



University of Nairobi

Department of Civil and Construction Engineering

FCE 372

ENGINEERING MANAGEMENT 1

LECTURE NOTES

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1 OVERVIEW

1.1 COURSE DESCRIPTION

Engineering management is a specialized form of management that is concerned with the application of engineering principles to business practice;

1.2 PREREQUISITE

None

1.3 IMPORTANCE OF THE COURSE

Engineers find themselves at a decision point typically within 3 to 7 years after graduation. They choose between the technical specialty and technical management route. According to various studies conducted, it is estimated that more than 75% of engineers choose the technical management route, and perform management tasks while maintaining identity in their technical specialties. Despite this phenomenon, engineers are rarely trained for management responsibilities. This course helps prepare engineers to assume managerial positions within their technical specialty areas.

Great deals of industrial executive's top corporate managers have engineering backgrounds. Today, several universities offer Engineering Management programs/concentrations at the undergraduate and/or graduate level.

1.4 IMPORTANCE OF THE COURSE

- To expose engineering students to managerial concepts and techniques used in the real world by Technical Managers, Project Directors, and other technically oriented management personnel.
- To do in-depth analysis of some case studies pertaining to engineering management functions.

1.5 TEACHING METHODOLOGY AND TECHNIQUES

This course relies on lectures and Power Point presentation by the lecturer. Tutorials will be offered. Students will then be required to contribute to discussions based on the explanations and will need to read the corresponding section in the assigned textbook.

1.6 REQUIRED TEXT BOOKS

- a) Engineering Management by B S, Dhillon, Technomic Publishing Co., 1987.
- b) Essentials Of Management by Joseph L. Massie, Prentice hall Publishing Co., 4th Edition.
- c) Managing Projects: A System Approach by Daniel D. Roman, Elsevier Science Publishing CO., 1986.
- d) Engineering Program Management by Hans J. Tharrihain, John Wiley & Sons, 1984.
- e) Engineering Management by D.I. Cleland and D. E Kocaoglu, McGraw-Hill, 1981.

2 PRINCIPLES OF MANAGEMENT PRACTICE

2.1 ENGINEERING

Definition;

Engineering is the profession in which a knowledge of the mathematical and natural sciences, gained by study, experience, and practice, is applied with judgment, to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind

Types;

1. Agricultural Engineering
2. Architectural Engineering
3. Bioengineering/Biomedical Engineering
4. Ceramic Engineering
5. Chemical Engineering
6. Civil Engineering
7. Computer Engineering
8. Electrical Engineering
9. Environmental Engineering
10. Fire Protection Engineering
11. Industrial Engineering
12. Manufacturing Engineering
13. Mechanic Engineering
14. Metallurgy and Materials Engineering
15. Mineral and Mining Engineering
16. Nuclear Engineering
17. Ocean Engineering
18. Transportation Engineering

2.2 MANAGEMENT

Definition;

The word “Management” originates from Old French *ménagement* “the art of conducting, directing”, and from Latin *manu agere* “to lead by the hand”)

Management characterizes the process of leading and directing all or part of an organization, often a business, through the deployment and manipulation of resources (human, financial, material, intellectual or intangible).

Areas of Management;

- Change management
- Communications management
- Constraint management
- Cost management
- Crisis management
- Customer relationship management
- Earned value management
- Engineering management
- Enterprise management

- Facility management
- Integration management
- Knowledge management
- Marketing management
- Micromanagement
- Pain management
- Perception management
- Procurement management
- Program management
- Project management
- Process management
- Product management
- Quality management
- Resource management
- Risk management
- Skills management
- Spend management
- Supply chain management
- Systems management
- Time management
- Stress management

2.3 ENGINEERING MANAGEMENT

Definition;

Engineering management is a specialized form of management concerned with the application in engineering, as a result of the unique personalities and technical nature of engineering.

Engineering management refers to the functional management of technical professionals. Example areas of engineering are product development, manufacturing, construction, design engineering, industrial engineering, technology, production, or any other field that employs personnel who perform an engineering function.

Successful engineering managers typically require training and experience in business and engineering. Technically inept managers tend to be deprived of support by their technical team, and non-commercial managers tend to lack commercial acumen to deliver in a market economy. Largely, engineering managers manage engineers who are driven by non-entrepreneurial thinking, thus require the necessary people skills to coach, mentor and motivate technical professionals.

Engineering professions joining manufacturing companies tend to become engineering managers over a period of time. They learn all the facets of management on job and often this process is slow and disoriented.

2.4 EVOLUTION OF MANAGEMENT THOUGHT

2.4.1 Approaches to Management

- Classical Approach
- Behavioral Approach
- Quantitative Approach
- Modern Approaches to Management

According to one school of thought, history has no relevance to the problems faced by managers today. Some are also of the opinion that management theory is too abstract to be of any practical use. However, both theory and history are indispensable tools for managing contemporary organizations.

Like most modern disciplines, contemporary management thought has its foundations in the history of management and the many significant contributions of theorists and practitioners. A theory is a conceptual framework for organizing knowledge that provides a blueprint for various courses of action. Hence, an awareness and understanding of important historical developments and theories propounded by early thinkers is important for today's managers.

2.4.2 Major Classification of Management Approaches and their Contributors

Table 2.1: *Major Classifications*

Major Classification of Management Approaches		Major Contributors
Classical approach	Scientific management	Frederick W. Taylor, Frank and Lillian Gilbreth and Henry Gantt
	Bureaucratic management	Max Weber
	Administrative management	Henri Fayol
Behavioral approach	Group influences	Mary Parker Follet
	Hawthorne studies	Elton Mayo
	Maslow's needs theory	Abraham Maslow
	Theory X and Theory Y	Douglas McGregor
	Model I versus Model II values	Chris Argyris
Quantitative approach	Management science	-
	Operations management	-
	Management information system	-
Modern approaches	The Systems Theory	-
	Contingency Theory	-
	Emerging approaches: Theory Z and Quality management	William Ouchi

2.5 HENRY FAYOL'S PRINCIPLES OF MANAGEMENT

Fayol developed theory of management. According to him managerial excellence is a technical ability and can be acquired. He developed theories and principles of management which are universally accepted and make him universalistic. He was pioneer of the formal education in management. Fayol's principles of management meet the requirements of modern management.

Henry Fayol, a french industrialist, offered fourteen principles of management for the first time in 1916. During the period of 1920-40 in the U.S. many authors did hard work in developing and testing various principles of management. Today, there is a very lengthy list of management principles and it is not possible to give an exhaustive lot of these management principles.

According to Fayol management was a separate and distinct skill from other business function. He also felt that management skills had been the most neglected aspect of business operations. Fayol developed fourteen general principals of managements. According to him these principles can be applied in all types, functions, levels and size of organizations. This had earned him the title of "UNIVERSALIST". For a long time Fayol's list was accepted on "Complete and Comprehensive". Following are the fourteen principles of management developed by the Henry Fayol:

- i. **Division of work: -**
This is the principle of specialization which applies to all kinds of work. The more people specialize the more efficiently they can perform their work. Specialization increases output by making employees more efficient.
- ii. **Authority and Responsibility: -**
According to Fayol responsibility is a corollary and a natural consequence of authority. Responsibility implies an obligation to perform the task in a satisfactory manner.
- iii. **Discipline: -**
Good discipline is the result of effective leadership a clear understanding between management and workers regarding the organization's rules and the judicious use of penalties for violation of the rules.
- iv. **Unity of Command: -**
Every employees should receive order and instruction from only one superior. Dual command is a perpetual source of conflict. If a person receives order from more than one superior, it would lead to confusion and chaos.
- v. **Unity of Direction: -**
This principle calls for one manager one plan for all operations having the same objectives. This principle when applied properly, ensure unity of action and facilitates coordination.
- vi. **Subordination of Individual Interest to the General Interests: -**
The interest of the organization is above the individual and the group. This can be achieved when manager set an example through their exemplary behaviour. They must be prepared to sacrifice their personal interest when ever such interest are in conflict with organizational interest.
- vii. **Remuneration: -**

Workers should be paid a fair wages for their service. The method of wage payment should provide maximum possible satisfaction to both employees and employer.

viii. **Centralization:-**

Everything that goes to increase the subordinate role is decentralization, everything which goes to reduce it is centralization. Whether decision making is centralized (to management) or decentralized (to subordinates) is a matter of proper proportion. The problem is to find the best amount of centralization in each case.

ix. **Scalar chain hierarchy: -**

The graded chain of authority from top to bottom through which all communication flow is formed the “Scalar Chain”.

x. **Order: -**

People and material should be in the right place at the right time. A place for everything and everything in its place.

xi. **Equity:-**

Manager should be both friendly and fair to their subordinates. Employees should be justice and kindness promotes better relation between employees and employer.

xii. **Stability of tenure of personnel: -**

Management must implement practice which encourages long term commitment of employees. Instability of tenure can significantly affect the fortunes of a company.

xiii. **Initiative: -**

Employees must be encouraged to think and implement a plan of action even through some mistake may result. The opportunity to perform independently is an essential component of employee growth and development.

xiv. **Spirit of Co-operation (Spirit de crops)**

This principle state that “Union is Strength”. Fayol defined esprit de corps as unity of effort through harmony of interest. Promoting team sprit will give the organization a sense of unity.

These fourteen principles were considered to be flexible and capable of meeting every managerial need. Fayol's contribution to management theory is unique and valuable. In fact he was the first management thinker who contributed substantially and brought respectability to management as a discipline. Undoubtedly, Fayol was the important management thinker who has presented the most lucid and highly systematic analysis of the management.

2.6 MODERN MANAGEMENT THEORY

The past thirty years witnessed a “Knowledge Explosion” in the field of managements. During this period management writer have been primarily concerned with integrating the findings of scientific management, principles of management and human relations movements. However two integrating trends have developed throwing adequate light on the dynamic nature of management namely: -

- **System Approach**
- **Contingency Approach**

These modern management theories considered all elements the whole organization as well as components parts. The organization is viewed as adaptive systems which must in order to survive adjust to environmental changes. The organization and its environment are seen as interdependent; each depends on the other for resources from scientific management, human relations. It is a background that furnishes a foundation for understanding Contemporary management theory and practice.

2.6.1 System Approach

A system in simple terms is a set of interrelated parts. It is a group of interrelated but separate elements working towards a common purpose. The arrangement of elements must be orderly, there must be proper communication facilitating interaction between the elements and finally the interaction should lead to achieve a common goal. The organization transforms input into a variety of outputs and offers the same to the external environment in the form of products good and services. Sale of the output provides the necessary energy (feedback) to the system cycle.

The system approach provides a unified focus to organizational efforts. A major contribution of the system approach results from its strong emphasis on the interrelatedness or mutuality of the parts of an organization. Another important benefit of system theory lies in its treatment of the organization as an open system. A close system imports something from the environment and exports something into the environment. The system theory of management is characterized by the following: -

(a) Dynamic: - Within the organization the process of interaction between subsystem is dynamic.

(b) Multilevel and Multidimensional: - It is micro within the nation's industrial network and it is macro with respect to its internal units. The modern manager is forced to recognize the importance of parts as well as the whole.

(c) Multimotivated: - Motivation is an extremely complex process and drawing simplistic equation is a futile exercise.

(d) Probabilistic: - Modern theory tends to probabilistic. "Statement in modern theory tends to be qualified with phrases such as "may be", in general" and usually" because modern theory recognizes that few predictive statement can be made with certainty.

(e) Multidisciplinary: - Modern theory of management is enriched by contribution from disciplines like sociology, psychology, economics, anthropology, ecology mathematics, operations research and so on.

(f) Descriptive:- Individual are free to select the objectives and the methods to improve organizational effectiveness.

(g) Multivariable: - There is no simple cause effect phenomenon in organizational activities. An event may be the product of many factors that are in turn interrelated and interdependent.

(h) Adaptive: - An organization and its environment are expected to rearrange their parts. Organization tries to cope with environment changes through the "feed back" mechanism. An organization must produce output acceptable to components in environment.

It is true that “System theory provides a broad Philosophical perspective that bridge academic disciplines and mounts integrated attack on a wide variety of problem”

2.6.2 Contingency Theory

In recent years especially after 1970 the word “contingency” has invaded the field of Management. One important contribution of contingency perspective may best be summed up in the statement that “there is no one best way to manage”. According to this approach the best way to lead, plan organize & conduct managerial activities varies with the situations. There are no plans, organization structure leadership style or control that will fit all situations. A manager trained in the contingency approach may offer a solution that is responsive to the characteristics of the total situation being faced. Organization characterized by the limited resources, unskilled labour force, limited training opportunities, limited products offered to local markets- work simplification would be ideal. Job enrichment programme would work better if the organization employs skilled labour force. Applying a contingency approach requires that managers diagnose a given situation & adapt to meet the conditions present. The strength of contingency theory rest on two points: -

- First it focuses attention on specific situation factors that influence the appropriateness of one managerial strategy over another.
- Second it highlights the importance to managers of developing skills in situational analysis. Such skills will help managers find out important contingency factors that influences their approach to managing.

The contingency approach is a useful instructional device in the sense that it compels us to be aware of the complexity in every situation and forces us to take an active and dynamic role in trying to determine what would work best in each case. It is said that the contingency approach is refreshing breeze in management literature that clears away the humanistic and general system fog. The contingency theory is concerned with achieving a “fit” between organization and its environment. The contingency approach dose not incorporates all aspects of system theory and hold that it is severely constrained by paucity of literature. Contingency theory is theoretically complex. The goal of integrating functional, quantitative behavioral and system approaches in the form of contingency model may prove to be too difficult to realize because of the incomplete development of the earlier approaches.

3 MANAGEMENT FUNCTIONS

3.1 INTRODUCTION

Management consists of the functions given below. It is based on Henri Fayol's thinking on the functions of management.

1. **Planning**
2. **Organizing**
3. **Staffing**
4. **Directing**
5. **Controlling**

3.2 THE FUNCTIONS OF MANAGEMENT

3.2.1 Planning

It is the basic function of management. It deals with chalking out a future course of action & deciding in advance the most appropriate course of actions for achievement of pre-determined goals. It bridges the gap from where we are and where we want to be. A plan is a future course of actions. It is an exercise in problem solving and decision making. Planning is determination of courses of action to achieve desired goals. Thus, planning is a systematic thinking about ways and means for accomplishment of pre-determined goals. Planning is necessary to ensure proper utilization of human and non-human resources.

3.2.2 Organizing

It is the process of bringing together physical, financial and human resources and developing productive relationship amongst them for achievement of organizational goals. According to Henry Fayol, "To organize a business is to provide it with everything useful or its functioning i.e. raw material, tools, capital and personnel's". To organize a business involves determining and providing human and non-human resources to the organizational structure. Organizing as a process involves:

- Identification of activities.
- Classification of grouping of activities.
- Assignment of duties.
- Delegation of authority and creation of responsibility.
- Coordinating authority and responsibility relationships.

3.2.3 Staffing

It is the function of manning the organization structure and keeping it manned. Staffing has assumed greater importance in the recent years due to advancement of technology, increase in size of business, complexity of human behavior etc. The main purpose of staffing is to put right man on right job i.e. square pegs in square holes and round pegs in round holes. Staffing involves:

- Manpower Planning (estimating man power in terms of searching, choose the person and giving the right place).
- Recruitment, selection & placement.
- Training & development.
- Remuneration.
- Performance appraisal.
- Promotions & transfer.

3.2.4 Directing

It is that part of managerial function which actuates the organizational methods to work efficiently for achievement of organizational purposes. It is considered life-spark of the enterprise which sets it in motion the action of people because planning, organizing and staffing are the mere preparations for doing the work. Direction is that inert-personnel aspect of management which deals directly with influencing, guiding, supervising, motivating sub-ordinate for the achievement of organizational goals. Direction has following elements:

- Supervision
- Motivation
- Leadership
- Communication

Supervision- implies overseeing the work of subordinates by their superiors. It is the act of watching & directing work & workers.

Motivation- means inspiring, stimulating or encouraging the sub-ordinates with zeal to work. Positive, negative, monetary, non-monetary incentives may be used for this purpose.

Leadership- may be defined as a process by which manager guides and influences the work of subordinates in desired direction.

Communications- is the process of passing information, experience, opinion etc from one person to another. It is a bridge of understanding.

3.2.5 Controlling

It implies measurement of accomplishment against the standards and correction of deviation if any to ensure achievement of organizational goals. The purpose of controlling is to ensure that everything occurs in conformities with the standards. An efficient system of control helps to predict deviations before they actually occur. Therefore controlling has following steps:

- Establishment of standard performance.
- Measurement of actual performance.
- Comparison of actual performance with the standards and finding out deviation if any.
- Corrective action.

4 STRUCTURES OF CONSTRUCTION BUSINESS

4.1 TYPES OF CONSTRUCTION PROJECTS

In the fields of architecture and civil engineering, **construction** is a process that consists of the **building** or assembling of infrastructure. Far from being a single activity, large scale construction is a feat of human multitasking. Normally, the job is managed by a project manager, and supervised by a construction manager / resident engineer, design engineer, construction engineer or project architect.

For the successful execution of a project, effective planning is essential. Those involved with the design and execution of the infrastructure in question must consider the environmental impact of the job, the successful scheduling, budgeting, construction site safety, availability of building materials, logistics, inconvenience to the public caused by construction delays, and bidding, etc.

In general, there are three types of construction:

- Building construction
- Heavy / civil construction
- Industrial construction

Each type of construction project requires a unique team to plan, design, construct, and maintain the project.

4.1.1 Building Construction

Building construction is the process of adding structure to real property. Building construction projects include some elements in common - design, financial, and legal considerations. Many projects of varying sizes reach undesirable end results, such as structural collapse, cost overruns, and/or litigation reason, those with experience in the field make detailed plans and maintain careful oversight during the project to ensure a positive outcome.

Building construction is procured privately or publicly utilizing various delivery methodologies, including hard bid, negotiated price, traditional, management contracting, construction management-at-risk and/or design & build

Construction practices, technologies, and resources must conform to local building authority regulations and codes of practice. Materials readily available in the area generally dictate the construction materials used (e.g. brick versus stone, steel versus timber). Cost of construction on a per square metre (or per square foot) basis for houses can vary dramatically based on site conditions, local regulations, economies of scale (custom designed homes are always more expensive to build) and the availability of skilled tradespeople. As residential (as well as all other types of construction) can generate a lot of waste, careful planning again is needed here.

4.1.2 Heavy / Civil Construction

Civil engineering deals with the design, construction and maintenance of the physical and naturally built environment, including works such as bridges, roads, canals, dams and buildings.

4.1.3 Industrial Construction

Industrial construction, though a relatively small part of the entire construction industry, is a very important component. Owners of these projects are usually large, for-profit, industrial corporations. These corporations can be found in such industries as medicine, petroleum, chemical, power generation, manufacturing, etc. Processes in these industries require highly specialized expertise in planning, design, and construction. As in building and heavy/highway construction, this type of construction requires a team of individuals to ensure a successful project.

4.2 CONSTRUCTION PROCESSES

4.2.1 Design and Construction Team

In the modern industrialized world, construction usually involves the translation of designs into reality. A formal design team may be assembled to plan the physical proceedings, and to integrate those proceedings with the other parts. The design usually consists of drawings and specifications, usually prepared by a design team including surveyors, civil engineers, cost engineers (or quantity surveyors), mechanical engineers, electrical engineers, structural engineers, and fire protection engineers. The design team is most commonly employed by (i.e. in contract with) the property owner. Under this system, once the design is completed by the design team, a number of construction companies or construction management companies may then be asked to make a bid for the work, either based directly on the design, or on the basis of drawings and a bill of quantities provided by a quantity surveyor. Following evaluation of bids, the owner will typically award a contract to the most cost efficient bidder.

4.2.2 Financial Advisors

Many construction projects suffer from preventable financial problems. Underbids ask for too little money to complete the project. Cash flow problems exist when the present amount of funding cannot cover the current costs for labour and materials, and because they are a matter of having sufficient funds at a specific time, can arise even when the overall total is enough. Fraud is a problem in many fields, but is notoriously prevalent in the construction field. Financial planning for the project is intended to ensure that a solid plan, with adequate safeguards and contingency plans, is in place before the project is started, and is required to ensure that the plan is properly executed over the life of the project.

Bankers, financial controllers and cost engineers are likely participants in creating an overall plan for the financial management of the construction project. The presence of the banker is highly likely even in relatively small projects, since the owner's equity in the property is the most obvious source of funding for a project. Financial controllers act to study the expected monetary flow over the life of the project, and to monitor the payouts throughout the process. Cost engineers apply expertise to relate the work and materials involved to a proper valuation. Cost overruns with

government projects have occurred when the contractor was able to identify change orders or changes in the project resulting in large increases in cost, which are not subject to competition by other firm as they have already been eliminated from consideration after the initial bid.

4.2.3 Legal Consideration

A construction project must fit into the legal framework governing the property. These include governmental regulations on the use of property, and obligations that are created in the process of construction.

The project must adhere to zoning and building code requirements. Constructing a project that fails to adhere to codes will not benefit the owner.

A construction project is a complex net of contracts and other legal obligations, each of which must be carefully considered. A contract is the exchange of a set of obligations between two or more parties, but it is not so simple a matter as trying to get the other side to agree to as much as possible in exchange for as little as possible. The time element in construction means that a delay costs money, and in cases of bottlenecks, the delay can be extremely expensive. Thus, the contracts must be designed to ensure that each side is capable of performing the obligations set out. Contracts that set out clear expectations and clear paths to accomplishing those expectations are far more likely to result in the project flowing smoothly, whereas poorly drafted contracts lead to confusion and collapse.

Legal advisors in the beginning of a construction project seek to identify ambiguities and other potential sources of trouble in the contract structure, and to present options for preventing problems. Throughout the process of the project, they work to avoid and resolve conflicts that arise. In each case, the lawyer facilitates an exchange of obligations that matches the reality of the project.

4.2.4 Interaction of Expertise

Design, finance, and legal aspects overlap and interrelate. The design must be not only structurally sound and appropriate for the use and location, but must also be financially possible to build, and legal to use. The financial structure must accommodate the need for building the design provided, and must pay amounts that are legally owed. The legal structure must integrate the design into the surrounding legal framework, and enforce the financial consequences of the construction process.

4.3 PROCUREMENT MODELS

Procurement is the acquisition of appropriate goods and/or services at the best possible total cost of ownership to meet the needs of the client in terms of quality, quantity and time. Procurement describes the merging of activities undertaken by the client to obtain a product. There are many different models of construction procurement; however the three most common types of procurement are:

- a) Traditional (Design-bid-build)
- b) Design and Build
- c) Management Contracting

There is also a growing number of new forms of procurement that involve relationship contracting where the emphasis is on a co-operative relationship between the principal and contractor and other stakeholders within a construction project.

4.3.1 Traditional

This is the most common method of construction procurement and is well established and recognized. In this arrangement, the architect or engineer acts as the project coordinator. His or her role is to design the works, prepare the specifications and produce construction drawings, administer the contract, tender the works, and manage the works from inception to completion. There are direct contractual links between the architect's client and the main contractor. Any subcontractor will have a direct contractual relationship with the main contractor.

This model uses three main mechanisms for determining a contract price:

- **lump sum contracts**, where the contract sum is largely determined before full construction starts;
- **Measurement contracts**, where the contract sum is not finalised until after completion by a re-measurement of the works on a previously agreed basis; and
- **Cost reimbursement contracts**, where the contract sum is determined on the actual cost of labour and materials, with an amount added to cover overheads and profit.

4.3.2 Design and Build

This approach has become more common in recent years and includes an entire completed package, including fixtures, fittings and equipment where necessary, to produce a completed fully functional building. In some cases, the Design and Build (D & B) package can also include finding the site, arranging funding and applying for all necessary statutory consents.

The owner produces a list of requirements for a project, giving an overall view of the project's goals. Several D&B contractors present different ideas about how to accomplish these goals. The owner selects the ideas he likes best and hires the appropriate contractor. Often, it is not just one contractor, but a consortium of several contractors working together. Once a contractor (or consortium/consortia) has been hired, they begin building the first phase of the project. As they build phase 1, they design phase 2. This is in contrast to a design-bid-build contract, where the project is completely designed by the owner, then bid on, then completed.

As design and construction may proceed in parallel, this could result in a shorter overall project timeframe. The client will have reasonable certainty over construction costs because the contract sum is known at the outset.

4.3.3 Management Procurement Systems

In this model, overall design is the responsibility of the client's consultants, while the contractor is responsible for managing the performance of the works through separate trade contracts.

The client appoints the consultants and prepares the project drawings, specifications and cost plan, and retains overall design control through its professional team.

As detailed design can proceed in parallel with construction work, the length of the project programme may be reduced.

However, there is no certainty over costs at the outset and works proceed on the basis of a contract cost plan. Final costs are not known until the last trade contract is let. Speculative risks lie largely with the client.

4.4 CONSTRUCTION CAREERS

There are many routes to the different careers within the construction industry which vary by country. However, there are three main tiers of careers based on educational background which are common internationally:

- **Unskilled and Semi-Skilled** - General site labour with little or no construction qualifications.
- **Skilled** - On-site managers who possess extensive knowledge and experience in their craft or profession.
- **Technical and Management** - Personnel with the greatest educational qualifications, usually graduate degrees, trained to design, manage and instruct the construction process.

Skilled occupations require further education qualifications, often in vocational subject areas. These qualifications are either obtained directly after the completion of compulsory education or through "on the job" apprenticeship training.

Technical and specialized occupations require more training as a greater technical knowledge is required. These professions also hold more legal responsibility. A short list of the main careers with an outline of the educational requirements are given below:

- **Architect** - Typically holds a degree in architecture.
- **Civil Engineer** - Typically holds a degree a civil engineering.
- **M&E Engineer** - typically holds a degree in mechanical or electrical engineering..
- **Project Manager** - Typically holds a greater higher education qualification, but are often also qualified in another field such as quantity surveying or civil engineering.
- **Quantity Surveyor** - Typically holds a master's degree in quantity surveying.
- **Structural Engineer** - Typically holds a bachelors degree in structural engineering,

4.5 CONTRACTOR BUSINESS STRUCTURES

One of the first steps you will need to take when starting a contracting business is to determine how to structure your business. There are a few choices out relating mostly to taxes and legal considerations. It's good to know the options before choosing one.

4.5.1 Sole Proprietorship

A sole proprietorship is the easiest business structure to set up. The sole proprietor owns all the assets and profits brought in by the business, and the sole proprietor also "owns" all the debt and liability. For tax and legal purposes, the business and the individual who is sole proprietor are considered the same entity. So, if the business gets sued, you as the sole proprietor are getting sued, and all your personal assets can be at risk. This is one of the most important considerations that needs to be made. If you run a contractor business that involves risky work, your chances of getting sued might be high. So a sole proprietorship might not be the way to go.

4.5.2 Partnership

Many contracting businesses choose to establish as a partnership. When two people start a business together, the benefits of a shared work-load-which includes decision-making can seem appealing. Getting a business up and running always seems more possible when there's someone else helping out. But a partnership takes serious advanced planning. There needs to be an agreement written up that addresses who makes what decisions, defines roles and commitments, and determines how the business profits will be split up. A written agreement will help keep the business running smoothly.

4.5.3 Corporation

Establishing as a corporation means the business is an entity separate from those who own and/or run it. As an owner, you are a shareholder, and you assume limited liability. You must have an elected board of directors who meet and oversee policy-making and enforcement. Setting up a corporation is a bit of a chore compared to the sole proprietorship and partnership options, and the tax filing process is more complicated. Corporations do have the benefit of raising capital through stock sales, and ownership in a corporation is easy to transfer to someone else.

4.5.4 Limited Liability Company (LLC)

The LLC combines features from both the sole proprietorship and corporation structures. In an LLC, the owner is a member, and receives liability protection similar to a corporation set-up. There are more flexible profit distribution options in an LLC, and earnings are considered "pass-through" profits, only getting taxed on the individual owner's tax form. Set-up is easier than incorporating, though it is still more work than a sole proprietorship or a partnership. There will be fees and paperwork, and certain counties have regulations mandating operating agreements similar to a partnership.

5 CONSTRUCTION ACCOUNTING METHODS

5.1 ACCOUNTING METHODS

There are two main accounting methods that construction companies use to record revenue and expenses. One is called the completed contract method and the other is called the percentage of completion method. They are very different from each other and the one you choose can dramatically affect your business.

5.1.1 Completed Contract Method

In the completed contract method, only completed projects are reflected in the income statement. Costs for uncompleted projects are accumulated in an asset account called Work in Progress. The principal advantage of the completed contract method is that reported revenue is based on final results rather than estimates of unperformed work. The major disadvantage is that it does not reflect current performance when the period of the contract extends into more than one accounting period.

If you only worked on a KShs. 1,000,000 project in a year and did not complete that project until January of the following year, no revenue would be shown on the income statement for that year. If in the following year another contract for KShs. 500,000 was started and completed, the revenue on the income statement for that second year would be KShs. 1,500,000 which is all the revenue from both projects covering the two-years.

The disadvantages of this method

- Income statement does not reflect what is happening from day to day. Year one looked as if no sales occurred.
- Does not supply swift financial feedback of uncompleted projects.
- Financial reports would not reflect a significant loss on a project until it was closed, which might not be until the following year.
- Several jobs significantly over-budget could cause cash flow problems that require immediate action. Finding out after the project is completed may be too late and jeopardize your relationship with customers, bankers and subcontractors.

5.1.2 Percentage Completion Method

Revenues and gross profit are recognized each period based upon the progress of the construction, i.e., the percentage of completion. To determine the percentage of completion of a project, simply divide actual costs by estimated costs. Calculating the amount of revenue to claim for the year is determined by multiplying the percentage of completion by the contract price.

The advantages of this method

- The financial statements reflect what is happening on the ground. Monthly statements, if prepared, would precede the completed contract method by several months or more.
- With current information on hand, management could take immediate corrective actions to minimize losses.

5.2 MISCONCEPTIONS

Some contractors think that their financial statements will look better to bankers and investors under the completed contract method. Not always. If you closed KShs. 5,000,000 of projects in year one, but only KShs. 3,000,000 in projects in year two, it appears that sales are down 40%. It may be that sales are really up because you have several large and profitable projects in progress. The percentage of completion method would reflect this rise in sales. In most cases, bankers are quite familiar with the effects of both the completed contract and percentage of completion methods on financial statements.

5.3 FINANCIAL STATEMENTS AND THEIR USERS

A **financial statement** (or **financial report**) is a formal record of the financial activities of a business. The basic objective of financial statements is to communicate useful and meaningful information that meets the needs of the users of the financial statements.

5.3.1 Qualitative characteristics

Qualitative characteristics of useful and meaningful financial statements are:

- **Understandability** – financial statements that are unduly complicated can send up a red flag to banks, surety companies and potential investors; transparency is key to success in today's business environment.
- **Relevance** – financial statements provide feedback on a company's performance (normally over 1 to 5 years) and are used by banks and surety companies to predict the future success of a company; timeliness of the preparation of financial statements is also important as outdated information may not be useful to users in assessing a bond or loan application.
- **Reliability** – financial statements are management's responsibility and to be reliable, representational faithfulness is key – the substance of a transaction must be consistent with how it is presented in the financial statements; the underlying transactions in financial statements must normally be verifiable to an economic event and neutral or free from bias;
- **Comparability** – financial statements that are comparable allow users to compare a company to another similar company or to compare a company's performance over a period of time; both are techniques used by banks, surety companies and potential investors to evaluate a company's performance.

5.3.2 Financial information

Financial statements provide financial information at a point in time and changes to assets, liabilities and equities covering a certain time. The following makes up a set of traditional financial statements:

- **Balance sheet** (a statement of financial position at a specific date, including assets, liabilities and equity);
- **Income statement** (a statement of operations covering a period such as a month, quarter or year, showing revenues, expenses, income taxes, gains/losses, net income/loss);

- **Statement of changes in retained earnings** (changes in retained earnings from the previous period, adding in net income/loss for the year and deducting dividends);
- **Statement of changes in cash flow** (changes in cash balances from the previous period, which shows sources and uses of cash); and
- **Notes to the financial statements**, which provide additional information for users for clarification purposes.

5.3.3 Internal users

Internal user such as management, owners and shareholders of private companies rely on financial statements to:

- Assess the appropriateness of the company's policies (pricing, credit, payment) to improve profitability and evaluate success by comparing its financial benchmarks to those of its competitors; for example, gross profit comparisons to industry standard (note that these are more meaningful if everyone in the industry prepares their financial information in the same way).
- Determine net income after taxes, which results from recognizing revenue when it has been earned and matching the corresponding expenses against that revenue in the same period; this enables management to determine how profitable the company was in a given year and measure return on equity invested.
- Measure the company's true growth from year to year.

5.3.4 External users

External users such as potential partners, investors or shareholders rely on financial statements to:

- Assess the financial health of a company and its ability to generate long term returns on investment, including a risk premium reflecting the nature of the industry; for example, a private company may want to grow without adding debt by admitting another partner or shareholder, or an owner may want to sell the company as a going concern and retire.
- Assess the company's exposure to liability through lawsuits.

5.3.5 Other external users

External users such as banks and surety companies rely on financial statements to:

- Assess the credit worthiness of the contractor, as well as ongoing credit worthiness once the initial position is established (i.e. credit risk);
- Determine the price for which lines of credit, long term debt and surety bonds will be offered (i.e. premiums, interest rates);
- Determine the terms and conditions (set out in covenants) and security requirements based on an overall assessment of risk (i.e. financial risk);
- Assess the company's exposure to foreign exchange fluctuations which may negatively impact net income (exchange risk); and
- Assess overall company liquidity and its ability to handle any difficult situations that may arise.
- Determine the debt load or bonding capacity that a potential customer can carry and ability to service debt and meet its obligations (i.e. liquidity risk);

5.4 CONCLUSION

Through an in-depth review of a contractor's financial statements, a bank assesses the company's ability to consistently maintain positive cash flow, collect its receivables, pay its employees and suppliers and meet its obligations to the government and other creditors.

Surety companies do the same, as they want to ensure that a contractor can meet its obligations while waiting for progress payments to be made to them on a contract. A surety or guarantee, in finance, is a promise by one party (the guarantor) to assume responsibility for the debt obligation of a borrower if that borrower defaults. The person or company that provides this promise, is also known as a surety or guarantor. A surety bond is a promise to pay one party a certain amount if a second party fails to meet some obligation, such as fulfilling the terms of a contract. Surety companies want to see that a contractor has adequate lines of credit to finance (multiple) contracts for which they are providing surety bonds. Surety companies and banks also assess a company's profitability as compared to others in the same industry, the stability of historical profits and the company's capacity to grow and be profitable.

5.5 AUDIT, REVIEW AND COMPILATION ENGAGEMENT

5.5.1 Audit Engagement

An audit engagement is conducted by a professionally accredited public accountant, who is required to be completely independent of the company's management, owners or shareholders and Board of Directors and hence be objective. The public accountant is required to follow auditing standards.

The auditor's objective is to express an opinion on whether the company's financial statements present fairly, in all material respects, the financial position, results of operations and cash flows in.

In performing audit procedures, the auditor seeks a high level of assurance that the financial statements are free of material misstatement, as a result of fraud or error.

Absolute assurance is not attainable in an audit because the auditor does not audit 100% of a company's transactions and there are also limitations in the quality of audit evidence, a need to place some reliance on management representations and a need to make professional judgments pertaining to management's estimates.

Audit procedures however, are rigorous and are targeted to areas of risk, and the auditor keeps management's biases in mind.

Audit procedures include;

- physical inspection of assets to confirm existence,
- observation and documentation of client procedures,
- confirmation from external parties and
- examination of documents supporting various assets and liabilities on the balance sheet.

Audited financial statements, therefore, have the highest degree of credibility among surety companies, banks and other external users of the financial statements.

5.5.2 Review Engagements

Review engagements are distinguishable from audits in that the level of assurance provided by the professionally accredited public accountant is lower. Review procedures consist primarily of enquiry, analytical procedures and discussion related to information supplied by the company.

The objective of a review engagement is to assess whether the information being reported on is plausible.

“Plausible information” is generally that which appears to be worthy of belief based on the information obtained by the public accountant from company's management.

Financial statements, which have been “reviewed” by a public accountant normally, have some credibility among the external users of the financial statements. This however, is based primarily on the credibility of the public accountant and the perceived independence from the company subject to the review. Therefore, contractors are encouraged to utilize the services of professionally accredited public accountants. Contractors should discuss the need for an audit versus a review with their bank and surety company.

5.5.3 Compilation Engagements

The objective of a compilation engagement is to compile unaudited financial information into financial statements, schedules or reports based on information supplied by the client.

A compilation engagement provides the lowest level of assurance to users of the financial statements. The public accountant simply compiles the financial statements of a company from information provided by the company's management and attaches a “notice to reader” outlining the scope of the work conducted.

5.6 LINES OF CREDIT, BANK LOANS AND LONG TERM DEBT

Liabilities are classified as current when they are payable within one year or within the normal operating cycle of the business when that is longer. Current liabilities normally include:

- a line of credit with a bank or financial institution;
- a demand bank loan;
- the current portion of long term debt; and

Examples of long term debt include a bond, debenture, an equipment loan or a mortgage against real property. Bank debt may also be classified as long term, when a maturity date beyond one year is set by a banking agreement.

The general disclosure requirements for debt include:

- the interest rate;
- the currency;
- the maturity date of the debt;
- the amount and timing of any scheduled principal repayments;
- if the loan is secured and type of security (for example, a personal guarantee by a shareholder, pledging of cash or accounts receivable, a mortgage against real property); and
- any conditions which if breached would change the terms of the debt.

Where an asset is pledged as security against liabilities, the nature and carrying amount of the asset needs to be disclosed. This information will be of interest to the surety company. Interest on short term and long term debt also needs to be disclosed separately on the income statement.

5.7 BOOK-KEEPING

5.7.1 What is Book-keeping?

Bookkeeping is the process of recording and classifying business financial transactions, or to put it another way, the process of maintaining the records of a business's financial activities. The objective in bookkeeping is to create a useable summary of financial transactions, which provides a snapshot of the business's financial stability.

5.7.2 Types of Book-keeping Systems

The most basic form of accounting is the single-entry system. In this system, you record each transaction only once, as either a deposit or as an expense. This system is generally used to determine the profit/loss of a business.

However, the preferred system is the double-entry system. The double-entry system is more accurate, and has built-in checks and balances. In this system, each transaction is recorded twice, in each "account" it affects. This is a more thorough method of keeping a business's financial transaction in order.

5.7.3 Basic Elements of Book-keeping

There are three basic elements of book-keeping: assets, liabilities, and net assets.

- **Assets** are all items used in the operation or investment activities of a business. This category includes all property, or items of value, owned by a business. Examples include cash, buildings, land, plant, equipments, vehicles, tools, inventory, office supplies, furniture, investments, and accounts receivable (any funds owed to the business). Increases in assets are called debits. Decreases in assets are called credits. Generally, various assets are referred to as debit accounts.
- **Liabilities** are claims by creditors to the assets of a business, or debts owed by the business to others. Types of liabilities include loans, notes payable, and lines of credit.
- **Net assets** are the equity earned by the business. Net assets are the value of the business once all liabilities have been paid. It can also be called owner's equity, capital, net worth, profit, or proprietorship.

Increases in liabilities or net assets are called credits, and decreases in liabilities or net assets are called debits. Generally, a company's liabilities and net assets are referred to as credit accounts.

There are also several other things to keep in mind when considering a company's net assets:

- Revenue is the increase in net worth resulting from the operations and other activities of the business. Revenue includes income earned through the business's

services, interest earned on investments, and contributions from individuals or foundations.

- Expenses are the costs of doing business. This includes the cost of goods, fixed assets, and services/supplies used in the business's operations. Examples of expenses include salaries, rent, travel expenses, and the costs of supplies and utilities. Expenses are credit accounts.

Net assets are calculated by subtracting total expenses from total revenue, on a yearly basis. Whenever revenue is received, net assets increase. Whenever expenses are paid, net assets decrease.

5.7.4 The Book-keeping Equation

The basic elements of book-keeping can be expressed in a simple equation:

$$\text{Assets} = \text{Liabilities} + \text{Net Assets}$$

In other words, the property of a business must be equal to the claims against that property. A bookkeeper wants to track not only the properties acquired by the business, but also how those properties were acquired and from whom.

Another way to think of this equation, which is helpful when considering bookkeeping documents, is:

$$\text{Assets} - \text{Liabilities} = \text{Net Assets}$$

5.7.5 Types of Business Transactions

All business transactions result in at least two changes to the bookkeeping equation. In other words, a transaction that changes a business's assets must also change that business's liabilities or net assets.

Some transactions increase accounts. If a business's assets increase, then there must also be an increase in either liabilities or net assets.

For example, Business X has KShs. 5,000,000 worth of assets, which is equal to KShs. 2,000,000 worth of liabilities plus KShs. 3,000,000 worth of net assets.

$$\begin{array}{rclcl} 5,000,000 & = & 2,000,000 & + & 3,000,000 \\ (\text{Assets}) & = & (\text{Liabilities}) & + & (\text{Net assets}) \end{array}$$

Business X then borrows KShs. 2,000,000 from the Bank. This is a liability, because it is a debt owed to the Bank. The transaction could be expressed thus:

$$\begin{array}{rclcl} 5,000,000 & = & 2,000,000 & + & 3,000,000 \\ 2,000,000 & = & 2,000,000 & + & 0 \\ \hline 7,000,000 & = & 4,000,000 & + & 3,000,000 \end{array}$$

Later, Business X receives a 5,000,000 grant. This is a new asset, as it is an item of value now owned by the business. The new equation would be:

7,000,000	=	4,000,000	+	3,000,000
5,000,000	=	0	+	5,000,000
12,000,000	=	4,000,000	+	8,000,000

Other transactions can decrease accounts. If a business's assets decrease, so must either its liabilities or its net assets.

Business X decides to pay back half of the amount it owes the Bank (1,000,000). The new equation is:

12,000,000	=	4,000,000	+	8,000,000
1,000,000	=	1,000,000	+	0
11,000,000	=	3,000,000	+	8,000,000

We can illustrate double entry book-keeping with the following sample transactions:

- If a company borrows 1,000,000 from its bank, the company debits its Cash account for 1,000,000 and credits its Notes Payable account for 1,000,000.
- When a company records wages for hourly employees, it debits Wages Expense and credits Wages Payable.
- If a company makes a sale "on credit," it debits Accounts Receivable and credits Sales.

6 FEASIBILITY STUDIES OF CIVIL ENGINEERING PROJECTS

6.1 DEFINITION

A feasibility study is an analysis and evaluation of a proposed project to determine if it

- (1) is technically feasible,
- (2) is feasible within the estimated cost, and
- (3) will be profitable.

Feasibility studies are almost always conducted where large sums are at stake.

6.2 TYPES OF FEASIBILITY STUDIES

6.2.1 Technical Feasibility

In technical feasibility the following issues are taken into consideration.

- Whether the required technology is available or not
- Whether the required resources are available

Once the technical feasibility is established, it is important to consider the monetary factors also. Since it might happen that developing a particular system may be technically possible but it may require huge investments and benefits may be less. For evaluating this, economic feasibility of the proposed system is carried out.

6.2.2 Economic Feasibility

For any project if the expected benefits equal or exceed the expected costs, the project can be judged to be economically feasible. In economic feasibility, cost-benefit analysis is done in which expected costs and benefits are evaluated. Economic analysis is used for evaluating the effectiveness of the proposed system.

In economic feasibility, the most important is cost-benefit analysis. As the name suggests, it is an analysis of the costs to be incurred in the project and benefits derivable out of it.

If the benefits outweigh the costs, then the decision is made to design and implement the proposed project.

6.2.3 Operational Feasibility

Operational feasibility is mainly concerned with issues like whether the proposed project will be used if it is developed and implemented. Whether there will be resistance from users that will affect the possible application benefits.

6.2.4 Legal Feasibility

What are the legal implications of the project? What sort of ethical considerations are there? You need to make sure that any project undertaken will meet all legal and ethical requirements before the project is on the table.

6.3 COST-BENEFIT ANALYSIS

6.3.1 Overview

Cost-benefit analysis (CBA) is a method of evaluating the net economic impact of a public project. Projects typically involve public investments, but in principle the same methodology is applicable to a variety of interventions, for example, subsidies for private projects, reforms in regulation, new tax rates etc. The aim of CBA is to determine whether a project is desirable from the point of view of social welfare, by means of the algebraic sum of the time-discounted economic costs and benefits of the project.

The technique used is based on:

1. Forecasting the economic effects of a project.
2. Quantifying them by means of appropriate measuring procedures.
3. Monetizing them, wherever possible, using conventional techniques for monetizing the economic effects.
4. Calculating the economic return, using a concise indicator that allows an opinion to be formulated regarding the performance of the project.

CBA estimates the net present value (NPV) of the decision by discounting the investment and returns. Though employed mainly in financial analysis, a CBA is not limited to monetary considerations only. It often includes those environmental and social costs and benefits that can be reasonably quantified.

6.3.2 The Purpose of the Technique

The justification for an investment project tallies with the feasibility and economic performance.

The objective of a feasibility study is to find out if an information system project can be done, and if so, how. A feasibility study should tell management:

- Whether the project can be done;
- What are alternative solutions?
- What are the criteria for choosing among them?
- Is there a preferred alternative?

After a feasibility study, management makes a go/no-go decision.

6.3.3 Identifying Costs

In order to successfully identify all potential costs of a project, one must follow the subsequent steps.

1. Make a list of all monetary costs that will be incurred upon implementation and throughout the life of the project. These include start-up fees, licenses, production materials, payroll expenses, user acceptance processes, training, and travel expenses, among others.
2. Make a list of all non-monetary costs that are likely to be absorbed. These include time, lost production on other tasks, imperfect processes, potential risks, market saturation or penetration uncertainties, and influences on one's reputation.

3. Assign monetary values to the costs identified in steps one and two. To ensure equality across time, monetary values are stated in present value terms. If realistic cost values cannot be readily evaluated, consult with market trends and industry surveys for comparable implementation costs in similar businesses.
4. Add all anticipated costs together to get a total costs value.

6.3.4 Identifying Benefits

The next step is to identify and quantify all benefits anticipated as a result of successful implementation of the proposed action. To do so, complete the following steps.

1. Make a list of all monetary benefits that will be experienced upon implementation and thereafter. These benefits include direct profits from products and/or services, increased contributions from investors, decreased production costs due to improved and standardized processes, and increased production capabilities, among others.
2. Make a list of all non-monetary benefits that one is likely to experience. These include decreased production times, increased reliability and durability, greater customer base, greater market saturation, greater customer satisfaction, and improved company or project reputation, among others.
3. Assign monetary values to the benefits identified in steps one and two. Be sure to state these monetary values in present value terms as well.
4. Add all anticipated benefits together to get a total benefits value.

6.4 SELECT EVALUATION METHOD

When all the financial data have been identified and broken down into cost categories, the analyst selects a method for evaluation.

There are various analysis methods available. Some of them are following.

1. Discounted cash flow method; Present Value and Net Present Value analysis
2. Payback analysis
3. Break-even analysis

6.4.1 Discounted Cash Flow Analysis (DCF)

Discounted Cash Flow is a cash flow summary adjusted to reflect the time value of money. DCF can be an important factor when evaluating or comparing investments, proposed actions, or purchases. Other things being equal, the action or investment with the larger DCF is the better decision. When discounted cash flow events in a cash flow stream are added together, the result is called the **Net Present Value (NPV)**.

A. Present Value analysis:

It is used for long-term projects where it is difficult to compare present costs with future benefits. In this method cost and benefit are calculated in term of today's value of investment. What future money is worth today is called its **Present Value (PV)**. The right to receive a payment one year from now for KShs. 100 (the future value) might be worth to us today KShs. 95 (its present value). Present value is **discounted** below future value.

$$PV = \frac{F}{(1+i)^n}$$

- n - the time of the cash flow
- i - the discount rate (the rate of return that could be earned on an investment in the financial markets with similar risk.)
- F - the Future Value at time n, or the net cash flow (the amount of cash, inflow minus outflow) at time n

Example 6.1:

Present value of \$3,000 invested at 15% interest at the end of 5th year is calculates as;

$$P = 3,000 / (1 + 0.15)^5$$

$$= 1,491.53$$

Table 6.1 shows present value analysis for 5 years

Table 6.1: *Present value analysis*

Year	Estimation Future Value	Present Value	Cumulative present Value of Benefits
1	3,000	2,608.69	2,608.69
2	3,000	2,268.43	4,877.12
3	3,000	1,972.54	6,949.66
4	3,000	1,715.25	8,564.91
5	3,000	1,491.53	10,056.44

B. Net Present Value (NPV)

The sum of all PVs is the net present value.

Net Present Value= Sum of all PVs

What NPV means

NPV is an indicator of how much value an investment or project adds to the firm. With a particular project, if F is a positive value, the project is in the status of discounted cash inflow in the time of t. If F is a negative value, the project is in the status of discounted cash outflow in the time of t. Appropriately risked projects with a positive NPV could be accepted.

If...	It means...	Then...
NPV > 0	the investment would add value to the firm	the project may be accepted
NPV < 0	the investment would subtract value	the project should be rejected

	from the firm	
NPV = 0	the investment would neither gain nor lose value for the firm	We should be indifferent in the decision whether to accept or reject the project. This project adds no monetary value. Decision should be based on other criteria, e.g. strategic positioning or other factors not explicitly included in the calculation.

Example 6.2: Comparing Competing Investments with NPV

Consider two competing investments. Each calls for an initial cash outlay of KShs. 100M and each returns a total of KShs. 200M over the next 5 years making net gain of KShs. 100M. But the timing of the returns is different, as shown in the table below (Case A and Case B), and therefore the present value of each year's return is different. The sum of each investment's present values is called the Discounted Cash flow (DCF) or Net Present Value (NPV). Using a 10% discount rate again, we find:

Timing	CASE A		CASE B	
	Net Cash Flow	Present Value	Net Cash Flow	Present Value
Now	– 100.00	– 100.00	– 100.00	– 100.00
Year 1	60.00	54.54	20.00	18.18
Year 2	60.00	49.59	20.00	16.52
Year 3	40.00	30.05	40.00	30.05
Year 4	20.00	13.70	60.00	41.10
Year 5	20.00	12.42	60.00	37.27
Total	Net CF_A = 100.00	NPV_A = 60.30	Net CF_B = 100.00	NPV_B = 43.12

Comparing the two investments, the larger early returns in Case A lead to a better net present value (NPV) than the later large returns in Case B. Note especially the Total line for each present value column in the table. This total is the net present value (NPV) of each "cash flow stream." When choosing alternative investments or actions, other things being equal, the one with the higher NPV is the better investment.

Example 6.3

A corporation must decide whether to start a new project. The new product will have startup costs, operational costs, and incoming cash flows over six years. This project will have an immediate ($t=0$) cash outflow of KShs.100M (which might include machinery, and employee training costs). Other cash outflows for years 1–6 are expected to be KShs. 5M per year. Cash inflows are expected to be KShs. 30M each for years 1–6. All cash flows are after-tax, and there are no cash flows expected after year 6. The required rate of return is 10%. The present value (PV) can be calculated for each year:

Year	Cash flow	Present value
T=0	$\frac{-100}{(1+0.10)^0}$	-100
T=1	$\frac{30-5}{(1+0.10)^1}$	22.737
T=2	$\frac{30-5}{(1+0.10)^2}$	20.661
T=3	$\frac{30-5}{(1+0.10)^3}$	18.783
T=4	$\frac{30-5}{(1+0.10)^4}$	17.075
T=5	$\frac{30-5}{(1+0.10)^5}$	15.523
T=6	$\frac{30-5}{(1+0.10)^6}$	14.112

The sum of all these present values is the net present value, which equals KShs. 8.882M. Since the NPV is greater than zero, it would be better to invest in the project than to do nothing, and the corporation should invest in this project.

Example 6.4

Suppose a firm is considering an investment of \$300,000 in an asset with a useful life of five years. The firm estimates that the annual cash revenues and expenses will be \$140,000 and \$40,000, respectively. The annual depreciation based on historical cost will be \$60,000. The required rate of return on a project of this risk is 13%. The marginal tax rate is 34%. The 13% required rate of return is a nominal required return including inflation.

(a) What is the NPV of this project?

- b) Suppose the firm has forgotten that revenues and expenses are likely to increase with inflation at a 5% annual rate. Recalculate the NPV. Is this a more attractive proposal now that inflation has been taken into account?

NB: The marginal tax rate is the rate on the income earned.

Solution (a)

Calculate the after-tax cash flows:

(DCF) or Net Present Value (NPV). Using a 10% discount rate again, we find:

Timing	Year 1	Year 2	Year 3	Year 4	Year 5
Cash Revenue	140,000	140,000	140,000	140,000	140,000
Cash Expenses	40,000	40,000	40,000	40,000	40,000
Depreciation	60,000	60,000	60,000	60,000	60,000
Taxes Paid	13,600	13,600	13,600	13,600	13,600
After-tax Cash	86,400	86,400	86,400	86,400	86,400

Calculate the PV of the cash flows:

$$PV(13\%) = \frac{86,400}{(1.13)} + \frac{86,400}{(1.13)^2} + \dots + \frac{86,400}{(1.13)^5}$$

The PV of the cash flows is \$303,889. The initial outlay is \$300,000 so the NPV of the project is \$3,889.

Solution (b)

Calculate the after-tax cash flows:

Timing	Year 1	Year 2	Year 3	Year 4	Year 5
Cash Revenue	147,000	154,350	162,068	170,171	178,679
Cash Expenses	42,000	44,100	46,305	48,620	51,051
Depreciation	60,000	60,000	60,000	60,000	60,000
Taxes Paid	15,300	17,085	18,959	20,927	22,954
After-tax Cash	89,700	93,165	96,804	100,624	104,634

Calculate the PV of the cash flows:

$$PV(13\%) = \frac{89,700}{(1.13)} + \frac{93,165}{(1.13)^2} + \frac{96,804}{(1.13)^3} + \frac{100,624}{(1.13)^4} + \frac{104,634}{(1.13)^5}$$

The PV of these cash flows is \$337,938. With the initial outlay of \$300,000, the NPV is \$37,938. The project is far more attractive now.

NB: The marginal tax rate is the rate on the income earned.

7 ECONOMICS OF DIRECT LABOUR CONSTRUCTION

The client uses his own workforce to carry out construction. This gives the client full control of the work and flexibility to alter it. However, with no competition on prices, costs can be high unless management of the work is efficient.

Direct labour construction was common for works in Britain and for all sizes of projects overseas until the 1950s. It has continued overseas where sufficiently experienced local contractors are not available. Local authorities and public utilities in the UK continued to use direct labour for such as re-surfacing roads, constructing minor roads, laying water mains or sewers, etc. until the 1980s when the government required such jobs be opened to competition from contractors.

Direct labour construction can be undertaken by consulting engineers on behalf of the promoter. The consultants hire the necessary labour and plant, and order the necessary materials, using money provided by the promoter. This procedure was widely adopted up to the 1950s for projects in the UK and overseas, and can still be used now. It was used on some works for raising the Essex side of the Thames tidal defences 1974–1984. Given a small team of engineers and some skilled foremen to guide local labour under a resident engineer with strong managerial capacities, direct labour under the control of a consulting engineer has often been notably successful in keeping a project to time and budget.

8 CIVIL ENGINEERING CONTRACTS

8.1 DEFINITION

A contract is a legally enforceable agreement between two or more parties. The core of most contracts is a set of mutual promises. The promises made by the parties define the rights and obligations of the parties.

Contracts are enforceable in the courts. If one party meets its contractual obligations and the other party doesn't ("breaches the contract"), the nonbreaching party is entitled to receive relief through the courts.

8.2 ELEMENTS OF A CONTRACT

The first step in a contract question is always to make sure that a contract actually exists. There are certain elements **that must** be present for a legally binding contract to be in place.

a) Offer

An offer: an expression of willingness to contract on a specific set of terms, made by the offeror with the intention that, if the offer is accepted, he or she will be bound by a contract.

b) Acceptance

Acceptance: an expression of absolute and unconditional agreement to all the terms set out in the offer. It can be oral or in writing. The acceptance must exactly mirror the original offer made.

c) Counter-offer

A counter-offer is not the same as an acceptance. A counter-offer extinguishes the original offer: you can't make a counter-offer and then decide to accept the original offer!

A counter-offer is when a person would like to accept an offer but on different terms than those set out in the original offer. Again, there has to be an acceptance of the counter-offer for there to be a contract.

d) Request for information

A request for information is not a counter-offer. If you ask the offeror for information or clarification about the offer, that doesn't extinguish the offer; you're still free to accept it if you want.

e) Invitation to treat

Is an invitation for other people to submit offers. Some everyday situations which we might think are offers are in fact invitations to treat:

NB: an offer can be revoked at any time before it is accepted, so long as you inform the person you made the offer to that the offer no longer stands.

f) Consideration:

Consideration is the concept of legal value in connection with contracts. It is anything of value promised to another when making a contract. It can take the form of money, physical objects, services, promised actions, abstinence from

a future action and much more. Each party to the contract must receive something of value.

This is best illustrated by an example: Suppose I promise to give you my watch, but you don't give me anything in return. If I break my promise and keep my watch, you can't then go to court and make me give it to you. The contract isn't legally binding: you didn't give me any consideration for my promise.

So put simply, consideration is the price paid for the other's promise.

g) Intention to create legal relations

If the parties make an agreement without any intention of being legally bound then that agreement will not be regarded by the courts as a contract. In commercial agreements there is a presumption that the parties intend the agreement to be legally binding. To rebut this presumption a party will have to produce clear evidence to that effect.

8.3 FORMATION OF A CONTRACT

In order to create an enforceable contract there must be an offer from one person (the offeror) asking another person (the offeree) to do or not do something. There needs to be an acceptance of this offer by the other person (the offeree). And lastly, there needs to be payment of some kind (consideration) for the benefit that is gained from the contract. Consideration is different from a gift or donation as these two types of payments do not ask for a benefit in return, for example if you decide to give KShs. 10,000 to an animal charity then you are not entering into a contract with the charity, they cannot ask anything of you and you cannot ask anything in return from them. Also, consideration does not have to be money. It can consist of products or the performance of a service.

8.4 TYPES OF CIVIL ENGINEERING CONTRACTS

- a) Item rate contract
- b) Percentage rate contract
- c) Lumpsum contract
- d) Labour contract
- e) Materials supply contract
- f) Piece-Work agreement
- g) Cost plus percentage rate contract
- h) Cost plus fixed fee contract
- i) Cost plus fluctuating fee contract
- j) Target contract

8.4.1 Item rate contract

For this contract, contractors are required to quote rates for individual items of work on the basis of schedule of quantities furnished by the client's department.

8.4.2 Percentage rate contract

In this form of contract, the client's department draws up the schedule of items according to the description of items sanctioned in the estimate with quantities, rates, units and amounts shown therein.

8.4.3 Lump sum contract

In this form of contract, contractors are required to quote a fixed sum (lumpsum amount) for execution of a work complete in all respects i.e., according to the drawings, design and specifications supplied to them with the tender within the specified time.

8.4.4 Labour contract

This is a contract where the contractor quotes rates for the item work exclusive of the elements of materials which are supplied by the client's Department.

8.4.5 Material supply contract

In this form of contract, the contractors have to offer their rates for supply of the required quantity of materials, inclusive of all local taxes, carriage and delivery charges of materials to the specified site within the time fixed in the tender.

8.4.6 Piece-Work contract

As the name signifies the piece-work agreement, it is that for which only a rate is agreed upon without reference to the total quantity of work to be done or the quantity of work to be done within a given period.

8.4.7 Cost plus percentage rate contract

In tendering for work on a "Cost Plus" basis, the contractor is paid the actual cost of the work, plus an agreed percentage in addition, to allow for profit.

8.4.8 Cost plus fixed rate contract

In this type of contract, the contractor is paid by the owner an agreed lump-sum amount over and above the actual cost of work.

8.4.9 Cost plus fluctuating fee contract

In this type of contract, the contractor is paid by the owner the actual cost of construction plus an amount of fee inversely variable according to the increase or decrease of the estimated cost agreed first by both the parties.

8.4.10 Target contract

This is the type of contract where the contractor is paid on a cost-plus percentage work performed under this contract. In addition, he receives a percentage plus or minus on savings or excess effected against either a prior agreed estimate of total cost or a target value arrived at by measuring the work on completion and valuing at prior agreed rates.

9 CONTRACT DOCUMENTS

The contract documents are all documents which, when combined, forms the basis of the contract. A possible list of documents that makeup the contract documents include:

- 1. Agreement** - The agreement to be used by the contracting officer (owner) and the contractor. The most essential part of the contract documents.
- 2. General Conditions** - This contract document will define the obligations and rights on how to execute the project.
- 3. Special Conditions** - This is usually an extension of the contract and to the general conditions. This part must specify specific conditions and clauses to each particular project or job.
- 4. Bill of Quantities** - This is formed by the list of diverse trades, and materials included that form part of the construction. Sometimes this document is not required by the contracting officer.
- 5. Drawings** - All set of drawings that form part of the job to be performed. These drawings are usually the latest drawings and must be received by the contractor prior to the date of commencement. It must include all drawings from consultants, and will constitute the entire project being contracted.
- 6. Specifications** - The technical requirement to complete, execute and/or perform every little task or material being incorporated in the construction projects. It will add intelligence to the construction drawings; specify common standards, deviations accepted, materials accepted and the required testing for all materials. Usually, specifications are composed by referencing construction standards and codes.
- 7. Schedules / Programme of Works** - The construction schedule is an important piece of the document. In this part, the contracting office will know how and when the project will be completed. Sometimes, construction contracts will require updated schedules throughout the construction progress, and might form part of the monthly, or agreed term, application for payments.
- 8. Pricing Schedules or Cash Flow Estimate** - Breakdown of all items being incorporated in the construction project. This is usually the base of the application for payment. It can be detailed per item or in a lump sum form, not specifying individual items.
- 9. Insurances** - This part will be an essential part to the contracting officer, since, it will provide the guarantee to the owner that the contractor has the means and the economic backup to perform the construction contract. It will include specific types of coverage's, required bonding, and all insurance protections to the owner, the contractor and third parties.

10 TENDERING PROCEDURE

10.1 OVERVIEW

The word Tender refers to a sealed bid or offer document submitted in response to a request for tenders and containing detailed information on requirements and terms associated with a potential contract at a specified cost.

The word Tenderer or Bidder refers to a person or company that puts forward or submits a sealed bid containing an estimate of cost and other requirements.

Tendering Procedure presents a systematic approach for tendering and awarding of contracts for construction projects. It is intended to assist the employer/engineer to receive sound competitive tenders in accordance with the tender documents so that they can be quickly and efficiently assessed.

The FIDIC Tendering Procedure provides the opportunity and incentive to contractors to respond easily to invitations to tender for projects which they are qualified to implement. The adoption of this procedure minimizes tendering costs and ensures that all tenderers receive a fair and equal opportunity to submit their offers on a reasonable and comparable basis.

The procedure is related to FIDIC's Conditions of Contract for Works of Civil Engineering Construction (Red Book) and Conditions of Contract for Electrical and Mechanical Works (Yellow Book), but can be readily adapted to any acceptable contract form.

Experience has shown that for projects involving international tendering, prequalification is desirable since it enables the employer/engineer to establish the competence of companies subsequently invited to tender. It is also in the interest of contractors since, if prequalified, they will know that they are competing against a limited number of other firms, all of whom possess the required competence and capability.

The procedure is suitable for tendering for most international construction works, but it may be adapted to suit the particular requirements occasioned by the size and complexity of a project, and any special conditions imposed by the established procedures of the employer or the financing institutions. It reflects good current practice. FIDIC recommends its use by employers, engineers, contractors and others involved in the international construction industry.

Postqualification is an assessment made by the Employer after the evaluation of bids and immediately prior to award of contract, to ensure that the lowest-evaluated, responsive, eligible bidder is qualified to perform the contract in accordance with previously specified qualification requirements.

- a) **Prequalification** is an assessment made by the Employer of the appropriate level of experience and capacity of firms expressing interest (Expression of Interest) in undertaking a particular contract, before inviting them to bid.

A responsible bidder is a contractor qualified on the basis of:

- is able to comply with the associated legal or regulatory requirements
- is able to deliver according to the contract schedule
- has a history of satisfactory performance
- has good reputation regarding integrity

- has or can obtain necessary data, equipment, and facilities, and
- is otherwise eligible and qualified to receive award if its bid is chosen.

10.2 BREAKDOWN OF FIDIC TENDERING PROCEDURE

1.0 Project Strategy

Establishment of Procurement Method and Form of Tendering 1.2 Preparation of Programme

2.0 Prequalification of Tenderers

2.1 Preparation of Prequalification Documents

2.2 Invitation to Prequalify

2.3 Issue and Submission of Prequalification Documents

2.4 Analysis of Prequalification Applications

2.5 Selection of Tenderers

2.6 Notification of Applicants

3.0 Obtaining Tenders

3.1 Preparation of Tender Documents

3.2 Issue of Tender Documents

3.3 Visit to Site by Tenderer

3.4 Tenderers' Queries

3.5 Addenda to Tender Documents

3.6 Submission and Receipt of Tenders

4.0 Opening of Tenders

4.1 Opening of Tenders

5.0 Evaluation of Tenders

5.1 Review of Tenders

5.2 Tenders containing Deviations

5.3 Adjudication of Tenders

5.4 Issue of Letter of Acceptance

6.0 Award of Contract

6.1 Issue of Letter of Acceptance

6.2 Performance Security

6.3 Preparation of Contract Agreement

6.4 Notification of Unsuccessful Tenders

11 CIVIL ENGINEERING ETHICS

11.1 INTRODUCTION

Engineering Ethics is the field of applied ethics which examines and sets standards for engineers' obligations to the public, their clients, employers and the profession.

Engineering does not have a single uniform system, or standard, of ethical conduct across the entire profession. Ethical approaches vary somewhat by discipline and jurisdiction, but are most influenced by whether the engineers are independently providing professional services to clients, or the public if employed in government service; or if they are employees of an enterprise creating products for sale.

11.2 PROFESSIONAL AND CHARTERED ENGINEERS

Professional engineers (Chartered Engineers) are distinct from other engineers in that they have obtained some form of license, charter, or registration from a government agency or charter-granting authority acting on their behalf. As such they are subject to regulation by these bodies, as are other regulated professions.

Professional and chartered engineers enjoy significant influence over their regulation. They are often the authors of the pertinent codes of ethics used by some of these organizations. These engineers in private practice often, but not always, find themselves in traditional professional-client relationships in their practice. Engineers employed in government service find themselves on the other side of the same relationship.

Engineers in industry, sometimes termed "graduate engineers" hold a Bachelor's degree, are not formally accredited by government agencies. Their professional relationships are much more likely to be employee-employer relationships.

11.3 CODE OF ETHICS

Many engineering professional societies have prepared codes of ethics. Some go back to the early decades of the twentieth century.

11.4 FUNDAMENTAL PRINCIPLES

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

1. using their knowledge and skill for the enhancement of human welfare and the environment;
2. being honest and impartial and serving with fidelity the public, their employers and clients;
3. striving to increase the competence and prestige of the engineering profession; and
4. supporting the professional and technical societies of their disciplines.

11.5 FUNDAMENTAL CANONS

1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development³ in the performance of their professional duties.

2. Engineers shall perform services only in areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession.
7. Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

11.6 WHISTLEBLOWING

11.6.1 Definition

The disclosure by a person, usually an employee in a government agency or private enterprise, to the public or to those in authority, of mismanagement, corruption, illegality, or some other wrongdoing.

A basic ethical dilemma is that an engineer has the duty to report to the appropriate authority a possible risk to others from a client or employer failing to follow the engineer's directions. An engineer may be disciplined, or have their license revoked, even if the failure to report such a danger does not result in the loss of life or health.

In many cases, this duty can be discharged by advising the client of the consequences in a forthright matter, and assuring the client takes the engineer's advice. However, the engineer must ensure that the remedial steps are taken and, if they are not, the situation must be reported to the appropriate authority. In very rare cases, where even a governmental authority may not take appropriate action, the engineer can only discharge the duty by making the situation public. As a result, whistleblowing by professional engineers is not an unusual event, and courts have often sided with engineers in such cases, overruling duties to employers and confidentiality considerations that otherwise would have prevented the engineer from speaking out.

11.6.2 Examples of problems that might warrant whistle-blowing

- Incompetence
- Criminal Behavior
- Unethical Policies
- Threat to Public Safety
- Injustices to Workers

11.6.3 Moral guidelines to Whistle-blowing

It is morally permissible for engineers to engage in external whistle-blowing concerning safety:

1. If the harm that will be done by the product to the public is serious and considerable
2. If they make their concerns known to their superiors

3. If getting no satisfaction from their immediate superiors, they exhaust the channels available within the corporation, including going to the board of directors.
4. He or she must have documented evidence that would convince a reasonable, impartial observer that his [or her] view of the situation is correct and the company policy wrong.
5. There must be strong evidence that making the information public will in fact prevent the threatened serious harm

12 TUTORIALS

GROUP 1, 2 and 3

Read the case carefully and answer the questions given at the end.

XYZ Manufacturing Ltd is a busy PVC Windows and Ceiling Manufacturing Plant. Being a self-contained plant, it has its own workshop in order to take care of regular maintenance work for its freight and manufacturing equipments. The plant functions in two shifts a day. The workers have been grouped into two groups, i.e., Relay 'A' and 'B'. The shift routine changes once a week, Sunday being the weekly holiday.

The Relay 'A', consisting of 50 workers is placed under the charge of Mr. Muthu, who is a graduate in mechanical engineering. After undergoing training for a period of six months in various divisions in PVC windows manufacturing, he acquired a thorough knowledge of works to be undertaken by the Plant. After being a Relay Supervisor for 3 years, he was promoted to the post of Team Leader, who is the shift-in-charge. When he joined the plant, he found that the tasks were done with the application of thumb-rules and higher officers had to be satisfied with such a quality of work.

Mr. Muthu, on witnessing this, started to instruct his workers in various theoretical aspects of manufacturing and maintenance, which he had studied in his college. They all highly appreciated the skill and techniques he had taught. The workers now learnt to do things in a better way, thus, gaining the confidence of workers. As he was able to finish his work in time and in a better way than Relay 'B', more work orders were allotted to his group. A few workers in Relay B started to grumble and one of the Muthu's Foremen came and told him that the "other relay workers do not have much work load and our workers too do not want to strain much and they are murmuring over getting more work." Muthu, however, convinced the Foreman that extra work should be taken as a credit and recognition, and they should do their best. After this had happened some workers even tried to get transferred to Relay A.

One morning, Muthu was making arrangements for the work to be taken and was giving instructions to his foreman. One worker called Kamau from Relay A came and told him that one of their colleague's father had passed away and that they all wanted to attend the funeral. He added that it was customary for the men in the workshop to attend such funerals and the shift-in-charge had to arrange for a means of transport. Since Muthu joined the company, it was the first such instance occurring and as he had to finish some urgent work orders, he told Kamau that he shall allow a small section of Relay A group to leave for the funeral. However he regretted that he will not arrange for their transport. Mr. Muthu's decision created turbulence among the workers and a group of workers stopped work and started demanding that they be allowed to attend the funeral or else they stop work in the coming shifts.

On learning of the new development, Muthu told his Foreman,

"I have given you an alternative and I have already told you the urgency of work and I am going to allocate the work as per planning schedule. If the work is not done, I may have to take action against you."

Then the group of workers started discussing among themselves as to what to do next. One worker came forth and said,

"You are not considerate enough on human matters and if you are still adamant we may prefer half-a-day wages cut as we must go and attend the funeral. Anyhow you have to make arrangements for our transport."

Muthu at this instance noted that a small group, who were usually complaining about the workload, was keenly interested in the affair. He decided to face the situation as a matter of prestige. He issued the gate pass to whoever wished to go, still emphasizing that he would not arrange any means of transport. Nearly 25 per cent of the workers remained and the others left for the funeral.

On that day, Muthu could finish only a part of the work as planned and he had to explain what had happened in his Relay, to his boss.

When he came the next morning, it was rumored that only a few of the workers attended the funeral and the others had gone to the cinema theatre near the village. Muthu got irritated by the workers' behavior and started writing memos to those who had received the gate pass the previous day. Some workers got annoyed by this action of Muthu and approached the union to intervene. The news had spread to other divisions and there was an air of protest at all places in the Plant.

Discussion

A. GROUP 1

What is your view of the action taken by Mr. Muthu ?

B. GROUP 2

What are the weakness and strong points, as you consider, of Mr. Muthu as a Manager?

C. GROUP 3

How would you have tackled the situation, if you were Mr. Muthu ?

GROUP 4

Scientific management was a classical approach of management analyzed and synthesized workflows. Its main objective was improving economic efficiency, especially labor productivity. The core ideas of the theory were developed by Frederick Winslow Taylor in the 1880s and 1890s. Discuss this management approach.

GROUP 5

Managers perform certain activities or duties as they effectively and efficiently coordinate the work of others. In the early part of the twentieth century, a French industrialist named Henri Fayol first proposed that all managers perform five functions: planning, organizing, commanding, coordinating, and controlling. In the mid-1950s, a management text book first used the functions of planning, organizing, staffing, directing and controlling as a framework. Today, most management text books still continue to be organized around the management functions, although they have been condensed to four basic and very important ones: planning, organizing, leading, and controlling. Discuss what each of these management functions encompasses.

GROUP 6

Views on management have changed substantially over the past century. Discuss the history of management thoughts.

GROUP 7

There was a recent survey carried out that indicated that major companies are less likely to include engineers on their board of directors, preferring instead to recruit from HR, financial, marketing and legal professions, arguing that Engineers don't become good managers?

GROUP 8

Discuss Tasks, Roles, Skills and Responsibilities of a Professional Manager

GROUP 9

Read the case carefully and answer the questions given at the end.

The ABC Manufacturing Company is a metal working plant under the direction of a plant manager who is known as a strict disciplinarian. One day a foreman noticed Njenga, one of the workers, at the time-clock punching out two cards, his own and the card of Kamau, a fellow worker. Since it was the rule of the company that each man must punch out his own card, the foreman asked Njenga to accompany him to the Personnel Director, who interpreted the incident as a direct violation of a rule and gave immediate notice of discharge to both workers. The two workers came to see the Personnel Director on the following day. Kamau claimed innocence on the ground that he had not asked for his card to be punched and did not know at the time that it was being punched. He had been offered a ride by a friend who had already punched out and who could not wait for him to go through the punch-out procedure. Kamau was worried about his wife who was ill at home and was anxious to reach home as quickly as possible. He planned to take his card to the foreman the next morning for reinstatement, a provision sometimes exercised in such cases. These circumstances were verified by Njenga. He claimed that he had punched Kamau's card the same time he punched his own, not being conscious of any wrongdoing. The Personnel Director was inclined to believe the story of the two men but did not feel he could reverse the

action taken. He recognized that these men were good workers and had good records prior to this incident. Nevertheless, they had violated a rule for which the penalty was immediate discharge. He also reminded them that it was the policy of the company to enforce the rules without exception.

A few days later the Personnel Director, the Plant Manager, and the Sales Manager sat together at lunch. The Sales Manager reported that he was faced with the necessity of notifying one of their best customers that his order must be delayed because of the liability of one department to conform to schedule. The department in question was the one from which the two workers had been discharged. Not only had it been impossible to replace these men to date, but disgruntlement over the incident had led to significant decline in the cooperation of the other workers. The Personnel Director and the Sales Manager took the position that the discharge of these two valuable men could have been avoided if there had been provision for considering the circumstances of the case. They pointed out that the incident was costly to the company in the possible loss of a customer, in the dissatisfaction within the employee group, and in the time and money that would be involved in recruiting and training replacements. The Plant Manager could not agree with this point of view. "We must have rules if we are to have efficiency; and the rules are no god unless we enforce them. Furthermore, if we start considering all these variations in circumstances, we will find ourselves loaded down with everybody thinking he is an exception." He admitted that the grievances were frequent but countered with the point that they could be of little consequence if the contract agreed to by the union was followed to the letter.

Questions

- (a) Identify the core issues in the case
- (b) Place yourself in the position of the Personnel Director. Which of the following courses of action would you have chosen and why?
 - (i) Would you have discharged both men?
 - (ii) Would you have discharged Njenga only?
 - (iii) Would you have discharged Kamau only?
 - (iv) Would you have discharged neither of them?Justify your choice of decision.
- (c) What policy and procedural changes would you recommend for handling such cases in future?

GROUP 10

Read the case Read the case carefully and discuss the questions given at the end.

PK Mills manufactures woolen clothes. Over the years, it has earned an envious reputation in the market. People associate PK Mills with high quality woolen garments. Most of the existing employees have joined the company long back and are nearing retirement stage. The process of replacing these old employees with younger ones, drawn from the nearby areas, has already begun. Recently, the quality of the garments has deteriorated considerably. Though the company employs the best material that is

available, the workmanship has gone down. Consequently, the company has lost its customers in the surrounding areas to a great extent. The company stands, in the eyes of general public, depreciated and devalued. The production manager, in a frantic bid to recover lost ground, held several meetings with his staff but all in vain. The problem, of course, has its roots in the production department itself. The young workers have started resisting the bureaucratic rules and regulations vehemently. The hatred against regimentation and tight control is total. The old workers, on the verge of retirement, say that conditions have changed considerably in recent years. In the days gone by, they say, they were guided by a process of self-control in place of bureaucratic control. Each worker did his work diligently and honestly under the old set-up. In an attempt to restructure the organizational set-up, the managers who have been appointed afterwards brought about radical changes. Workers under the new contract had very little freedom in the workplace. They are expected to bend their will to rules and regulations. Witnessing the difference between the two 'cultures' the young workers, naturally, began to oppose the regulatory mechanism devised by top management. The pent-up feelings of frustration and resentment against management, like a gathering storm, have resulted in volcanic eruptions leading to violent arguments between young workers and foremen on the shop-floor. In the process production has suffered, both quantitatively and qualitatively. The production manager in an attempt to weather out the storm is seriously thinking of bringing about a radical change in the control process that is prevailing now in the organization.

Questions:

- (a) What are the core issues in the case?
- (b) Do you agree with the statement "The problem, of course, has its roots in the production department itself"? Reason out your stand.
- (c) Critically evaluate the finding that old workers complain and new workers too resist any type of control.
- (d) What type of control system would you suggest to the company to improve production?

GROUP 11**Read the case carefully and discuss**

"Hiring talent is perhaps not as difficult as is retaining and keeping them motivated. While favorable image of an organization may attract someone to get in, at the same time it is also crucial for the employees to find appreciation for and satisfaction from their work." Elaborate this statement and critically discuss the underlying issues.

GROUP 12**Read the case carefully and discuss**

Cost – Benefit Analysis may be applied for a highway improvement project during feasibility studies such as the extension and widening of Thika Road all the way into the Central Business District. The four-lane highway which carried the commuter traffic into Nairobi did not have interchange lanes and rampant accident scenes led to the labeling

of some section as “**blood spots**”. The improvement of the highway would lead to more capacity which produces time saving and lowers the risk. But inevitably there will be more traffic than was carried by the old highway.

Thika Road Scope of Works

A. Nairobi – Thika Highway Improvement Works –

This component involves:

- The provision of additional capacity through construction of additional lanes (from four-lane to a six/eight-lane highway),
- The construction of services roads to segregate through traffic from local traffic;
- The construction of traffic interchanges at six (6) locations to replace the existing roundabouts at Pangani, Muthaiga, GSU, Kasarani, Githurai, and Eastern Bypass; and
- The rehabilitation of some existing bridges, execution of drainage structures, road safety devices, and environmental and social mitigation measures.

B. Nairobi City Arterial Connectors

This component involves the improvement of major arterial connectors linking Pangani to Uhuru Highway in Nairobi CBD including

- Pangani-Museum Roundabout with interchanges at Limuru Road and Museum;
- Pangani-University Way with a fly-over at the Globe Cinema roundabout;
- Widening/dualling of Ring Road Ngara from Pangani to Haile Selassie Avenue;
- Traffic Management.

The Project Area Description

The project area lies in the Nairobi Metropolitan and Central Province covering parts of the City and Thika district. The road traverses Kasarani, Githurai, Ruiru, Juja and ends at Thika River Bridge in Thika district. The total population living along the road is approximately 843,526 comprising 446,930 male and 397,019 female giving approximately 252,330 households (Population Census, 1999). The main features and economic activities along the route are human settlements with urban characteristics, various businesses, light manufacturing, educational institutions, and some farming activities. There is a thriving informal sector (Jua kali) specializing in metal work, carpentry, vehicle repairs, dressmaking and construction. Other noticeable land uses include cut-flower growing, tea and coffee farming as well as livestock for meat and dairy.

Problems;

5. In economic feasibility, Cost-Benefit analysis is done in which expected costs and benefits are evaluated. Economic analysis is used for evaluating the effectiveness of the proposed system. Discuss why Cost-Benefit analysis might be an appropriate tool to apply in the above scenario.

6. Discuss, with appropriate examples, all monetary costs and benefits that will be incurred upon implementation and throughout the life of the project.

Discuss, with appropriate examples, all non-monetary costs and benefits that are likely to be absorbed

GROUP 13

A City Council Engineer demanded a 25% kickback in secret payments for highway work contracts he issued. He made such an offer to a 32 year old civil engineer who was Project Director of a young and struggling consulting firm greatly in need of the work. The Project Director discussed the offer with others in the firm, who told him it was his decision to make. Finally he agreed to the deal, citing as a main reason his concern for getting sufficient work to retain his current employees. Discuss.

GROUP 14

Older engineers, in particular, find job security in competition with ethical instinct. An older Project Engineer, in the shadow of a comfortable retirement, was confronted by a new general manager of the plant in which he was employed as a facilities engineer. In consideration of plans for a plant expansion, the general manager insisted that the Project Engineer reduce foundations and structural steel specifications below standards of good practice. The Project Engineer was told to choose between his job and his seal on the plans. Did he really have a choice? Discuss.

GROUP 15

On a midnight shift, a botched solution of sodium cyanide, a reactant in an organic synthesis, is temporarily stored in drums for reprocessing. Two weeks later, the day shift foreman cannot find the drums. Roy, the plant manager, finds out that the batch had been illegally dumped into the sanitary sewer. He severely disciplines the night shift foreman. Upon making discrete inquiries, he finds out that no apparent harm has resulted from the dumping.

- a) Should Roy inform government authorities, as is required by law in this kind of situation? Discuss.
- b) Discuss Roy's managerial approach to the issue. How will his decisions likely to impact to the firm's reputation together with his relationship with employees below him.