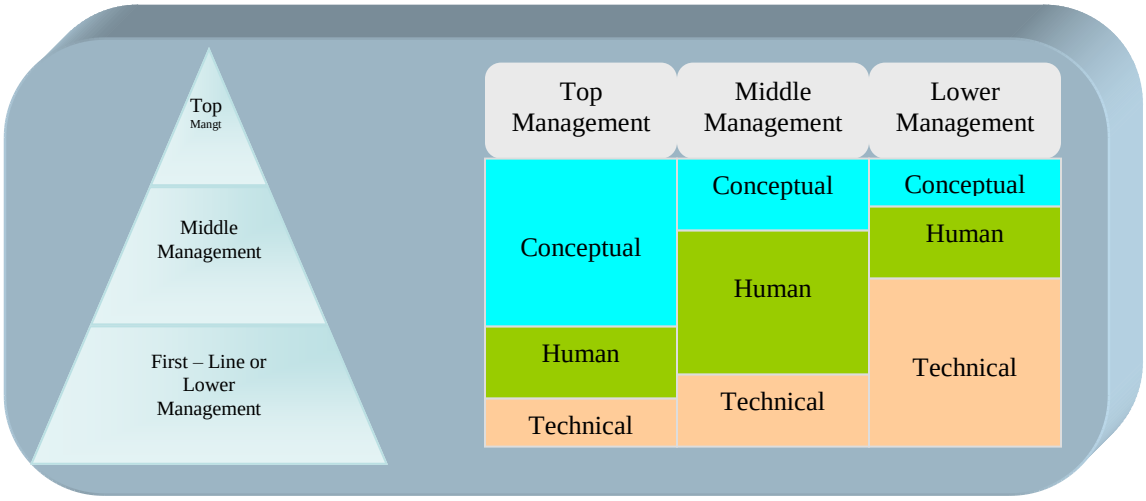
- ✓ Globalization of markets
- ✓ Increasing predominance of Entrepreneurial Firms
- ✓ Growth in Service - based organizations
- ✓ Increasing Diversity
- ✓ New organizational Model, and
- ✓ Increasing customer focus.

This has brought new competencies in the managerial roles. These are *Effective Communicator; Team Player; Technology Master for information age; Problem Solver; Diplomat and politically astute; Change Maker and Promoter of Empowerment and Delegatory roles.*

2.4 Management Level & Scope

Managers could be classified into different categories depending upon the scopes and levels of management they are involved in. Depending on the nature and scope of the job managers are performing, they can be classified under either functional or general managers. While functional managers are responsible for a work group segmented according to functions; general managers involve in managing several different functions or departments which are responsible for different tasks. While Functional managers greatest challenge is lack of communication skill; that of General Managers is technical skills.

Managers exist at various levels in the organizational hierarchy but are dependent on their sizes and forms. That is, while small organizations may have only one, big ones several layers. Generally speaking, a relatively large organization possesses three levels of managers: Top, Middle and First – line or Lower managers and could resemble pyramidal shape (Figure …). These levels of managers do perform certain job or level – specific skills which are more important to their respective levels.



From the figure above, Technical skills are more important to lower management levels; Human skills are more important to middle management levels and Conceptual skills are more important to top management levels.

3 CONSTRUCTION PROJECT MANAGEMENT

3.1 Background

Construction Project Management starts when an idea is first synthesized in the mind of the promoter to meet the needs of a society, customers and markets. Historians agree that humankind has been involved in projects of varied scale as early as the recorded history; in an attempt for fetching better living condition. As long as humankind does things, there will be projects and hence management.

It is worthwhile to bear in mind the managerial competence, the skill and technology employed by the ancient Egyptians who are well known by their world large stone buildings made during the third millennium B.C. Despite the lack of sophisticated machinery, they were able to raise and fit some 2.3 million stone blocks, weighing 2 to 70 tons/piece, into a structure the height of a modern 40-storey building. Equally important to mention is the later Aksumite Kingdom that took place during the third to seventh centuries A.D. The technology employed for quarrying, heavy transport over a distance of 4 km, stela-erection of some 33m long and 520 tones in weight, and the building techniques still remain a world mystery. But just as mind-boggling was the managerial ability of the time: the planning, organizing and controlling that were exercised through out the construction; in the accounts that require involvement of large number of workers for quarrying, transport and erection as well as the utilization of enormous quantities of materials.

Despite the above facts, in many ways project management today represents a significant departure from the traditional management theory and practice. Three salient characteristics distinguish modern society from earlier periods of history: interdependency, complexity, rapid and radical change. The challenges and problems of modern society involve risk and uncertainty arising from numerous interacting environmental forces and variables possessing internal and external grounds. Although managers could attempt to control risks and uncertainties emanating from the internal origins, factors such as the rapidly changing technology, the rising and volatile prices, increasing competition among rivalry units, frequent resource shortage, and involvement of numerous stakeholders and their conflicting views occupy a differing and challenging facet. Construction Management in the modern society seeks to unify the planned and work efforts of numerous individuals and organizational units working in a project towards a common goal; as imposed by frequent change, technological complexity, increasing competition, greater risks and uncertainties.

3.2 Construction Projects

The term construction project refers to a high value, time bound, special construction mission with predetermined performance objectives. The project mission is accomplished within complex project environments, by putting together human and non-human resources into a temporary organization. Project:

- Seeks to accomplish specific objectives,
- Produces deliverables and end items,
- Has definite beginning and end,
- Unique in character and do not lend themselves in standardization. Projects differ from each other in one or more influencing factors such as client and contractors, quality specifications, resources employed, responsibilities delegated and the project environments.

- Employ huge resources as material, labor, equipment, cash and time, high level of technology and need effective management of resources.

The six Parameters that can sufficiently define a construction project:

Size: denotes the number of tasks to be executed in a project and each task is measured in terms of quantities of work involved.

Complexity: a measure of variety in the nature of tasks to be executed. Complexity increases with the number of dissimilar tasks increasing.

Quality: to be achieved in accomplishing tasks is stated in terms of standard specifications.

Productivity: Measures the ratio of planned effort to produce a unit quantity of work divided by the actual effort employed to achieve this unit of work.

Completion time: depends upon the speed which the project is to be executed,

Cost: The expenditure which the client has agreed to commit for creating the desired construction facility.

3.3 Project Process Cycle

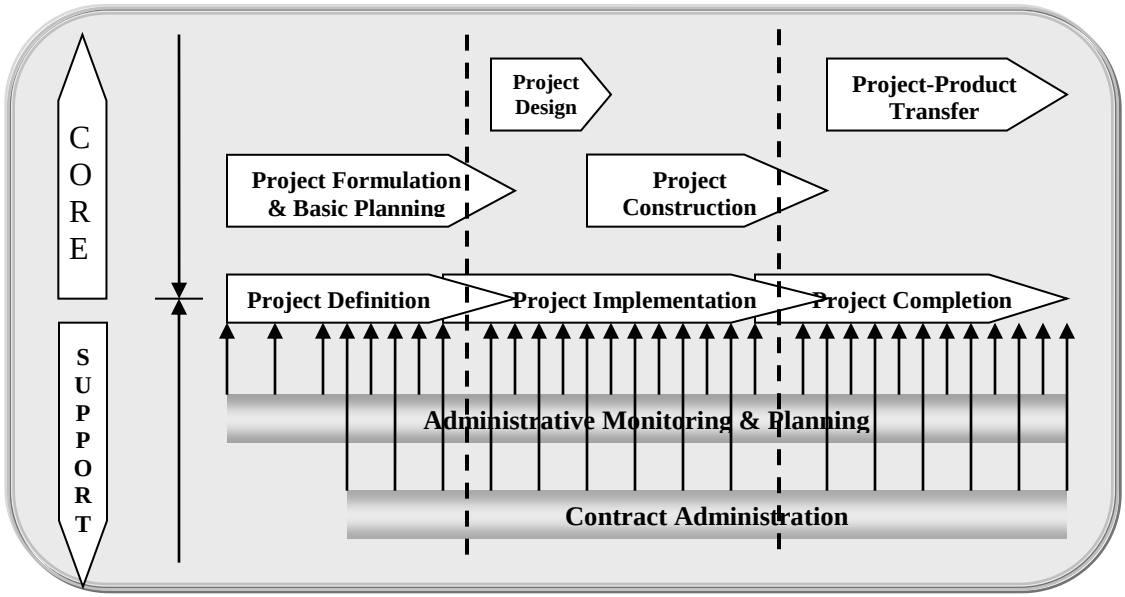
Although construction projects differ in many ways, the life span of a project follows a similar pattern. After conception, there is a gradual build-up in the use of resources, followed by a long duration plateau and towards the end; there is a rapid run-down till completion. Projects (including construction projects) are carried out using identified project phases. Project phases are understood as the processes at which projects are formulated, implemented and completed. These processes are well understood in many literatures as *The Project Life Cycle*. Some literatures presented project life cycle into three, four to five phases with nearly similar functions under their classification. There are some however, which detailed the same phases into more sub phases such that their respective functions could be explicitly explained.

Items	Project Management Processes	Authors
1	Identify a need, Develop a proposed Solution, Perform the Project, and Terminate the project	Gido & Clements, 1999 [7]
2	Initiating, Planning, Executing, Controlling, and Closing	PMIBoK, 2000 [5]
3	Feasibility or Conceptual, Definition, Execution and Close out	Laufer, 1995 [8]
4	Conceptualization, Planning, Execution and Termination	Meredith & Mantel, 2000 [4]
5	Early or Front - End Assessment, Implementation	Knut Samset, 2001 [6]
6	Concept (Conceive), Planning (Design, Plan and Allocate), Execute, Termination (Deliver, Review and Support).	Chapman & Ward, 1997: Eight stages [9]
7	Planning, Appraisal and Design; Selection, Approval & Activation; Operation, Control and Hand over; and Evaluation and Refinement.	Goodman, 1984: 11 stages [10]

However, the life cycle of a typical construction project can be broadly divided into the following stages and processes as shown in the figure below. It clearly shows the relationship between the three main project processes and the four phases of the project cycle.

Core Processes	Concept Definition	Concept Development	Design of buildings, Roads, etc & Physical construction works	Maintenance Period and Defect Remedies
Administra-tive Processes	Concept Evaluation Project Approval Budget Allocation		Monitoring, Procurement and Other Processes	Acceptance, Hand Over and
Public Regulatory Processes	Right-of-way (if necessary) and Regulatory Permits		Tender award and Changes and Variation	Final Approval, and User Permit

Wubishet, 2004 in his dissertation came-up with three major project Management phases called *Project Definition, Project Implementation* and *Project Completion* Processes as shown under the following figure. And the vertical axis shows the two rows of the matrix built upon two major tasks: *Core Activities* and *Facilitating or Supporting Tasks*. He called them Main Processes and Regulatory Processes.



(Source: Wubishet, 2004)

i) Project Definition /Development

The major construction projects are undertaken to meet the particular needs of a client. The first step in the development of a project is to analyze the needs of the client. This requires a critical examination of the needs through feasibility studies. The feasibility study evaluates project potential by examining technical feasibility, economic viability and financial implications.

The feasibility report of an industrial project may include the following:

- Proposed product features,
- Demand Survey. It includes prospective customers, consumption pattern, existing market, government policy, demand forecast and sale potential.
- Technical studies. These cover production process selection, construction methodology, location study, power and local resources availability, means of transportation, scope of work, construction cost estimates, preliminary time plan, resource forecast, outline project organization, statement of project time and cost objectives.
- Financial implications. It contains sales forecast, project budget, capital costs, profitability trend, payback period, net present worth, cash flow forecast and sources of financing.
- Economic viability. It highlights social implications.

The feasibility report is followed with investment appraisal. The purpose of appraisal is to conduct an objective assessment for investment decision. It involves critical examination of the techno-economic analysis of feasibility findings with particular analysis to:

- Demand analysis
- Technical specifications feasibility,
- Environmental implications,
- Financial analysis,
- Economic analysis.

The process of formulation needs, collection of information, critical examination of concepts and re-examination of needs, may have to be repeated several times over before a project inception finally takes shape. Finally the feasibility studies and its appraisal lead to the definition of the following aspects relating to the project:

- Broad scope of work involved,
- Project objectives,
- Outline execution methodology,
- Preliminary time plan,
- Resource forecasts,
- Cash flow pattern and sources of funding,
- Outline organization
- Potential risks and problem areas.

ii) Project Implementation Design/Preparation Stage/Construction/:

In this stage, the tasks to be accomplished include but are not limited to the following:

- Conduct detailed site reconnaissance including geo-technical investigation and topographic survey,
- Compiling detailed design and drawings, specifications and bill of quantities so as to complete all the documents necessary for contracting works,
- Evolve the pre-tender construction plan for each tender package,
- Scrutinize the tender packages, including drawings and specifications,
- Conduct the pre-tender briefing to contractors to ensure that the bidders understand the tender documents and the work involved,
- Evaluate project costs and compile project budget including preliminary allocations for the various heads of expenditures.
- Mobilization and site layout activities,
- Construction execution by availing all the necessary resources with specified time frame, quality and budgetary limitation.

iii) Project Completion

- Interior set-up and furniture layout
- Connection of utilities
- Closing Final Account
- Exit Procedure

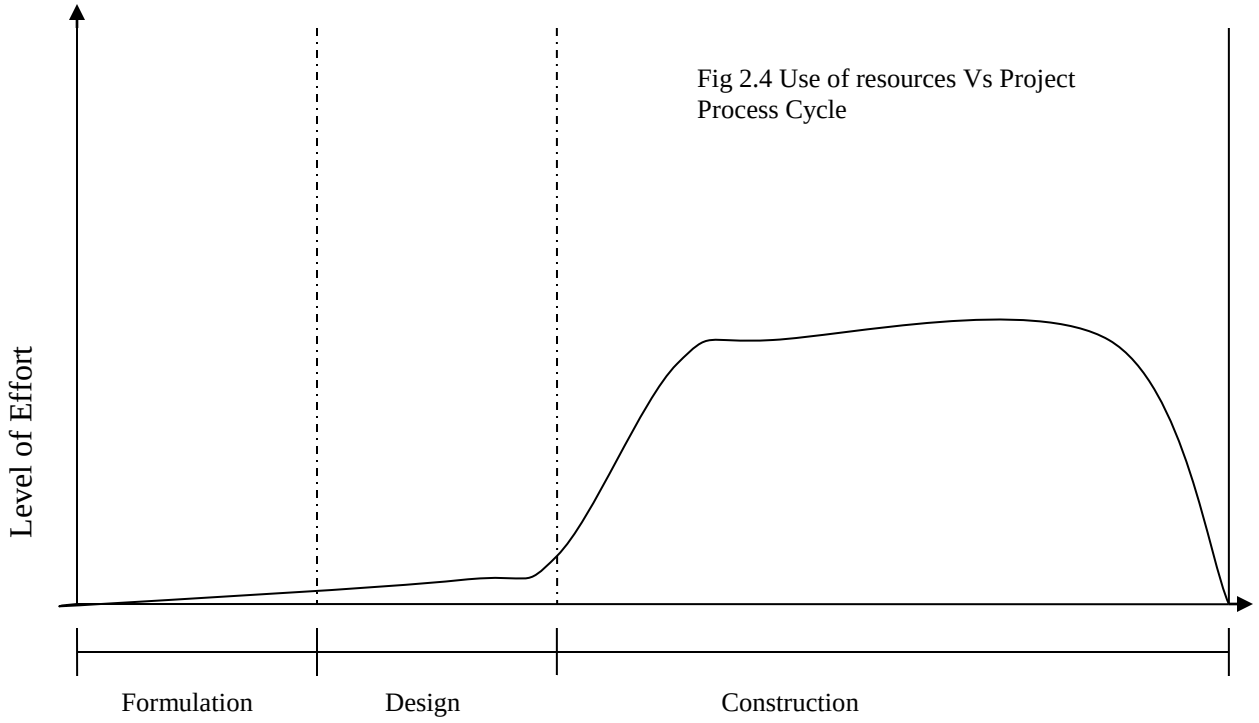
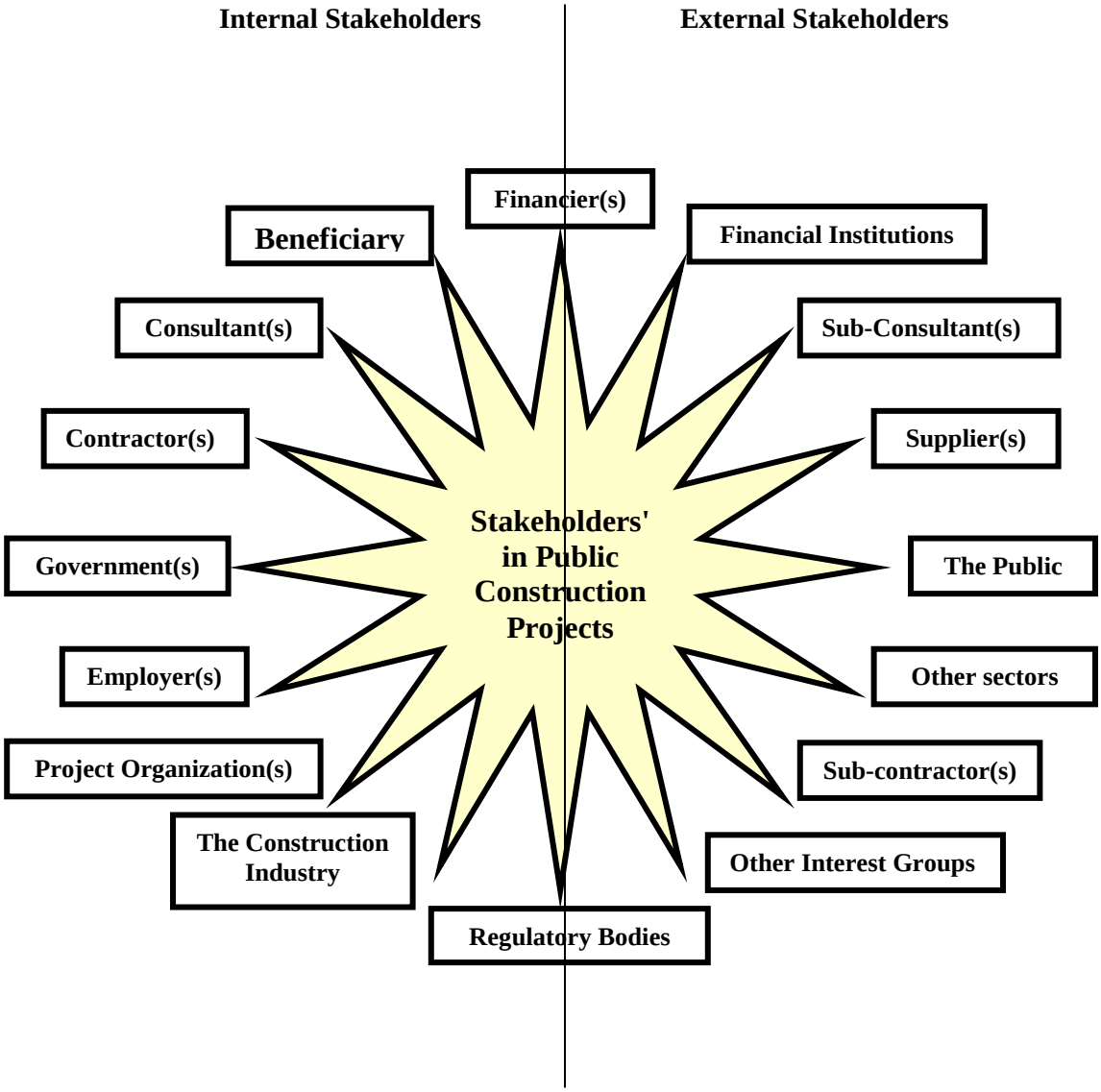


Fig 2.4 Use of resources Vs Project Process Cycle

3.4 Stakeholders Management

Stakeholders can be defined as either individuals or units or the organization itself for which they claim a stake in the project such that they get benefit from or affected by the whole processes of the project and its deliverables. They can generally be classified under Internal and External stakeholders.

	Project Owners	**Project Providers**	**Project Regulators**	**Other Interest Groups**
Budgetary Stakeholders	Client / Employer	----	Financiers / Sponsors	Legislative bodies
Contractual Stakeholders	Client / Employer	Consultant / Contractor	----	Financial Institutions
Regulatory Stakeholders	Client (Partial)	Consultant (Partial)	Public works bodies	General Audit
Collateral Stakeholders	Beneficiaries / Users	Suppliers / Sub-con	Public	Associations/Institutions



Stakeholders	Roles
Beneficiaries / Users	Demand Emergence; Users
Client / Employer	Demand Recognition; Project Scope Definition; Project Financing; Administration (Limited); Organization and Risk allocations
Consultants	Market Promotion and Study; Demand Articulation; Project Reformulations; Design Implementation and Contract Administration
Constructors	Market Promotion and Study; Project Construction Works Implementation and Contract Administration
Suppliers / Sub contractors	Same as Consultants and Constructors but for Outsourced activities and Input resources sources
Financiers / Sponsors	Demand Articulations; Project Scope Redefinitions; Project Financing and Monitoring

Public works bodies	Regulatory services for overall implementation of Policies, Standards, Codes, etc
Legislative Bodies	Demand Articulation and Resources Allocation
General Audit	Regulatory services for legislative bodies
Associations / Institutions	Ensuring their interest and ethical implementations of Professions and Human resources development

Stakeholders Relationships & Management

Stakeholders' relationships management is meant that attitudes, objectives and self serving interests of individuals, groups or organizations who have stakes in the project are reflected in their relationships to affect the success of the project. As a result, projects need to manage such relationships in order to ensure their successful completions. The following seps are useful for successful Project stakeholder management:

- Stakeholders' Identification
- Stakeholders' Information gathering on recurrent attitudes, strategy (Vision, Mission, Objectives, etc) and self-serving interests
- Stakeholders' SWOT Analysis
- Stakeholders' predicted / expected Behavior, and
- Stakeholders' Relationships Management Strategy.

Recent important skills required for project stakeholders' management are Communication, Negotiation, Alliance, Socializations, Organization Culture and value building skills.

3.5 Resource Management

For any construction Industry to be efficiently operating and be successful the elements or the resources should be well known, planned and made available. For most of the construction projects, the resources to look into are the following;

1. Human Resources / Labor or Workmen
2. Financial Resources / Fund
3. Information Resources
4. Physical Resources such as Materials, Equipment and Other Assets
5. Services and Management.

Human Resources / WORKMEN / Labor

All works involved, including the operation of equipment can not be executed without human labor. Labor in the form of technical and managerial personnel and work forces in various trades and professions are essential to carryout projects efficiently and effectively. All other resources are coordinated and generally the work itself is executed by labor. Therefore careful planning, organizing and monitoring of workmen are mandatory.

These resources are very much necessary and for the successful accomplishment of a project, the availability of workmen from the top management including project manger to the daily laborer staff level is very vital.

These include professional, skilled, semi skilled and unskilled laborers. Human resources can be understood in two values: Capacity and Capability. While the first refers to the quantity of labor for the scope defined; the second covers knowledge, technology know-how and skill as per the demands of the scopes ability.

Human resources need to be attracted, selected, developed, motivated and retained if an organization needs to successfully accomplish project objectives. They do need also be capable of:

- Communication – Inter - personal, group interaction - skills
- Problem solving / Conflict resolution / Negotiation Skills
- Facilitating / Decision – making Skills
- Writing skills for Proposals / Reports / ToRs / MoUs; and
- Hard Skills – Planning, Implementing, Leading and Monitoring tools.

Financial Resources / FUND

It is obvious that one of the basic resources in the construction industry is Fund, which should be arranged before starting any project. The project to be conceived shall be with in the fund available for it. Usually funds are available from among Governmental institution, Private institutions and Donors in the form of loan or assistance.

In the case of Governmental entities, since budgetary resources are scarce it is advisable and in almost all cases that a priority shall be given to projects which are very useful and necessary to the society. However, in the case of private organizations it is the business what mater.

The objective and goal of the project is achieved successfully if and only if the fund is sufficiently flowing to carryout the project as planned. That is, it is the regular supply of fund that keeps projects moving progressively. It is necessary to ensure financial planning for smooth cash inflow and outflow to avoid delays in project activities. Financial resources shall be planned and managed with special care due to the fact that all other resources very much depend on the availability of funds.

Information Resources

Information can be understood in two terms: data whether processed or not; and its technology. Both are vital for the successful implementation of projects. Contextual information, data useful for estimating duration and costs; etc are some of informational resources used in projects.

Information technology both the hard and soft wares have brought the processing and management of such information becomes important and helpful in facilitating the comparison of several alternatives. This helps in optimization or maximization of uses of project resources. As a result, informational resources need to be managed. PMIS, MProject, Thinktool, etc are some of the soft wares developed in managing information resources.

Physical Resources

- MATERIALS: The very large portion of a project cost is gone to material cost. As the material cost component of the construction industry covers between 55-70% of the total construction cost, proper consideration shall be given in the planning stage to design with easily available material with out compromising the quality for the intended purpose and for proper flow and storage of materials. Care shall be provided for materials easily spoiled by climatic and expiry conditions. This undoubtedly will affect the project if not properly managed.
- EQUIPMENT: These days various plants, equipment, tools etc., are used very often in construction activities. Provision of equipment replace the hard work that can be made by human labor taking much time with in reasonable period of time. Therefore it increases efficiency and economy. Its initial cost though high, it works for long period of time under adverse conditions with less manpower than working in its absence which will result to be economical for long term investment. Depending on the types and nature of construction, machinery at site includes batching plant, mixers, trucks, tractors, excavators, dampers, cranes, vibrators, pumps etc.
- OTHER ASSETS: Physical Infrastructures and Owned Land are assets which can be collaterals for capital base enhancement and credit facilities and are useful to develop the scarce financial resources and getting into business access.

Services and Management

- SERVICES: Services such as acquisition of land, provisions of water supply, electric power, communication systems, etc., are very much necessary in the construction industry. Without acquiring such services, it is too hard to implement construction activities successfully. Therefore, well thought and due consideration shall be given to services and shall be considered as one of the resources required for civil works projects.
- MANAGEMENT: Management has come to employ a disciplined approach to the use of available resources. To coordinate these resources and achieve the required goal, a system shall be devised to plan, organize, execute, and control, the project. Such system which helps to achieve the necessary goal is called Construction Management, without which it will be a catastrophe both in cost and completion time to the project.

3.6 Performance Management

3.6.1 Time Management

In construction all projects are time bound. The project time objective specifies the project completion time. Time delays results to penalties while early completion might earn rewards. However, in spite of one's best efforts to complete a project on time, changes from the original estimated project time plan do occur sometimes. There may be many reasons both foreseeable and unforeseeable, for non-completion of a project time. However, the absence of a project time plan almost makes certain that a project cannot be completed on schedule without incurring extra costs. A plan prepared well before the commencement of construction in a project can be instrumental in formulating directions, coordinating functions, setting

targets, forecasting resources, budgeting costs, controlling performance and motivating people. It is for this reasons that the project planning starts with time planning as the first step.

Planning is the devising of a workable scheme of operations to accomplish an established objective when put into action. It requires an intimate knowledge of construction methods combined with the ability to visualize discrete work elements and to establish their mutual interdependencies.

Construction planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. A good construction plan is the basis for developing the budget and the schedule for work. Developing the construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspects of construction planning, it may also be necessary to make organizational decisions about the relationships between project participants and even which organizations to include in a project. For example, the extent to which sub-contractors will be used on a project is often determined during construction planning.

Construction planning as well as scheduling must be done by people who are experienced in and thoroughly familiar with the type of field work involved. It is especially important that those who will be expected to implement the plan in the field have an opportunity to participate in its development. The project network and the management data obtained from it will be realistic and useful only if the job plan is produced and updated by those who understand the job to be done, the ways in which it can be accomplished, and the job site conditions.

The construction planning may be said to consist of the following steps:

- Choice of technology and construction method,
- Determination of the job steps or 'activities' that must be performed to construct the project,
- Ascertainment of the sequential relationships among these activities,
- The presentation of this planning information in the form of a network,

1) Choice of Technology & Construction Method

In the development of appropriate alternatives for construction planning, choices of appropriate technology and methods for construction are often ill-structured yet critical ingredients in the success of the project. For example, a decision whether to pump or to transport concrete in buckets will directly affect the cost and duration of tasks involved in building construction. A decision between these two alternatives should consider the relative costs, reliabilities, and availability of equipment for the two transport methods. Unfortunately, the exact implications of different methods depend upon numerous considerations for which information may be sketchy during the planning phase, such as the experience and expertise of workers or the particular underground condition at a site.

In selecting among alternative methods and technologies, it may be necessary to formulate a number of construction plans based on alternative methods or assumptions. Once the full plan is available, then the cost, time and reliability impacts of the alternative approaches can be reviewed. This examination of several alternatives is often made explicit in bidding competitions in which several alternative designs may be proposed or *value engineering* for alternative construction methods may be permitted. In this case, potential constructors may wish to prepare plans for each alternative design using the suggested construction method as well as to prepare plans for alternative construction methods which would be proposed as part of the value engineering process.

In forming a construction plan, a useful approach is to simulate the construction process either in the imagination of the planner or with a formal computer based simulation technique. By observing the result, comparisons among different plans or problems with the existing plan can be identified. For example, a decision to use a particular piece of equipment for an operation immediately leads to the question of whether or not there is sufficient access space for the equipment. Three dimensional geometric models in a computer aided design (CAD) system may be helpful in simulating space requirements for operations and for identifying any interference. Similarly, problems in resource availability identified during the simulation of the construction process might be effectively forestalled by providing additional resources as part of the construction plan.

2) Determination of job activities:

At the same time that the choice of technology and general method are considered, a parallel step in the planning process is to define the various work tasks that must be accomplished. These work tasks represent the necessary framework to permit *scheduling* of construction activities, along with estimating the *resources* required by the individual work tasks, and any necessary *precedence* or required sequence among the tasks. The terms work "tasks" or "activities" are often used interchangeably in construction plans to refer to specific, defined items of work. In job shop or manufacturing terminology, a project would be called a "job" and an activity called an "operation", but the sense of the terms is equivalent. The *scheduling problem* is to determine an appropriate set of activity start time, resource allocations and completion times that will result in completion of the project in a timely and efficient fashion. Construction planning is the necessary fore-runner to scheduling. In this planning, defining work tasks, technology and construction method is typically done either simultaneously or in a series of iterations.

More formally, an activity is a single work step that has a recognizable beginning and end and requires time for its accomplishment. The following are suggested as guidelines for use when activities are being identified.

- By category of work as distinguished by materials such as concrete, timber, steel etc,
- By category of work as distinguished by craft or crew requirements (formworks slab, formwork footings)

- By category of work as distinguished by equipment requirements,
- By area of responsibility. Work items done by the general contractor and each of his sub-contractor should be separated,
- By distinct structural elements such as footings, walls, beams, columns and slabs, etc
- With regard to owner's breakdown of the work for bidding or payment purposes,
- With regard to contractor's breakdown for estimating and cost accounting purposes.

It is generally advantageous to introduce an explicit *hierarchy* of work activities for the purpose of simplifying the presentation and development of a schedule. For example, the initial plan might define a single activity associated with "site clearance." Later, this single activity might be sub-divided into "re-locating utilities," "removing vegetation," "grading", etc. However, these activities could continue to be identified as sub-activities under the general activity of "site clearance." This hierarchical structure also facilitates the preparation of summary charts and reports in which detailed operations are combined into aggregate or "super"-activities.

In practice, the proper level of detail will depend upon the size, importance and difficulty of the project as well as the specific scheduling and accounting procedures which are adopted. However, it is generally the case that most schedules are prepared with too little detail than too much. It is important to keep in mind that task definition will serve as the basis for scheduling, for communicating the construction plan and for construction monitoring. Completion of tasks will also often serve as a basis for progress payments from the owner. Thus, more detailed task definitions can be quite useful. But more detailed task breakdowns are only valuable to the extent that the resources required, durations and activity relationships are realistically estimated for each activity. Providing detailed work task breakdowns is not helpful without a commensurate effort to provide realistic resource requirement estimates.

3) Job Logic /Sequential Relationships/ or Precedence

Job logic refers to the determined order in which the activities are to be accomplished in the field. The start of some activities obviously depends on the completion of the others. A concrete wall cannot be poured until the formworks are in place and the reinforcing steel has been tied. Yet many activities are independent of one another and can proceed concurrently.

Forgetting a necessary precedence relationship can be more insidious. For example, suppose that installation of dry wall should be done prior to floor finishing. Ignoring this precedence relationship may result in both activities being scheduled at the same time. Corrections on the spot may result in increased costs or problems of quality in the completed project. Unfortunately, there are few ways in which precedence omissions can be found other than with checks by knowledgeable managers or by comparison to comparable projects. Finally, it is important to realize that different types of precedence relationships can be defined and that each has different implications for the schedule of activities:

- Some activities have a necessary technical or physical relationship that cannot be superseded. For example, concrete pours cannot proceed before formwork and reinforcement are in place.

- Some activities have a necessary precedence relationship over a continuous space rather than as discrete work task relationships. For example, formwork may be placed in the first part of an excavation trench even as the excavation equipment continues to work further along in the trench. Formwork placement cannot proceed further than the excavation, but the two activities can be started and stopped independently within this constraint.
- Some "precedence relationships" are not technically necessary but are imposed due to implicit decisions within the construction plan. For example, two activities may require the same piece of equipment so a precedence relationship might be defined between the two to insure that they are not scheduled for the same time period. Which activity is scheduled first is arbitrary. As a second example, reversing the sequence of two activities may be technically possible but more expensive. In this case, the precedence relationship is not physically necessary but only applied to reduce costs as perceived at the time of scheduling.

In revising schedules as work proceeds, it is important to realize that different types of precedence relationships have quite different implications for the flexibility and cost of changing the construction plan. Unfortunately, many formal scheduling systems do not possess the capability of indicating this type of flexibility. As a result, the burden is placed upon the manager of making such decisions and insuring realistic and effective schedules. With all the other responsibilities of a project manager, it is no surprise that preparing or revising the formal construction plan is a low priority to a manager in such cases. Nevertheless, formal construction plans may be essential for good management of complicated projects.

For a project of any consequence, there is always more than one general approach and no unique order of procedure exists. It is the planner's responsibility to examine the workable choices and select the most suitable alternatives.

Example:

Suppose that a site preparation and concrete slab foundation construction project consists of nine different activities:
A. Site clearing (of brush and minor debris),
B. Removal of trees,
C. General excavation,
D. Grading general area,
E. Excavation for utility trenches,
F. Placing formwork and reinforcement for concrete,
G. Installing sewer lines,
H. Installing other utilities,
I. Pouring concrete.
Activities A (site clearing) and B (tree removal) do not have preceding activities since they depend on none of the other activities. We assume that activities C (general excavation) and D (general grading) are

preceded by activity A (site clearing). It might also be the case that the planner wished to delay any excavation until trees were removed, so that B (tree removal) would be a precedent activity to C (general excavation) and D (general grading). Activities E (trench excavation) and F (concrete preparation) cannot begin until the completion of general excavation and grading, since they involve subsequent excavation and trench preparation. Activities G (install lines) and H (install utilities) represent installation in the utility trenches and cannot be attempted until the trenches are prepared, so that activity E (trench excavation) is a preceding activity. We also assume that the utilities should not be installed until grading is completed to avoid equipment conflicts, so activity D (general grading) is also preceding activities G (install sewers) and H (install utilities). Finally, activity I (pour concrete) cannot begin until the sewer line is installed and formwork and reinforcement are ready, so activities F and G are preceding. Other utilities may be routed over the slab foundation, so activity H (install utilities) is not necessarily a preceding activity for activity I (pour concrete). The results of our planning are the immediate precedence shown herewith.

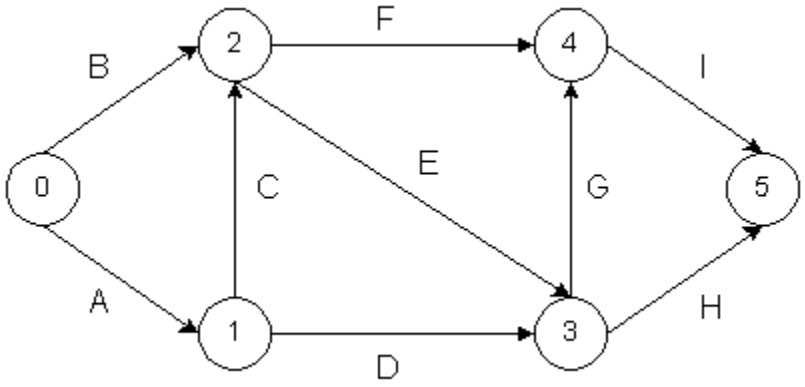
Precedence Relations for a Nine-Activity Project Example

Activity	Description	Predecessors
A	Site clearing	---
B	Removal of trees	---
C	General excavation	A
D	Grading general area	A
E	Excavation for utility trenches	B,C
F	Placing formwork and reinforcement for concrete	B,C
G	Installing sewer lines	D,E
H	Installing other utilities	D,E
I	Pouring concrete	F,G

3) Job Network

Showing the job activities and their order of sequence (logic) in pictorial form produces the project network. This network being a graphical display of the proposed plan.

With the information in the example, the next problem is to represent the activities in a network diagram and to determine all the precedence relationships among the activities. This representation is called an *activity-on-branch* diagram. Note that an initial event beginning activity is defined Node 0, while node 5 represents the completion of all activities.



Project Scheduling:

Once the network diagram has been developed, the time management system enters into a new phase, that of work scheduling. A project scheduling is a projected timetable of construction operations that will serve as the principal guideline for project execution. There are several steps involved in the devising of an efficient and workable job schedule:-

- estimate the time required to carry out each network activity,
- using these time estimates, compute the time period required for the overall project completion,
- establish time intervals within which each activity must start and finish to satisfy the completion date requirement,
- identify those activities whose expedient execution is crucial to timely completion of the project,
- using surplus or float times that most activities possess, adjust the start and finish times of selected activities to minimize resource conflicts and smooth out demands for manpower and equipment,
- make up a working project schedule that shows anticipated calendar dates for the start and finish of each network activity.

Estimating activity duration:
All formal scheduling procedures rely upon estimates of the durations of the various project activities as well as the definitions of the predecessor relationships among tasks. The variability of an activity's duration may also be considered. Formally, the *probability distribution* of an activity's duration as well as the expected or most likely duration may be used in scheduling. A probability distribution indicates the chance that a particular activity duration will occur. In advance of actually doing a particular task, we cannot be certain exactly how long the task will require.

A straightforward approach to the estimation of activity durations is to keep historical records of particular activities and rely on the average durations from this experience in making new duration estimates. Since

the scopes of activities are unlikely to be identical between different projects, unit productivity rates are typically employed for this purpose. For example, the duration of an activity D_{ij} such as concrete formwork assembly might be estimated as:

$$D_{ij} = \frac{A_{ij}}{P_{ij} N_{ij}}$$

Where A_{ij} is the required formwork area to assemble (in square yards), P_{ij} is the average productivity of a standard crew in this task (measured in square yards per hour), and N_{ij} is the number of crews assigned to the task

The following important rules apply to the estimation of activity durations:

i) Evaluate activities one at a time, independently of all others. For a given activity, assume that materials, labor, equipment and other needs will be available when required,

ii) For each activity assume a normal level of manpower and/or equipment. Compute the estimate duration by applying a crew or equipment production rate to the total number of units of work to done.

Ex. Activity duration to pour 230 m^2 of slab formwork, assuming a production rate of 1.5 m^2/hr /crew can be established as follows

Duration = quantity/productivity

= 230 m^2/ 12 m^2/day = 17.5 days

iii) If time units of working days are being used, assume a normal working day. Do not consider overtime or multiple shifts unless this is a usual procedure or a part of the standard work day.

Planning Techniques:

A variety of planning techniques are available of which only three are to be outlined indicating the advantages and disadvantages and the most application in practice.

- The Networking Schedule Technique
  - The Critical Path Method (CPM),
  - The Precedence Diagram Model (PDM)
  - The Performance Evaluation & Review Technique (PERT)
- The Bar Charts
- Line of Balance Chart

3.6.2 Cost Management

For cost management and control on a project, the construction plan and the associated cash flow estimates can provide the baseline reference for subsequent project monitoring and control. For schedules, progress on individual activities and the achievement of milestone completions can be compared with the

project schedule to monitor the progress of activities. Contract and job specifications provide the criteria by which to assess and assure the required quality of construction. The final or detailed cost estimate provides a baseline for the assessment of financial performance during the project. To the extent that costs are within the detailed cost estimate, then the project is thought to be under financial control. Overruns in particular cost categories signal the possibility of problems and give an indication of exactly what problems are being encountered. Expense oriented construction planning and control focuses upon the categories included in the final cost estimation.

Apart from the work plan and schedule for time management, contractors are required to show their budgetary forecast (cash flow diagram) indicating the gross and net cash requirements of projects. Often projects are observed running into difficulties from short of cash flow. Projects by nature require to be financed from other financing securities especially during the early phases of the construction period until they reach a stage of *self-financing date*. Hence for successful performance of projects, one has to prepare a cash flow diagram and monitor progress during the contract period.

Contract budgets may be presented in graphical or tabular form. The budget prepared is compared at weekly or monthly intervals with the actual performance achieved. This enables discrepancies to be assessed and management investigation and action implemented where adverse trends are evident. Graphical presentations highlight the relationship between budget and actual performance
Information required for preparing a cash flow forecast:

- *The Contract Budget in monthly or Cumulative form*. This chart may be based on an analysis of the Contract work plan or alternatively an empirical approximation- the quarter/third rule.
- *Monthly or Cumulative Self-Cost of Projects (Project Expenditure).* From the monthly or cumulative value forecast (Contract budget in step 1 above), one can establish the cumulative Self-Cost based on the assumed project Mark-Up release. (Mark-up = General Overhead cost + Profit release)
- *Income Forecast*. The revenue to be collected from the project on monthly basis equates from the cumulative value minus the retention money, previous payments and other deductions such as advance payments. Income forecast is the contractor's revenue to be collected from the client through successive payment certificates.
- *Gross and Net Cash Requirements of Projects:*

Net Cash required = the cumulative Income (in step 3) – the Cumulative Self Cost (in step 2)
Gross Cash required = the cumulative Income (in step 3) – the Cumulative Self Cost (in step 2); but the cumulative income prior to receiving the monthly payment. In other words, Gross cash required balances the net cash requirement plus the monthly income just to be received

Time-Cost Performance Evaluation

So far two major approaches were developed for performance evaluation time and cost. These are *Variance* or *Deviation Analysis* based on *direct differences or Earned Value* analysis between planned and actual conditions (Harrison, 1997; PMI 1996 & 2000 and Lockyer & Gordon, 1996). This study called these

two project performance analysis approaches as *Simple Deviation Analysis* and *Earned Value Deviation Analysis*. Harrison presented the various and commonly used simple deviation analyses and he claimed that these are inadequate, often misleading and sometimes meaningless.

Time Performance: Scheduled start or finish time against Actual start or finish time; Schedule date of a milestone against Actual date when the milestone was reached;
Cost Performance: Budgeted cost against Actual Cost; Measured value against Actual cost; Budgeted man-hour against actual man-hour; Budgeted unit cost against Actual unit cost; Budgeted percentage completion against Actual percentage completion.

Simple Deviation Analysis

For instance; computations using simple deviation analysis could not address whether the project is on or above or below cost or time performances, and indicate /predict/ the likely hood of completion cost and time. Therefore, for budget variances of these computations; one can not easily conclude that positive variance means unconsumed budget or negative variance means cost overrun (Lockyer & Gordon, 1996 & Harrison, 1997). However, in all instances negative variance indicate that there is a necessity for some actions.

Harrison generally put forward the following limitations in using simple deviation analysis. Hence, there will always be a considerable subjective evaluation to interpret for judgments to determine poor and good performances. Lockyer & Gordon; and Harrison also indicated that simple deviation analysis does not use sufficient information to determine performances.

Limitations of Simple Deviation Analysis

- It is historic than forward looking.
- It does not indicate performances clearly.
- It is not sensitive enough for early gauging.
- It does not use all the data available.
- It requires considerable subjectivity for interpretation.
- It falls short of integrating cost and time performance criteria.
- It falls short of indicating accountability and responsibility.

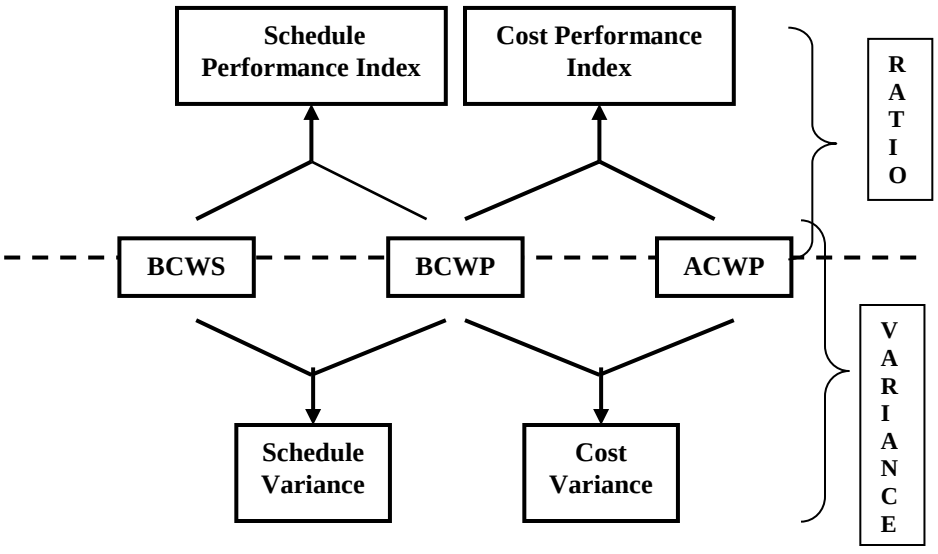
The second approach is *Earned Value Deviation Analysis*. In this approach, project management focused on two major principles; the integrative account of cost and time performance criteria and the Earned value concept (a concept developed for amending the triple constraints above). The earned value is then used as

a measure of project performance in terms of cost-schedule control system. This has improved the objective measurement level of simple deviation analysis using more information's on activities performed.

Hence, the comparisons are made between planned and earned values. This concept though gains popularity in project performances recently, it has been used in the form of Cost / Schedule Control System (C/SCS) by the US Department of Defence since the 1960s (Rosenau, 1998 & Willkens 1999). This proved that, construction project management is slow in adapting conceptual developments from other disciplines.

Planned values are related to budgets and schedules over the designated work scope in a time phased plan. These values formulate the baseline or performance criteria for time and cost performances. In the case for *Earned Value Deviation Analysis*, two additional information are used; Budgeted Cost of Work Schedule (BCWS) and Actual Cost of Work Performed (ACWP). BCWS represents the budgets of the activities planned or scheduled for performance and it is represented by S-Curve (Figure ….). And ACWP represents the actual cost dispersed for the activities performed. In both cases, use can be made for progress tracking and for the completed project as a whole.

Furthermore, Earned value is related to the work accomplished within the same work scope (WBS), budget or cost items (CBS) and Organization levels or elements (OBS) they are intended to be compared with. This is represented by Budgeted Cost of Work Performed (BCWP) which is the planned schedule cost of activities completed. Earned value is, hence, representative of percent completion. The Comparison between planned and earned values provides work accomplishment or project performance in terms of cost and time variances.



Earned Value versus Simple Deviation Analyses

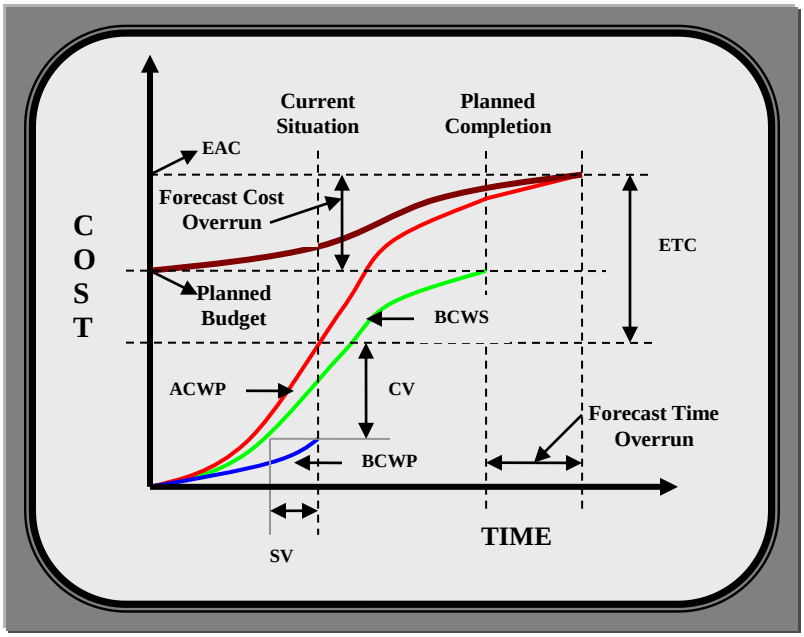
Willkens put this simply as equating earned value with physical progress. Further to this, he noted three attributes to the use of earned value analysis. These are; *Uniform unit of measurement (Work-hours and Dollars), Consistent method of measurement,* and *Bases for cost performance analysis*. Besides, Performance Indices (SPI & CPI) and Estimated completion of the project (EAC and ETC) can be computed using the three information and the total Budget at Completion (BAC). Accordingly, the following expressions can be used for computations (Box …..).

Expressions in Earned Value Analysis (EVD)

Cost Variance (CV)	**=**	**BCWP - ACWP**
Schedule Variance (SV)	**=**	**BCWP - BCWS**
Cost Performance Index (CPI)	**=**	**BCWP / ACWP**
Schedule Performance Index (SPI)	**=**	**BCWP / BCWS**
Estimate to Completion (ETC)	**=**	**(BAC -BCWP) / CPI**
Estimate at Completion (EAC)	**=**	**ACWP + ETC**

The expression used for computations based on EVD Analysis can also be shown clearly using three S-Curves (S-Curves for BCWS, BCWP and ACWP – Figure below).
This approach has also its own limitations. These included:

- the cost and effort to make the system for earned value analysis is initially extensive,
- the inability to reveal cost information's immediately causing time gap for decision making,
- the issue of its use for project performance analysis, and
- the reliance on a single, that is; financial which is an objective system of measurement.



Earned Value Computations (Source: Lockyer & Gordon, 1996)

Recent trends revealed that there is a need to combine financial and non-financial; hard and soft; and hence target and process system of measurements. Accordingly, researchers are trying to forge this need and Balanced Score Card was one of their developments recently. Hence, project performance can easily be compared with planned conditions and be declared behind or over planned values.

However, these values can not directly indicate the case of success or failure of projects. As a result causal relationships are necessarily considered to reach into a reasonable conclusion. But without any doubt, these values are indicative for improvement interventions and learning as a part of the purpose in performance determination.

Further to these, subjective evaluation techniques incorporated time planning, cost estimation and risk analysis for uncertainties and complexities. Simultaneous management, Theory of Constraints, Successive Principles, Decision theories strive for this end. This study however used comparison between planned and accomplished values to determine performances. Information such as completion time, project costs and quality in line with stakeholders' satisfaction were used as the triple constraints.

In addition, the contribution of these criteria to the two sector development programs will be considered. Only simple deviation analysis could be employed due to lack of information for earned value computations. Hence, Earned value deviation analysis will be considered for possible improvement interventions.

3.6.3 Quality Management

Quality Management is an important project management function. It is one of the critical attributes of project success, with the others being cost, time and safety. The traditional microeconomic view of quality management is that there is an acceptable "optimum" proportion of defective items. Trying to achieve greater quality than this optimum would substantially increase costs of inspection and reduce worker productivity. However, many companies have found that commitment to total quality control has substantial economic benefits that had been unappreciated in traditional approaches.

- Expenses associated with inventory, rework, scrap and warranties were reduced,
- Worker enthusiasm and commitment improved,
- Customers often appreciated higher quality work and would pay a premium for good quality,
- As a result, improved quality control became a competitive advantage.

The form’s greatest marketing assets are satisfied owners, and delivering quality projects is critical to achieving customer satisfaction. The project manager and its superintendents must work together to ensure that all materials used and all work performed on a project confirm to the requirements of the contract plans and specifications. Non confirming materials and work must be replaced at the contractor’s cost both in time and cash. This means that the contractor must bear the financial cost of tearing out and replacing unsatisfactory work and that additional time is not granted for the impact the rework has on the overall construction schedule.

Quality Management involves the following processes:

- Setting Quality Standards to achieve both technical and managerial competence,
- Scheduling inspections,
- Managing any required rework,
- Documentation.

Testing and Inspection Requirement in Quality Management:

Quality control starts with the submittal process. A submittal is a document or product turned in by the construction team to verify that what they plan to purchase, deliver and ultimately install is in fact what the design team intended in their drawings and specifications. A submittal can be any of the following:

- Color charts,
- Coordination drawings,
- Cut sheets of product data,
- Fabrication (shop) drawings,
- Samples,
- Mock-ups,

Approved materials and equipment are then procured. All materials and equipments should be inspected as they are being delivered to the project site. They should be examined and compared to the appropriate purchase orders and submittal documentation. If the materials and/or equipment are not as specified, they should not even be unloaded from the truck; they should be rejected. Materials stored on site also need to be inspected periodically to ensure they are properly protected against weather damage. It is advisable to conduct three forms of inspection of works:

- Preparatory inspection: this inspection is conducted prior to initiating work to ensure that all preliminary work has been completed on the project site. Eg, Mock-up: establish workmanship standards and test certificates of materials.
- Initial inspection: Once the work starts, the inspector conducts an initial inspection to ensure workmanship meets quality standards and dimensional requirements are met,
- Pre-Final/ Final inspection: When the project is nearing completion, inspection is conducted by superintendents of the owner, the project manager and the designers. All deficiencies noted are recorded on a punch list. When all deficiencies listed on the punch list have been corrected, the project manager schedules for final inspection to verify that all required work has been completed in conformance with contract requirements.

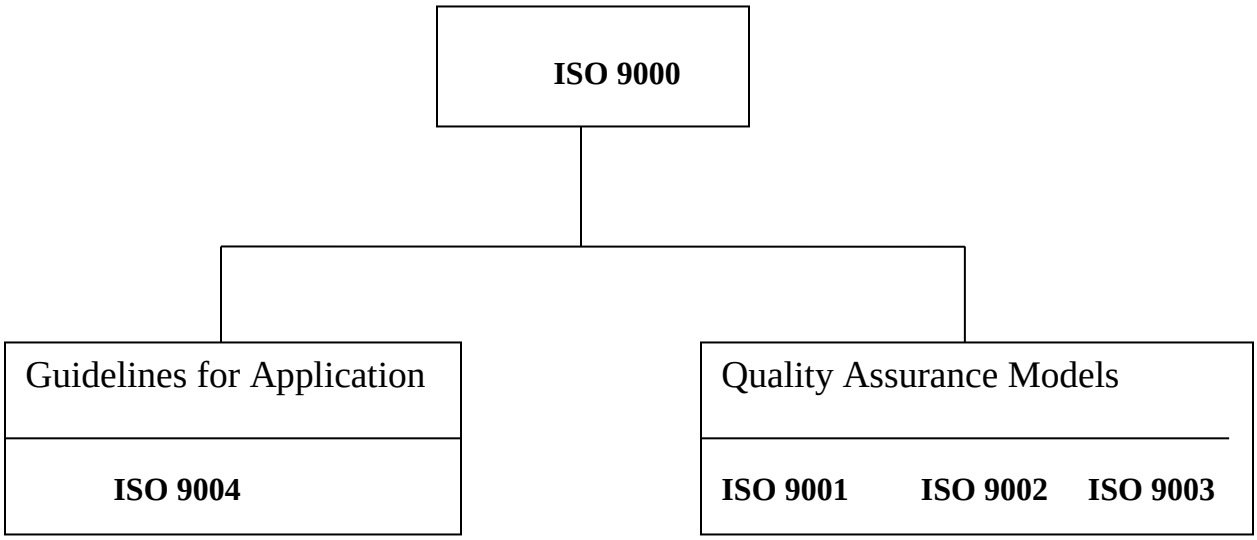
Quality Assurance System: ISO 9000

Quality assurance is concerned with developing a formal structure, organization and operational procedures to ensure specified quality throughout the total construction process. Quality assurance:

- is concerned with planning and developing the technical and managerial competence needed to achieve the host organization's desired objectives,
- is concerned with the management of people, addressing the roles, duties and responsibilities of individuals within the organizations
- is primarily the responsibility of management; its structure and implementation as part of the total organizational framework,
- is also an important aspect of the marketing and promotional strategy of the organization.

In 1987, the International Organization for Standardization, a federation of the national standards organizations of over 90 countries, published ISO 9000 International Standards for quality management and quality assurance. These standards which have been adopted by many countries throughout the world provide quality management guidance and identify generic quality system elements necessary for quality assurance. They provide direction regarding what needs to be done but do not prescribe how quality is to be accomplished.

ISO 9000 series quality systems constitute four parts as shown hereunder:



Structure of ISO 9000 Standards.

ISO 9001:

The most stringent level of application and contains all 20 clauses of the quality system and are therefore the most comprehensive system available for certification. Organizations involved in the design process and seeking certification need to comply with ISO 9001 requirements. For example this specification would apply to design consultants, architects, and design and build companies.

ISO 9002:

This is applicable to manufacturing and/or installation companies that do not undertake design activities. ISO 9002 requires process and inspection control during production and/or service delivery. This standard applies to most construction organizations, where evidence of inspection and tests, during a construction process, has to be provided to clients.

ISO 9003:

This applies to organizations where quality assurance systems can be based upon final inspection of product or service only. This part of the standard has limited application in the construction industry.

Table of ISO 9000 series quality system elements:

Title	Corresponding Applicability		
	ISO 9001	ISO 9002	ISO 9003
Management Responsibility	x	x	x
Quality System	x	x	x
Contract Review	x	x	
Design Control	x		
Document Control	x	x	x
Purchasing	x	x	
Purchaser Supplied Product	x	X	
Product Identification and Traceability	x	x	x
Process Control	x	x	
Inspection Testing	x	x	x
Inspection, Measuring and Test Equipment	x	x	x
Inspection Status	x	x	x
Control of Non-Conforming Product	x	x	x
Corrective Action	x	x	
Handling, Storage, Packaging and Delivery	x	x	x
Quality Records	x	x	X
Internal Quality Audits	x	X	
Training	x	x	x
Servicing	X		
Statistical Techniques	x	x	x

Any company wishing to become registered for quality assurance must satisfy the requirements of a certification body. Certification is conducted by a third party which has no contractual relationship with the client and/or the contractor to provide confidence that products or services supplied comply with the specified requirements. The certification process can be represented in the following three aspects of implementation:

- *Examination of Documentation*: applicants must submit evidence that proves they have a documented quality system complying with the requirements of the standard. Documentation will normally consist of a quality manual, a procedural manual and if required a set of work instructions,
- *Assessment:* Once the documentation has been accepted by the certifying body, it will perform an on spot investigation in order to verify that the documents system is being implemented as described. If everything is satisfactory, a certificate will be awarded.
- *Monitoring:* After the initial assessment, regular visits are made to ensure that standards are being maintained. If standards are not being maintained, the ultimate sanction would be the withdrawal of the certification.

3.6.4 Safety & Health Management

Construction is the most dangerous and hazardous undertaking. In industrial countries, it accounts for about 10% of the disability injuries and 20% of the fatalities that occur in the industrial work force. Although we don't have the actual statistics in our country, there are significantly more injuries, death and lost workdays due to injuries or illnesses in construction than virtually in any other industry. These works related injuries and illnesses are exceedingly costly. It entails the following:

- Leads to disruption of the construction schedule and demanding significant time management even for investigation and reporting,
- Direct costs that include medical costs, premiums for workers' compensation benefits, liability and property losses etc. While contractors may pay insurance premiums directly to cover such costs, these costs are reflected in bid prices or contract amounts,
- Indirect costs that include:
    - reduced worker productivity,
    - Schedule delays in projects and administrative time,
    - Damage to equipment and the facility,
    - First aid expenses,
    - Idle equipment time,
    - Loss of skilled worker
    - Administrative and legal expenses
    - Lowered employee morale
- Injuries on bystanders (Third Party) from construction accidents. Several crane collapses from high rise buildings under construction have resulted in fatalities to passersby.

The causes of injuries in construction are numerous. The under listed causes are reported accidents in the US construction industry in 1997. A similar catalogue of causes would exist for other countries too. The largest single category for both injuries and fatalities are:

- Individual falls: a railing might not be secured, a worker might be inattentive, and the footing may be slippery etc.
- Handling of goods: falling from an elevation being struck by something,
- Transportation incidents,

- Being caught between two objects,
- Electric shock.

Fatality Causes in Construction US, 1998

Cause	Deaths	Percentage
Fall from/through roof	66	10.6%
Fall from/with structure (other than roof)	64	10.2
Electric shock by equipment contacting power source	58	9.3
Crushed/run over non-operator by operating construction equipment	53	8.5
Electric shock by equipment installation or tool use	45	7.2
Struck by falling object or projectile (including tip-over)	29	4.6
Lifting operation	27	4.3
Fall from/with ladder (includes collapse/fall of ladder)	27	4.3
Crushed/run over/trapped operator by operating construction equipment	25	4.0
Trench collapse	24	3.8
Crushed/run over by highway vehicle	22	3.5

Source: Construction Resource Analysis

While eliminating accidents and work related illnesses is a worthwhile goal, it will never be attained. Construction has a number of characteristics making it inherently hazardous. Large forces are involved in many operations. The jobsite is continually changing as construction proceeds. Workers do not have fixed worksites and must move around a structure under construction. The tenure of a worker on a site is short, so the worker's familiarity and the employer-employee relationship are less settled than in manufacturing settings. Despite these peculiarities and as a result of exactly these special problems, improving worksite safety is a very important project management concern.

Various measures are available to improve jobsite safety in construction. This includes:

- Educating workers and managers in proper procedures and hazards can have a direct impact on jobsite safety. The realization of the large costs involved in construction injuries and illnesses provides a considerable motivation for awareness and education. Regular safety inspections and safety meetings have become standard practices on most job sites.
- Perform a job hazard analysis prior to operation. This encompasses:
    - detailed description of the construction operation,
    - A listing of the hazard associated with the operation,
    - A plan of eliminating, reducing or responding to the hazardous situations.
- Prevent substance abuse: Workers under the influence of drugs or alcohol on the job site pose serious safety and health risks, not only to themselves, but also to all those who work in the proximity of the users. It is advisable to establish specific policies prohibiting substance use on project sites and people from working on site who are under the influence.
- Personal protective equipment:

- Head protection (hard hats),
- Hand protection (gloves),
- Foot protection (Safety shoes),
- Eye protection (safety glasses and goggles),
- Body protection (protective clothing, oily body-paint),
- Hearing protection (earplugs and earmuffs),
- Respiratory protection (respirators),
- Providing first-aid supplies and trained personnel on site.

- Hazardous Materials Communications: It is required that all personnel working on a construction site be informed of all chemicals being used on the site and any harmful effect they may cause.
  - Warning labels on all containers indicating the specific hazard posed,
  - Posting of material safety data sheets
  - Specialized training regarding the safe handling, transporting, storage and use of the chemicals.
- Pre-qualification of contractors and sub-contractors with regard to safety is another important avenue for safety improvement. If contractors are only invited to bid or enter negotiations if they have an acceptable record of safety (as well as quality performance), then a direct incentive is provided to insure adequate safety on the part of contractors.

3.7 Contract Management

3.7.1 Tendering

It is highly desirable when inviting competitive offers from a number of bidders that the tender received should be based as far as possible on equal terms and conditions and presented in a standardized manner. In this way evaluation and comparison between the tenders received can be made more simply and accurately with less risk of misunderstandings, errors and omissions.

The Tender is the most important single document submitted by the bidder. It is here that each bidder confirms that he has read and understood the requirements of the tender documents and based on such requirements, it is here that the bidder states his tender sum for undertaking and fulfilling all his obligations under the contract. It is therefore essential for the Employer that all Tenders received are stated in identical terms and thus it is necessary for the Employer, when inviting tenders, to provide bidders with a standard form of tender which each bidder is required to complete and sign.

Actually the usual tender document consists of a number of different documents, of which the following forms the essential elements:

- Bidding Information:
  - Invitation to bid,
  - Instruction to bidders,
  - Bid form including Bill of Quantities

- Addenda (Bid amendment)

- Contractual Information:
  - Agreement form
  - Standard or General Conditions of Contract
  - Particular or Special Conditions of Contract
  - Technical Specifications & Methods of Measurement
  - Drawings
  - Appendix to Construction Agreement

Bidding Information:

This is part of a tender document, where bidders are required to respond (provide their offer, data, information) in accordance with the inquiry of the documents within the bidding period. This section of the document comprises:

i) *Invitation to Bid*: this is an announcement or a call of bidders to participate in the bid. It contains a short brief description of the project and forward information to bidders such that they caneventually reach a decision on whether to purchase the full bid document and participate in the bid. The invitation to bid shall contain, as a minimum:
   - The name and address of the Client,
   - A brief description of the project (type, size and location) including desired time for completion,
   - The means and conditions for obtaining the bid documents and the place from which they may be obtained,
   - The place and deadline for the submission of bids,
   - The place and time for opening of bids,

ii) *Instruction to Bidders*: This is a separate document in the tender to furnish instruction to bidders on the preparation and submission of the bids. Although it may repeat some of the information in the invitation to bid, the instructions are mostly concerned with the following:
   - Instructions about filling out the bid form,
   - Bid due date,
   - Location to deliver the bid,
   - Examination and evaluation of bids
   - Method of awarding the contract
   - Bid security information,
   - Conditions to become non-responsive to the bid

iii) *Bid Form*: The bid form is the document upon which the bidder submits its offer such as financial, technical and legal requirements of the bid. The form is usually prepared by the designers with

blanks left to be filled out by the bidder. This makes the bids more easily comparable. Items may include some or all of the following:

- Name of Contractor,
- Unit prices for the bill of quantities,
- Basic price index
- Tender sum both in numbers and in words,
- Technical information such as key staff to be deployed, equipments to be availed, past experiences, etc
- Legal status of the company : proprietorship, corporation, partnership,
- Financial status of the company
- Key subcontractors
- Time required for the job by the contractor,
- Signature, title and date.

iv) *Addenda*: After the documents are issued but before the bids are due, changes often need to be made. The most common reason is the need to correct simple mistakes in the bidding documents.Contractors dig deeply into the documents and can spot things missed by the drafter or specification writer or designer. This may generate additional requests that need to be included in the bid documents.

Contractual Information:

These are documents included in the tender document to furnish bidders with full and detailed information of the project for application after winning the contract. The bidder should utilize such information to provide a fair and reasonable offer to the bidding document. This section of the document comprises:

i) *Agreement Form*: It serves the purpose of presenting a condensation of the contract elements, stating the work to be done and the price to be paid and providing suitable places for signature and seal of the parties. The following provisions are common to most agreement forms:

- Identification and full address of the signing parties,
- short description of the project and the work,
- Date of commencement and signature,
- Completion time of the project,
- The contract price,
- Enumeration of contract documents constituting the entire agreement.

ii) *Standard or General Conditions of Contract*: The purpose of the general conditions is to establish the legal responsibilities, authority and rights of all parties involved in the project in normal procedure of the work, in case of disputes, hazards etc. Although the owner can devise his own general conditions, most prefer to use a standard version. This version is understood by all parties, includes tested language and can be revised as needed. For example the FIDIC Conditions of

Contract, The Standard Conditions of Contract by the Ministry of Works and Urban Development, 1994 etc.

iii) *Particular or Special Conditions of Contract*: Having similar performance with that of the general conditions, however more specific and relevant to a particular project. It is a supplementary and modified section of the general conditions of contract. Special conditions include additional owner requirements such as parking, use of toilet facilities and working in occupied spaces, etc.

iv) *Technical Specifications & Methods of Measurement*: These are written descriptions of the quality of the project. They detail the materials, equipment and workmanship to be incorporated into the project.

v) *Drawings*: These are intended to describe the size and dimensional requirements of the project. Many professionals are involved in developing drawings. These include the architectural, structural, sanitary, mechanical, electrical, topographic survey, land profile, and detailing.

vi) *Appendix to Construction Agreement*: Comprises tabulated and narrative information of the project such as amount and liquidated damages, interest rates, completion time, amounts of bond and insurances, defects liability period, retention, progress payments, advance payment, etc. Some of this information might be left blank to be filled by the contractor or might be readily provided by the client.

3.7.2 Contracting

It is a universal practice in construction for a contract to be formalized by a written contract document. The basic purpose of a contract document is to define exactly and explicitly the rights and obligations of each party thereto. The complex nature of construction dictates a form of contract that is relatively lengthy, detailed and binding document in order to describe precisely the legal, financial and technical provisions and requirements. Construction contracts are substantially different from the usual commercial variety. The product concerned is not a standard one but a structure that is unique in its nature and whose realization involves considerable time, cost and hazard.

The Contract document comprises the full package tender documents including any addenda issued there to with the technical and financial offer of the successful bidder. Here, both parties put their respective signature and seal on the agreement form which was included in the tender as contractual information.

Different kinds of contracts provide different advantages to the client and the contractor. Depending on the risk of the project and the degree of difficulty in estimating costs, the client and contractor try to negotiate the type of contract that best serves their interests.

i) The Unit-Price Contract: It is based on estimated quantities of certain well defined items of work and costs per unit amount of each of these work items. This type of contract is suitable for a competitive bid. The specification and estimated quantities are compiled by the designer during the conception phase

and the unit costs by the contractor for carrying out the stipulated work in accordance with contract documents.

Advantages:

- Promotes open competition involving quantities of work that cannot be accurately forecast at the time of bidding.
- More transparent and easier for supervision and control.

Disadvantages:

- Requires reasonable time and cost for the preparation of specification and detailed bill of quantities.

ii) The Lump-Sum Contract: The lump sum contract is one in which the contractor agrees to carryout a stipulated job of work in exchange for a fixed sum of money. The satisfactory completion of work for the stated price remains the obligation of the contractor, regardless of the difficulties and troubles he may experience in the course of his construction activities. This type of contract is suitable for a competitive bid.

Advantages:

- The owner knows the total cost of his project in advance,

Disadvantages:

- Limited to construction programs that can be accurately and completely described at the time of bidding.

iii) Cost-Plus Contract: Generally this type of contract is suitable for negotiated contract between the contractor and the client. This designates actual cost plus additions for profit and risks depending on the mutual agreement to be reached between the parties. There are three varieties of cost-Plus Contract.

1) Cost-Plus Percentage of Cost Contract: This type of contract fixes percentage of the cost of construction for the profits and risks to be due to the contractor. This contract is particularly well fitted to cover work whose scope and characteristics can be only poorly defined at the outset of operations.

Advantages:

- For an emergency nature that time is not available for the advance preparation of contract documents and for the usual bidding routine,
- The work entailed may be such that no one can ascertain what difficulties will be encountered or even of what order of magnitude the eventual cost may be,

Disadvantages:

- It doesn't urge the contractor to maintain and practice strict economy in the interests of the owners.

2. Cost-Plus Fixed Fee Contract: A popular type of cost-plus contract is one in which the contractor's fee is established as a fixed sum of money. This work must be of such a nature that it can fairly be well defined and reasonably good estimate of cost approximated at the time of negotiations. The contractor computes the amount of his fee on the basis of the size of the project, estimated time of construction,

nature and complexity of the works, hazards involved, location of the project, equipment and manpower requirements and similar considerations.

Advantages:

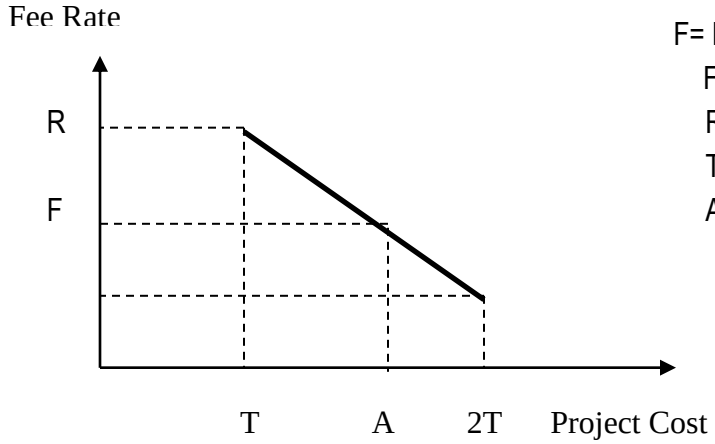
- Time saving in the preparation of contract documents and the usual bidding document,
- Expedition of work is desirable from the view point of freeing labor and equipment for other contracts.

Disadvantages:

- The contractor should work in a diligent manner and failure to do so will cause additional office, overhead expense to be incurred for which he is not reimbursed.

3. Cost-Plus Sliding Scale Fee Contract: A form of cost-plus contract that acts in the nature of a compromise between the percentage of cost fee and a fixed fee. It is one in which the fee is established in accordance with a sliding scale arrangement. Either of the following general schemes may be followed.

a) The fee may be determined as a percentage of cost, with the percentage increasing as the cost falls below the target estimated and the percentage decreasing as the cost rises above the target figure.



F= R (2T- A) Where,
F: Actual Fee Rate
R: Base Fee Rate
T: Targeted Estimate
A: Actual Cost

b) The setting of a lump sum base fee with provision of increasing it for costs below the target estimate and decreasing it for costs above the estimate. Under either arrangement, a minimum fee or percentage is stipulated that is subject to no further decrease regardless of the final cost of the work.

L.S = B.L.S (2T – A) Where,
L.S: Lump Sum Fee
B.L.S: Base Lump Sum
T: Target Estimate
A: Actual Cost

iv) Design-Construction Contract:

This type of contract refers to both the design and the field construction. Such a project is called a “turn-key” or “package deal”. Both design and construction can be included in one contract with the owner on a fixed-sum or cost plus basis. This is common practice in industrial construction that requires special skill in the work.

4 ORGANIZATION MANAGEMENT

4.1 Introduction

Formal organizations are contrived social entities designed to fulfill specific purposes. Organizations constitute a group of individuals of varying levels of expertise combined into a social structure of some type to accomplish one or more functions in a manner of contributing to one or more of the following development objectives of a region or a country.

i) Income Objectives:

A country's and its region income determines:

- The level of welfare of a country's society (level of living standard),
- The capacity of a society to save and invest.

The term income here as defined from the economic sense refers to the total amount of goods and services produced by formal organizations and available for a society within a defined period of time. Traditionally Gross Domestic Product (GDP) per head is considered as income indicator to measure performance of country's or region's economy. Distribution of the income has the following two divisions:

- Primary distribution of income - Owner of organizations through dividend,
- Secondary distribution of income – Society through the levying of taxes, subsidies and grants.

ii) Employment Objectives:

Organizations are also looked from their employment generating aspect. For most people employment is a condition for raising income. This is directly linked with the first objective. However there exists a situation where society may have sufficient income for its living situation but with significant number of unemployed active population that could create political unrest and instability. It is common experience that a person's role and the respect he may find in his social environment can depend more upon the job function exercised than his income.

iii) Objectives Concerning Public Goods:

Organizations that provide public services at no cost at all or at prices that do not cover production cost are an important element of a development strategy. Public agencies or organizations are established to provide specific services such as:

- Educational Institutions,
- Health Services
- Transport services etc.

iv) Objectives Concerning Natural Resources and Environment:

Every country's development potential depends on the availability of natural resources. Most development activities although to differing degrees, require the use or even the destruction of existing natural resources. The assessment of environmental impacts of development strategies,

maintaining and protecting, and in many cases redeveloping the conditions and the functioning of natural resources (systems), often constitute a major objective of development programs.

The purpose of organization is to achieve the most effective utilization of human, material and capital resources by the establishment of decision making and communications processes designed to accomplish specific objectives.

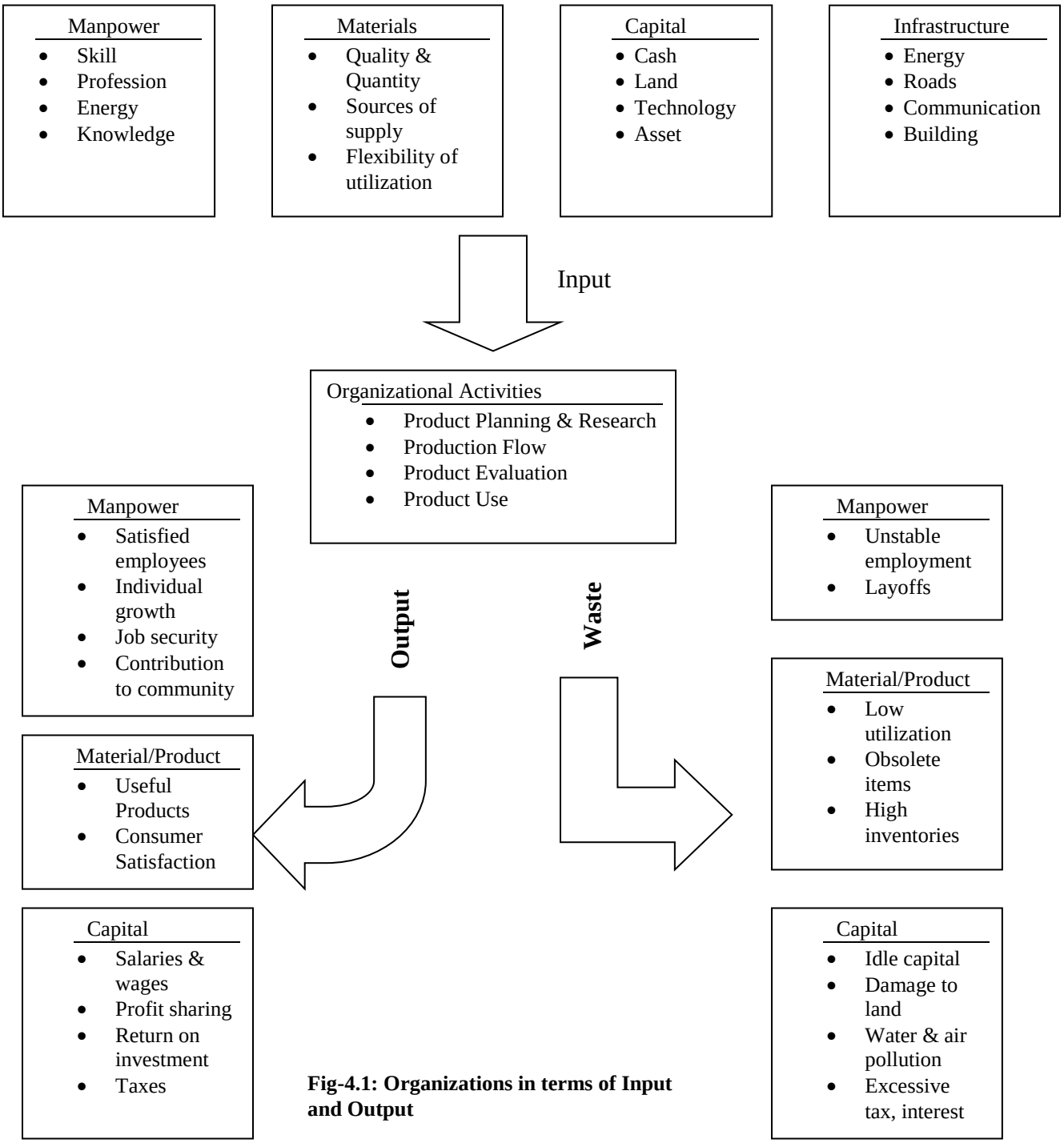


Fig-4.1: Organizations in terms of Input and Output

4.2 Forms of Organization

Organizations generally fall into either profit or non-profit category and include the following on the basis of forms of ownership.

A. *Profit- oriented non corporate businesses,* where forms of ownership are basically:

i) The individual or sole proprietorship,
ii) The general partnership,
iii) The limited partnership.

The vast majority of business units that include small engineering firms and individual consultants fall under this category.

B. *Profit-oriented corporations*, where ownership is in the form of individual stockholders. In terms of monetary value of goods produced and the quantity of workers employed, the corporate form of business is the most significant and represents major part in country's total income.

C. *Non-profit organizations* that include government agencies, research and development organizations and academic institutions.

A. *Profit- oriented non corporate businesses*

i) *Sole Proprietorship:*

An individual proprietorship is an enterprise owned by a single person who contributes the original assets to start the business, maintains and controls business operations, enjoys full benefit in terms of profit, and is fully liable for all debts associated with the business. Individual proprietorships are particularly important in retail trade and service industries and include small engineering firms, private consultants and contractors. Examples are:

- Consulting in the design of bridges, highways, waterways and structures,
- Involvement as sub-contractors or sub-consultants to large corporations,
- Consulting at local community level on issue related to town management,
- Performing studies and analyses at the federal and state level in support of budgeting decisions, accomplishing specific tasks for project and staff functions within a corporation and so on.

Advantages of sole proprietorship:

- Enjoys unlimited rights to the control and profits of the business,
- It is easy to establish, since no legal formalities and filings are required to start the business
- The expense in starting a business is relatively minimal as there are no filing fees, legal fees or taxes involved in the organizational process
- Management is relatively simple and extremely flexible, since business decisions are often made by one man,

- There is a great deal of personal motivation and incentive to succeed because the owner receives all the profits.
- There are no corporate income taxes.

Disadvantages of sole proprietorship:

- Risk of unlimited liability for debts and losses. In the event of failure, creditors can take the proprietor's personal property as well as his business property to settle their claim,
- Often difficult to raise large amounts of capital to buy equipment and hire manpower,
- Market instability from the fact that if something should happen to the proprietor, (death or disablement) the business may cease to exist.

ii) *General Partnership:*

A general partnership is an association of two or more persons to conduct as co-owners a legal business for profit. A written agreement may take the form of a filing of articles of partnership in a state or local office of public record. It is quite common to organize a group of engineers who represent different fields of expertise oriented towards the need and to establish a partnership.

Advantage:

- Relatively easy to establish and inexpensive in terms of organization,
- Securing additional capital for expanding the business or purchase of expensive equipment is better than the sole proprietor.

Disadvantage:

- Personal unlimited liability of the individual members of the partnership. In instances where debt exceeds the assets of the partnership, the individual partners are liable to the extent of their personal assets. Major commitments and some basic operating mechanisms should be made in writing and be reviewed and approved by all partners prior to starting the business since all are affected by the results.
- There can be occasions of misunderstanding, disagreement or mistrust that could lead to catastrophe for the firm. Hence transparency and accountability of the partners are the best means of prevention.

iii) *Limited Partnership*

The limited partnership is an association of general partners and limited partners to perform business. The general partners manage the business and have all the rights and liabilities of partners in the general partnerships form of ownership discussed earlier. The limited partners invest their money in the firm and receive a share of the profits, but their liability is limited to the amount of their investment as long as they do not involve in the control and management of the firm or attempt to interfere with such. Every limited partnership must have at least one general partnership that manages the business and is therefore subject to unlimited liability.

Advantage:

- Enables the firm to obtain risk free capital from limited partners who might otherwise not invest in the venture because of the unlimited liability implications.
- Characteristics of the ease and low cost formation and the personal incentives to succeed are retained.

Disadvantage:

- The limited partner, who invests in the firm but no voice in management decisions.

B. Profit-Oriented Corporations

The corporation constitutes a group of people organized to operate a business under a formalized charter granting them some of the legal rights and liabilities of an individual. Some of the major characteristics of a corporation are noted below:

- The owners of the corporation are stockholders who elect a board of directors charged with the responsibility of running the business,
- The profits from the operations are paid to the stockholders in the form of dividends as the board of directors declare,
- No requirements relative to the size. Small corporations may be owned by few stockholders, while large corporations are owned by a wide variety of individuals,
- The stockholders are not generally liable for the debts of the corporation. Their liability is usually limited to their investment and their personal asset cannot be taken by creditors to pay corporation debts,
- Shares of the stock, representing ownership of the corporation, can be freely transferred without the approval of other stockholders and without affecting the corporation as a whole.
- Double taxation takes place in corporate earnings. Corporate earnings are first subject to federal tax. After the remaining profit is distributed to the stockholders in the form of dividends, the stockholders in turn must pay income taxes on these dividends.
- Accountability and the business posture of the corporation are disclosed periodically through publicly available reports for the government and stockholders.

C Non-Profit Organizations

This includes government agencies, research and development organizations, universities and colleges with non-profit goals but having social, economical and political objectives. The federal and state government sponsor and direct numerous programs that require engineering expertise. In many instances, the responsible agencies accomplish conceptual design, preliminary system design, detailed design and various activities that require the involvement of many engineers.

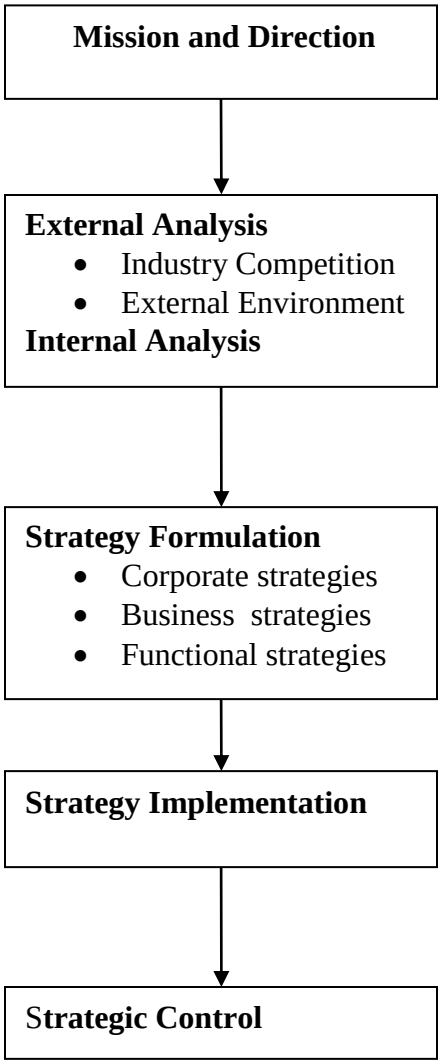
Highly qualified and special zed researchers and engineers are actively engaged in a wide variety of complex problems and projects. The orientation is towards accomplishing basic and applied research. The performance of system studies and analyses, the establishment of advanced design

concepts and in some instances the development of prototype equipment increases scientific and engineering knowledge and are made available to sponsors through the release of research reports.

4.3 Strategic Management

Strategy refers to top management's plans to develop and sustain competitive advantage towards organizations mission and goal. *Strategic management* is a broader term than strategy. It is the continuous process of determining the missions and goals of an organization within the context of its external environment that create opportunities and threats, its internal strengths, weaknesses, formulating and implementing strategies and exerting strategic control to ensure that the organization's strategies are successful in attaining its goals.

The strategic management process can be examined in six steps as shown in Fig 4.2.



***4.3.1 External Analysis*:** organization's strategic management should analyze the opportunities and threats that exist in the organization's external environment including industry competition and macro-environmental forces.

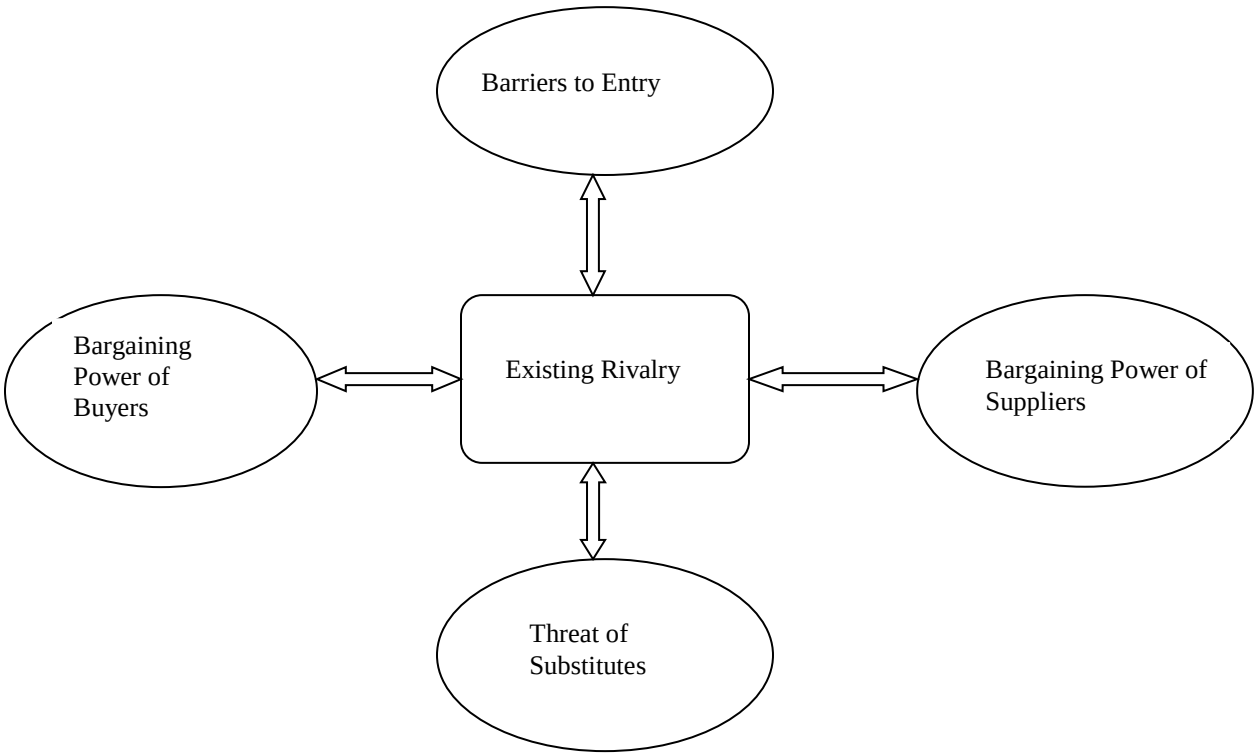
Industry Competition: / Micro Environmental Forces/

Each business operates among a group of companies that produce competing goods and services known as industry. For example the engineering consulting firms, suppliers and contractors are all categorized under the construction industry having its own set of "rules of combat" governing such issues as product and service quality, pricing and service delivery. It is important for the strategic managers to understand the structure of the industry in which their firms operate and identify their competitors prior to decide how to compete successfully.

It is important to clarify industry definition at the outset so that the macro-environmental forces (i.e. legal, social, economical and technological issues) that affect the operation of the firm are realistically assessed. In addition a firm's relative strengths and weaknesses can be classified as such only when compared to other companies in the industry.

Industry factors have been found to play a dominant role in the performance of many companies. Micheal Porter, a leading authority of industry analysis, proposed a systematic means of analyzing an industry's potential profitability known as Porter's five forces model. Accordingly profitability depends on five basic competitive forces, whose relative weight depends upon the type of the industry.

Fig 1-3: Porter's five forces model.



i) The intensity of rivalry among incumbent firms.

Competition intensifies when a firm identifies the opportunity to improve its position or senses competitive pressure from other businesses in its industry which can result in price wars,

advertising battles, new product introductions, modifications and even increased customer service or warranties. The intensity of competition depends on a number of interacting factors that include:

- Concentration of competitors. The number of companies in an industry or their relative size or power levels influences an industry's intensity of rivalry. Industries with few firms tend to be less competitive, but those with many firms that are relatively equivalent in size and power tend to be more competitive.
- High storage costs. When firms have unused capacity, they often cut prices in an effort to increase production and move toward full capacity.
- Lack of differentiation or low switching costs. The more similar the offerings among the competitors, the more likely customers are to shift from one to another. As a result such firms tend to engage in price competition. Switching costs are costs that buyers incur when they switch from one company's product or services to another. When products are less differentiated, purchase decisions are based on price and service considerations, resulting in greater competition.

ii) Threat of entry

An industry's productive capacity expands when new competitors enter. Unless the market is growing rapidly, new entrants intensify the fight for market share, lowering prices and ultimately industry profitability. Retaliation may occur on the new entrants if incumbent firms are committed to remain in the industry or have sufficient cash and productive capacity to meet anticipated customer demand in the future. New entrants often face the following barriers to enter the industry.

- Economies of Scale: the decline in unit cost of a product or service that occurs as the absolute volume of production increases. Economies of scale arises from a variety of factors,
    - high firm specialization and expertise
    - volume purchase discounts
- Brand Identity and Product Differentiation: Established firms may enjoy strong brand identification and customer loyalties that are based on actual or perceived product or service differences. New entrants incur substantial marketing and other costs over an extended period to overcome this barrier.
- Capital Requirements: Higher entry costs tend to restrict new competitors from entering the industry. These costs include: expenditure for production, facility construction, research and development, advertising, customer credit and inventories.

iii) Pressure from Substitute Products

Firms in one industry may be competing with firms in other industries that produce substitute products. These are offerings produced by firms in other industries that satisfy similar consumer needs but differ in specific characteristics. E.g. low fares offered by airlines can limit the price of

long-distance bus. Growth in the film industry may frustrate or limit the price of the Stage-Theater. Hence firms that operate in industries with few or no substitutes are more likely to be profitable.

iv) Bargaining Powers of Buyers

The buyers of an industry's output can lower the industry's profitability by bargaining for higher quality or more services and playing one firm against the other. Circumstances leading to bargaining power of buyer's:

- If a few buyer purchases a significant proportion of an industry's sales, then they wield considerable power over prices.
- The products that the buyers purchase are standard or undifferentiated. In such cases, buyers are able to play one seller against another and initiate price wars.
- When buyers have complete information. The more information the buyers have regarding demand, actual market prices and supplier costs, the greater the bargaining power.

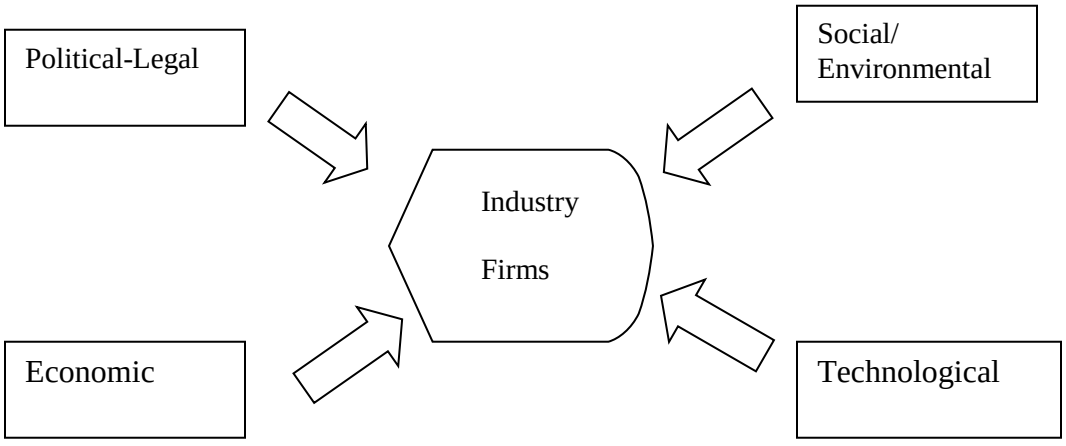
v) Bargaining Powers of Suppliers

Suppliers can extract the profitability out of an industry that is unable to recover cost increases by raising prices. Suppliers are powerful under the following circumstances:

- The supplying industry is dominated by one or a few companies
- There are no substitute products
- The suppliers' products are differentiated or have built-in switching costs there by reducing the buyers' ability to play one against another.

External Environment /Macro Environmental Forces/

The effects of external environment force on a firm's industry should be well understood before strategic options are evaluated. It is often termed as PEST Analysis.



i) Political/ Legal Forces: Depends on the industry but should include the effects of political and legal events which likely have on the industry in which the organization operates. Some key issues include:

- Legislations at all levels, legal framework for contract enforcement,
- Environmental regulations, safety regulations
- Tax laws,
- Consumer lending regulations,
- Outcomes of elections,
- International trade regulations and tariffs,
- Laws on hiring, firing, promotion and pay,
- Political stability, military invasion
- Favored trading partners

ii) Economic Forces:

a) The Gross Domestic Product (GDP) refers to the value of a nation's annual total production of goods and services.

- Consistent GDP growth implies healthy economy and increase in consumers spending on goods and services.
- GDP decline (Recession) results lower on consumer's spending and decrease in demands of goods and services.

b) Inflation Rates:

- High inflation rates imply negative effect on most businesses by raising cost of doing businesses. Governments often raise interest rates to slow down economy and reduce inflation.

c) Interest Rates:

- Short and long-term interest rates affect the demand for many products and services. At the corporate level interest rates influence strategic decisions related to financing.
- High interest rates dampen business plans to raise funds.
- Low interest rates promote capital expenditures on expansion and development.

d) Exchange Rates:

- When exchange rates get weaker: firms find themselves at a competitive advantage internationally. Consumers abroad may be inclined to purchase goods produce locally which are cheaper than goods produced abroad.
- When exchange rates are strong, manufacturers tend to locate more of their plants abroad and make purchases from foreign sources.

e) Others

- Type of economic system in countries of operation
- Government intervention in the free market
- Comparative advantages of host country
- Efficiency of financial markets
- Infrastructure quality
- Skill level of workforce

- Labor costs
- Discretionary income
- Unemployment rate

iii) Social Forces: Social forces include such factors as societal values, trends, decisions and religious practices and can substantially influence firm's performance. Societal values are concepts and beliefs that members of a society tend to hold in high esteem. Some of the social factors include the following:

- Demographics
- Class structure
- Education
- Culture (gender roles, etc.)
- Entrepreneurial spirit
- Attitudes (health, environmental consciousness, etc.)
- Leisure interests

iv) Technological Forces: Includes scientific improvements and innovations that create opportunities or threats for businesses. Examples are:

- Information Technology against brokers,
- Internet against transportation modes,
- Typewriter against computer.
- Technology's impact on product offering
- Impact on cost structure
- Impact on value chain structure
- Rate of technological diffusion

Technological change may dictate companies to shift from one product to another.

v) Environmental Forces: Environmental regulations may induce additional costs (social costs) to firms depending on the degree of the impacts it has with the environment.

- Tobacco producing company,
- Industries producing non-disposable items as a by product,
- Companies with industrial wastes such as green gas emissions.

4.3.2 Internal Analysis

The internal analysis is a comprehensive evaluation of the internal environment's potential strengths and weaknesses. Factors should be evaluated across the organization in areas such as:

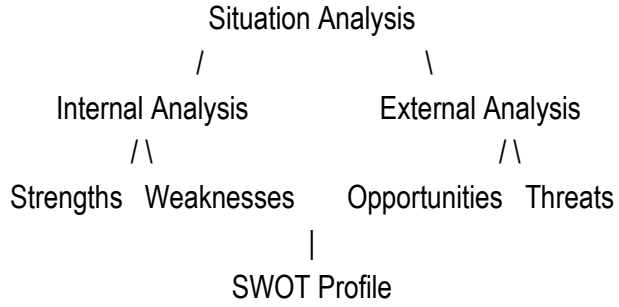
- Company culture
- Company image
- Organizational structure
- Key staff
- Access to natural resources
- Position on the experience curve

- Operational efficiency
- Operational capacity
- Brand awareness
- Market share
- Financial resources
- Exclusive contracts
- Patents and trade secrets

4.3.3 SWOT Analysis

SWOT analysis is a simple framework for generating strategic alternatives from a situation analysis. It is applicable to either the corporate level or the business unit level and frequently appears in marketing plans. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats.

The following diagram shows how a SWOT analysis fits into a strategic situation analysis.



The internal and external situation analysis can produce a large amount of information, much of which may not be highly relevant. The SWOT analysis can serve as an interpretative filter to reduce the information to a manageable quantity of key issues. The SWOT analysis classifies the internal aspects of the company as strengths or weaknesses and the external situational factors as opportunities or threats. Strengths can serve as a foundation for building a competitive advantage, and weaknesses may hinder it. By understanding these four aspects of its situation, a firm can better leverage its strengths, correct its weaknesses, capitalize on golden opportunities, and deter potentially devastating threats.

4.3.4 Strategic Formulation

Strategies exist at three levels in any organization: the corporate level, the business unit level and functional level strategy.

I) Corporate Level Strategy: The strategy that top management formulates for the overall corporation. At the corporate level, top management is charged with defining the corporate profile by identifying the specific business or industry in which the firm is operating. A firm has three basic alternatives at the corporate level:

- Growth,
- Stability,
- Retrenchment.

Growth Strategies: Seeks to significantly increase a firm's revenues market share. Growth may be attained in a variety of ways.

a) Internal Growth: is accomplished when a firm increases revenue, production capacity and its work force. Internal growth can occur by growing an existing business or creating new ones.
b) Horizontal Related Integration: a firm that acquires other companies in the same line of business is engaging in a process called horizontal integration. Doing so allows a firm operating in a single industry to grow rapidly without moving into other industries. Such growth can create scale economies for the firm, increase its negotiating leverage with suppliers and enable the firm to promote its goods and services to a large audience more effectively and efficiently.
c) Horizontal Related Diversification: A firm is engaging in horizontal related diversification when it acquires a business outside its present scope of operation, but with similar or related core competencies, the firm's key capabilities and collective learning skills that are fundamental to its strategy, performance and long term profitability. The purpose of horizontal related diversification is to create synergy (combination of two firms create higher efficiency) by transferring and sharing the capabilities among the various units.
d) Conglomerate (Unrelated) Diversification: When a corporation acquires a business in an unrelated industry to reduce cyclical fluctuations in cash flows or revenues. Diversifying into unrelated industries is primarily financially driven. It allows a firm to continue to grow even when its core business has matured. However firm managers often lack the expertise acquired to manage a myriad of unrelated businesses.
e) Vertical Integration: refers to merging various stages of activities in the distribution channel. Full integration occurs when a firm performs all activities ranging from the procurement of raw materials to the production of final outputs. When a firm acquires its suppliers, it is engaging in backward integration, whereas a firm acquiring its buyers is engaging in forward integration.

   Advantages:
   - It is possible to reduce costs by coordinating distribution activities among the business units.
   - It is easier to develop and maintain high quality when a single firm control all businesses owned by the same parent firm.

   Disadvantage:
   - It can reduce operational flexibility because the firm is heavily invested upstream and downstream,
   - Overhead costs may increase as the need and ability to coordinate activities among business units increases.

f) Mergers: A merger occurs when two or more firms, usually of similar sizes, combine into one through an exchange of stock. Mergers are generally undertaken to share or transfer resources and improve competitiveness by developing synergy.

g) Strategic Alliance (Partnership): occur when two or more firms agree to share the costs, risk and benefits associated with pursuing new business opportunities. Such arrangements include joint venture, license agreements, joint operations etc. Strategic alliance can be temporary; disbanding after the project is finished.

Stability Strategies: Although growth is intuitively appealing, it is not always the most effective strategy. A corporation may adopt stability strategy instead of growth strategy under the following circumstances:

- When industry growth is slow (at times of recession) and shift to a growth strategy when economic situations improve.
- Costs associated with growth do not exceed its benefits,
- When strategic managers feel that growth may place great constraints on quality and customer service.

Retrenchment /cutback/ Strategies: Growth and stability strategies are generally adopted by firms that are in satisfactory competitive position. But when performance is disappointing, a retrenchment strategy may be appropriate. This includes one of the following forms:

- Corporate Restructuring: Seeks to transform the corporation into more effective firm and includes such actions as eliminating unprofitable outputs, cutting assets, reducing the size of the work force, cutting costs of distribution, and reassessing the firm's product lines and customer groups.
- Divestment: cut down business units that drain resources from more profitable units, is not performing well, or is not synergistic with other corporate holdings.
- Liquidation: is the strategy of last resort, and terminates the business unit by selling its assets. Liquidation represents a divestment of all the firm's business units and should be adopted only under extreme conditions.
    - Shareholders and creditors experience financial losses,
    - Some of the managers and employees lose their job,
    - Community suffers from unemployment,
    - Decrease in tax revenues, etc.

ii) Business Unit Strategies: Addresses the competitive aspect - who the business should serve, what needs should be satisfied, and how a business should develop core competencies and be positioned so that the customer's need is satisfied. Strategic managers craft competitive strategies for each business unit and sustain competitive advantage, a state whereby its successful strategies cannot be easily duplicated by its competitors.

Although each business strategy is unique, strategies can be classified into a limited number of generic strategies based on their similarities. Selection of the generic approach is only the first step in formulating a business strategy. It is also necessary to adjust the strategy and put emphasis on the organization's unique set of resource strengths.

Generic Strategies based on Michael Porter's Typology.

Strategy Emphasis / Market	**Low-Costs**	**Differentiation**	**Low-cost & Differentiation**
Entire Market	Low-cost Strategy	Differentiation Strategy	Low-cost-Differ. Strategy
Niche	Focus-low-cost Strategy	Focus-Differentiation Strategy	Focus-low cost/ Differentiation Strategy

Low-cost Strategy: Large businesses that compete for a mass market composed of price-sensitive customers. They produce basic products or services and often succeed by building market shares through low prices.

Focus-Low-Cost Strategy: Emphasizes low overall costs while serving a narrow segment of the market, producing no-frills (basic) products or services for price sensitive customers in the market niche. Ideally the small business unit that adopts this strategy where it enjoys a cost advantage relative to large, low-cost competitors.

Differentiation Strategy: Businesses that employ the differentiation strategy produce and market to the entire industry products and services that can be readily distinguished from those of their competitors. Differentiated businesses often attempt to create new product and market opportunities and have access to the latest scientific break-troughs because technology and flexibility are key factors if firms are to initiate or keep pace with new developments in their industries.

Focus-Differentiation Strategy: Firms employing this strategy produce highly differentiated products and services for the specialized needs of a market niche. In general high prices are acceptable to certain customers who need product performance, prestige, safety or security especially when few businesses cater their needs. As such focus-differentiation is most appropriate when market demand is inelastic because high cost products are often required to support the specialized efforts to serve a limited market niche.

Low-Cost-Differentiation Strategy: Some scholars and practitioners suggest that implementing a low-cost-differentiation strategy is not feasible because differentiating a product generally costs a considerable amount of money. Others contend that the two approaches are not necessarily mutually explanatory. For example some businesses begin with a differentiation strategy and integrate low costs as they grow, developing economies of scale along the way. Others seek forms of differentiation that also provide cost advantages.

Focus-Low-Cost/ Differentiation Strategy: Business units that adopt this strategy produce highly differentiated products and services for the specialized needs of a selected group of customers while keeping their costs low. Businesses employing this strategy share all the characteristics of the previous strategy.

iii) Functional Strategies: The strategies pursued by each functional area of business unit. After corporate and business level strategies have been developed, strategies should be formulated at the business unit's functional levels, such as those of marketing, finance, production, purchasing, human resources and information systems. Managers in all functional units should work together to formulate functional strategies that fit together and support the business and corporate level strategies.

a) Marketing

Low-cost	Differentiation	Low-cost-Differentiation	
Pricing Strategy	compete with low Cost generic strategy Produce basic, common Outputs and often very Low prices	Emphasis on differentiated and quality products and relatively with higher prices	markets high quality products and services to meet the specialized needs of a relatively small market.
Promotional Strategy	Low-cost advertising and promotion	Advertising and promotion in the large scale.	Promotion on a large Scale but at a lower cost.
Service and Distribution Strategy	Distribution channels that meet the basic Needs of the target Market	Select the most appropriate means of distribution regardless of cost and may even use the means of Distribution as a way of Differentiating the business	Appropriate means of distribution but with low-cost.

b) Finance: The financial strategy addresses:

- Raising capita, means of securing finance
- Making investments
- Supervising and controlling the cash flow
- Participating in top decision making body on issues of finance.

Low-cost business pursue financial strategies that are intended to minimize their financial Costs. They place great emphasis

- to keep costs within their reserves.
- When borrowing necessary, tempt to do so when credit rates are low.

Differentiating businesses: pursue financial strategies that fund initiatives such as quality improvements and product research and development even when the cost of securing finance is kept very high.

c) Production: Low-cost business: Emphasize operation efficiencies through learning/skill, economies of scale, and capital labor substitution possibilities.
Differentiated businesses: Emphasize quality in operations even when the cost of doing is So high.
Low-cost differentiated: Emphasize quality in operation only when costs of doing are kept Low.

d) Purchasing Low-cost businesses: Purchase at low costs through quantity discounts. Operate storage and ware houses facilities and control inventory efficiency.
Differentiated businesses: purchase high quality inputs, even if they cost more. Conduct storage, warehouse and inventory activities with extensive care, even if costs are higher.
Low-costs-differentiated: purchase high quality inputs when costs are low.