

U N I V E R S I T Y O F L O N D O N

// THE MANAGEMENT OF PUBLIC SECTOR
CONSTRUCTION PROJECTS IN KENYA :
A systems and contingency approach //

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ABSTRACT

This report sets out to explore the possibility of extending systems and contingency theory of organization into the management of construction process for a public sector building project in Kenya with a view to identifying a theoretical framework which can be used to explore the patterns of relationships which exist between project participants.

A review of the evolution of conventional project organization procedures and of the related literature on project management reveals that project management in the UK has developed from the Master Mason of the Middle Ages to the designer-lead project team of today. Problems of uncertainties in the growing complexities of the construction industry has^{ve} lead to a review of these procedures culminating in a succession of official industry's reports on topics of project organization.

In Kenya the conventional procedures are said to have origins in the UK practice and to have remained substantially unchanged amidst growing specialization and differentiation of skills in building process. These procedures have received criticism, from the industry, for their inappropriateness.

The usefulness of systems and contingency approach to problems of building process is demonstrated. By examining application of some of the systems/contingency concepts in construction process the importance of the approach, which lies in its advocacy of view^{of} the process as a "whole system", is illustrated.

An integrated systems view of the environment (the industry) within which construction process takes place in Kenya is reviewed. The place of construction, the government and construction industry, the structural perspective of the professions, and the contracting sector, and training and education for project management are discussed.

An examination of two case studies reveals that most problems encountered in the project organization had more to do with lack of appropriate co-ordinating and integrating mechanisms and use of undifferentiated managing sub-systems with limited or distributed authority.

Organizational conditions necessary for effective project management are identified and possible method of improvement of the conventional procedures are considered.

Finally a tentative conclusion is drawn that there is need for those responsible for public sector project administration in Kenya to apply a systems approach to construction process and its sub-systems.

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CHAPTER 1

1.0 THE PROBLEM AND ITS SETTING

1.1 Introduction

In developing countries construction projects such as office buildings, schools, hospitals, health centres, roads, water supply schemes etc. are undertaken under conditions which create several complex managerial problems. These conditions are *inter alia*:

- (i) The projects involve a host of interested groups ranging from a multitude of donor agencies, users groups, design consultants, constructors, suppliers and government ministries.
- (ii) Responsibility for implementation is usually divided between a number of ministries and small agencies.
- (iii) The whole building process is carried out under numerous complex environmental forces (controls) - legal including planning laws, building standards, codes of practices, labour regulations, industrial relations and trade groupings, national economic policies etc.
- (iv) There is a widespread use of obsolete inappropriate contractual procedures and practices adopted from more advanced countries.¹
- (v) Construction process's environment and therefore project management skills required in developing countries extend still further into such fields as import and customs duty regulations, local taxation, local labour laws, port handling difficulties, currency exchange and remittance problems, etc.

Success of construction project team and therefore project organization can only be measured on the basis of client satisfaction, functional quality, cost and time. Satisfaction is closely correlated to performance on cost and time.² Experience has shown that most of the projects carried out in these developing countries have been either unreasonably delayed, suffered uncontrolled cost escalations or precipitated poor functional qualities.

Stallworthy and Kharbanda (1983)³ in their recent work which included investigation of project failures in developing countries have concluded that "time and cost overruns are the rule rather than the exception in developing countries".

The construction industry's clients also exist under complex conditions which have been forced on them by circumstances arising from technological developments, uncertain economic conditions, social pressures, political instability etc. These conditions make them place increasing demands upon the industry in general and construction team in particular in terms of project performance.

The complexity of clients' demand, together with the increasing complexity of building process and the environment has forced specialization in the building industry. The professions associated with construction are distinct as separate skills of architects, quantity surveyors, structural, mechanical or electrical engineers, planners etc. The organizations associated with supply of buildings have also emerged as main-builders, specialist sub-contractors, suppliers, plant hirers etc. working with the main contractor. Any project even the very small one will involve a large number of contributors. For all these differentiated professions, firms or skills involved there is need for interorganizational co-ordination and integration.

Stressing this need for interorganizational relationship in the building process Nahapiet *et al*⁴ have claimed that one of the distinctive features of construction is its dependence upon the establishment and maintenance of effective working relationships not only across different groups and specialisms but also across different organizational boundaries. They acknowledge co-ordination and integration are likely to be even more important and problematic across several organizations that are likely to be involved in the construction of any facility in the several stages which run from design through to completion.

Given these complex conditions under which the projects are carried out and the dynamic nature of the environment the people responsible for project administration face complex tasks. Indeed real world problems are complex and no ideal solutions exist for all of them. There is not and there cannot be any single answer to all managerial problems. However

in all these projects and others, various forms of "project management" and organizational practice have been advocated by the professions of the construction industry.^{5,6,7} It has been claimed that the architect as a leader of the design team has always managed the projects on behalf of the clients. One member of the design team or the other or at times the contractor has claimed to have co-ordinated and controlled the project. Most of these claims are based on individual practitioners' or professions' experience. There have been claims of projects that have been successfully managed using project based initiatives in a range of organization patterns. Indeed the management of construction projects has been carried out since the first time when man co-operated to erect buildings yet there is little documentation of how people interact in this process.⁸ What is lacking is a fundamental framework of management organization theory relating to building projects against which these individual experiences can be analysed, measured and compared in order to identify attributes and/or deficiencies for purposes of improvement. Sawacha (1984)⁹ supports this view when he argues that although project management as a concept has been internationally recognised and accepted, there is "no agreed framework for considering the procedures of project management". A conceptual framework is needed that allows project management functions to be identified in a manner that will enable order to be brought into what otherwise appears to be disconnected items of information.

This project proposes to examine the possibility of extending systems and contingency theory into the management of the construction process in order to identify a theoretical organizational framework which can be used to explore the pattern of relationship which exists between the clients, project design team and constructors organization in a public sector project. It is hoped to discern from two case studies project interorganizational relationships and contingency factors that would be of general application to designing project organization structure for public client projects.

Subsystems relationships for the two projects will be examined in two ways:

- First we shall consider the use made of the range of mechanisms available for co-ordination and integration of activities of various groups within the terms laid down by their contracts.
- Secondly consideration will be given to the practice, regulations, and contractual arrangements defining relationships between the relevant organizations.

1.2 THEORETICAL FRAMEWORK AND HYPOTHESIS

1.2.1 Theoretical Framework

The underpinning theoretical framework for this research is proposed to be systems and contingency theory. A general systems theory provides a basis for understanding and integrating knowledge from a wide variety of specialized fields. A system may be defined as "an organized or complex whole, an assemblage or combination of things or parts forming a complex or unitary whole".¹⁰ "It is a complex of personal and social components which are specific systematic relationship by reason of co-operation of two or more persons for at least one definite end."¹¹ The systems approach to organization is the "simple recognition that any organization is a system made up of segments".¹² The importance of this approach is that it disciplines anybody concerned with management of organization to realize that he can achieve the overall objective of the organization only by viewing the entire system as a whole and seeking to understand and interpret the interrelationships.

In view of the large number of participants in the construction process, the complexity of the relationships and the large number of functions to be performed it is not surprising that there has been concern in industry in developed as well as developing countries that the process does not always work smoothly.¹⁵

Ad The acknowledgement of the usefulness of viewing the construction process as a system as a "whole" has come from many quarters. Hillebrandt¹³ in Analysis of the British Construction Industry, sees great need for a project management which views the total construction process against the background of the industry as a whole and which sees the need for an integrated approach. The appeal for systems approach to construction problems at least in the UK is echoed in many government reports whose general theme is summarised in the Barwell Report¹⁴ in these words, "We consider that the most urgent problem that confronts the construction industry is the necessity of thinking and acting as a whole". Systems approach is a valuable starting point in examining our problems in project management as it contains concepts that are pertinent to the complexity of the inter-relationships which building project organizations generate and the objectives which these organizations seek to reach.

The value of application of systems concepts to the organization of design construction process organization has been demonstrated by such researchers as Walker,¹⁶ Morris,¹⁷ Handler,¹⁸ Napier,¹⁹ Barton.²⁰ The attraction of systems theory as a medium for identifying a conceptual framework for management of construction process lies in the basic premise that:

- A system is an organized or complex whole.
- A system is an assemblage or combination of things or parts forming a complex or unitary whole which is greater than the simple sum.
- The approach stresses the contribution of the interrelationships of the parts of the system and the systems adaptation to its environment in achieving its objective.

Contingency theory of organization encompasses many applications of systems ideas to organization. It suggests that "an organization is a system composed of sub-systems and it seeks to understand the interrelationships within and among sub-systems as well as between the organization and its environment".²¹ and to define configurations of variables.

It attempts to understand how organizations operate under varying conditions and in specific circumstances. Contingency theory is ultimately directed towards suggesting organizational designs and managerial systems most appropriate for specific situations. Contingency view holds that the best way to organize and manage varies from situation to situation therefore project organizations should be operated differently depending on their particular circumstances. Most current thinking tends to emphasize the contingency factors which influence organization as either aspects of environment or basic technology used.²² Recent research²³ in building project organization stressing the need for flexibility in the approach for organization structures for building projects has identified the environmental context of a project and the nature of the task to be undertaken as the determinants of the organization structure adopted.

1.2.2 Hypothesis

The formal sector of Kenya's construction industry is organised very much along lines similar to those of the British construction industry. The construction process basically follows the stages of client's decision to build; appointment of consultants; designing; application of planning permission; design realization; construction and completion.

Participants include clients; architects; engineers; quantity surveyors; contractors; sub-contractors and suppliers, duties of which are formalized in forms of contracts. As it is to be expected there are a lot of interorganizational problems. In setting out to examine some of these problems this project has hypothesised that:-

- (i) The project organizational structure and its co-ordinating, integrating and control mechanisms used for public client Projects in Kenya is based on traditional relationships and has changed little in response to the demands of the changing conditions and technology.
- (ii) The design of construction process organization structures, together with their integrating mechanisms, does not take account of important project and environmental situational (contingency) factors.
- (iii) For a large complex public sector client project where the building process is differentiated into discrete specialised operations, project management sub-systems should be differentiated from operating systems and should not be contained in any one of the latter.

1.2.3 Delimitation

This project is based on an examination of the construction process in two public client (central Government) projects. Only two government projects were selected for a number of reasons.

- Given the limited time and logistical location problems information in sufficient detail could only be obtained on these two.

- Information on privately owned projects could not be usefully obtained without the exercise of extensive field study, the kind that is out of the scope of the funds and time allocated.

In spite of these drawbacks it is considered that from the two projects chosen systematic arguments and schemes can be developed and aligned with the empirical data in sufficient terms to generalize the information into some ordered theory of general application to the practice in Kenya.

This is so for two main reasons:-

- Government as a client accounts for well over 60% of construction work in the nation and can therefore be regarded as a fair representation of construction industry practice.
- Government influences the professional practice in construction industry through the Board of Registration and through other legislative mechanisms to an extent that practice and procedure applicable for government projects can be considered to be widespread.²⁴

Construction can be classified in many ways but one of the ways that is used even by the Government of Kenya is to divide it into:

- (i) Building division, that produces a wide range of buildings - dwellings, factories, schools and hospitals.
- (ii) Civil engineering division, which includes the construction of roads, dams, water supply etc.

Although acknowledging that even civil engineering division will be highly relied upon by the building division for provision of the infrastructure this project will only deal with the latter division.

The survey reported here can be regarded only as a pilot study and any conclusions drawn from it must necessarily be regarded as tentative. However the report will form a basis for further research on the problem of interorganizational relationships in the building process.

1.3 DEFINITION OF TERMS

1.3.1 Project Management

Literature abounds with definitions of the term project management with some writers offering dictionary definitions. Sawacha (1984)²⁵ in a survey among project management practitioners found not less than five versions of what these practitioners perceived to be project management. This diversity of perception even among practitioners and clients underlines the lack of developed agreed theoretical framework for considering project management.

In this report the definition offered by C.I.O.B. 1982²⁶ is adopted and it sees project management as "The overall planning control and co-ordination of a project from inception to completion aimed at meeting a client's requirements and ensuring completion on time within cost and to required standards." The integration, co-ordination and control of project contributors and their output in pursuit of the client's satisfaction with the project outcome are fundamental aspects of construction project management.

In adopting this definition it is realized that management of temporary organization is referred to as project management. This is an all embracing concept with boundaries far beyond the construction process. However probably in the absence of a better word this generic term can be considered useful as a means of identifying provision of leadership to the building team. The approach adopted in this report rejects the proposition that the term "project management" and "construction management" are readily interchangeable.

1.3.2 Management contracting and construction management

The project management concept as used in this report is to be distinguished from the terms and concept "management contracting" and "construction management". Project management is concerned with the integration and co-ordination of activities of project participants from project inception to completion to achieve objectives of the client.

On the other hand in management contracting, a management contractor who, in traditional situations is regarded as a general contractor, is appointed by the building owner. He is appointed on a fee basis to provide

professional construction management services. He is to be distinguished from the design and build contractor in that he does not undertake construction himself. Each element of the work is let out to "construction contractors" and he manages them in return for a fee.³⁶

Several forms of management contracting have developed distinguished by the range of activities that they are intended to cover. These include management contracts, construction management contracts, design and management contracts and project and management services contracts.²⁸

New developments in the organisation of the construction process involving concepts such as project management and management contracting are basically attempts by both the design and the building sectors of the industry to fill the "management void". The design sector generally uses the term "project management" whilst the builders talk of "management contracting". This "management void" has existed in the construction process to an increasing extent since the "master craftsman era".

1.3.3 Organization

Organizations exist to combine human effort in order to achieve goals. Schein (1972)³⁴ has defined organization as, "the rational co-ordination of the activities of a number of people for the achievement of some common explicit purpose or goal, through the division of labour and function and through a system of authority and responsibility".

For the purpose of accomplishing a construction project an organization is the pattern of interrelationships, authority and responsibility that is established between the contributors to achieve the construction client's objectives. The contributors to the project act through the organization that has been established to carry out their work.

The concept, organization, adopted in this report is principally concerned with the "structure" and "people" aspects of the temporary organisations in the construction process. It recognizes that organizations depend on recruitment of people or groups to fill the specified roles and to provide specified activities.³⁵

1.4 THE IMPORTANCE OF THE STUDY

Many development construction projects in Kenya are delayed in completion or suffer unwarranted cost escalations. Experience has shown that causes of these failures is lack of proper project control and co-ordination of process activities. There is a growing demand from clients in Kenya for better project management.²⁹ This need for the role of project management systems which takes account of changing times and technology is exemplified in debates conducted in building construction professions journals over the need for better control of construction projects on behalf of the client.³⁰ Although most of this debate has centred on who should exercise the control, on which profession has exercised control in the past, and what kind of education training and professional experience the project manager should have, they have all acknowledged there is need for project management.

The conventional methods of organising construction projects in Kenya have developed through a relative position of influence from historical evolution of professional institutions who have influenced the manner of contractor appointment and project organization. There is an automatic assumption that the conventional manner of project organization is appropriate for all projects. This widespread assumption may arise from two reasons:

- The professions involved in the project process have achieved a "protected niche" in the environment which provides organizations comprising such members with protection from rejection of even sub-optimal performances.³²
- There is lack of generalized organization theory applicable to project organization against which attributes of the conventional project organization practices can be measured, and from which any development can move.

It is hoped that this project will give some thought on development of some conceptual framework for analysis, classification and comparison of the experience from conventional project management procedures of a wide variety of projects. The framework will give greater insight into problems

of project process management and ability to generalize for without the ability to generalize project management experience, in the words of Handler,³³ "becomes a divergent set of operations never twice the same, a chaos of accidental and successful or unsuccessful outcomes". Such a framework would also give impetus to the progress in the needed change in organization structure of building projects.

1.5 ORGANIZATION OF THE REPORT

The objective set out in this report is pursued through chapter two by a review of the related literature and a discussion of the theoretical framework. An attempt ^{is made} in this chapter to summarize some of the important findings of research on construction project management supplemented by relevant literature on general organization theory adapted for the construction process. The evolution of traditional project organization procedures in the UK and Kenya's construction industry and a review of pressures and influences from the industry which have forced these traditional procedures to change are dealt with.

In chapter three starting with the development of systems model of the building process the report discusses some of the relevant concepts of organizational environment, differentiation, interdependency, integration, feedback and control systems with their application to the building process. This prepares the ground for use of these concepts in the analysis of the case studies that follow in the next two chapters.

Because of the significance of environment in systems theory and for any building process the environment is dealt with at a "micro level" and 'macro-level'. At a macro level a case study of the construction industry in Kenya is given in chapter four. In this chapter a general overview of the environment within which any construction process takes place in Kenya is discussed.

Chapter five after giving a brief synopsis of the two projects surveyed, discusses the findings of the two case studies and the conclusion to be drawn therefrom. The two projects surveyed lie on two technological complexity extremes. One a large multistorey office block with complex electrical and mechanical installations, the other a large project comprising simple structures of building with geographically scattered sites.

Chapter six discusses the implications of this research findings to the organization of public sector client projects in Kenya.

CHAPTER II

2.0 A REVIEW OF RELATED LITERATURE AND DISCUSSION OF THEORETICAL FRAMEWORK

2.1 Evolution of Project Organization Procedures

The pattern in which construction projects are organized has taken different evolutionary trends in different countries. In Kenya the pattern has evolved from traditions and practices laid down by the professions.

The professional traditions and conventions in Kenya have origins in the UK practice, but the original patterns have been influenced significantly by social economic political development, and the increasing complexity of the conditions in which building process takes place. The process, which is organized along lines similar to those of Great Britain, follows the stages of client's decision to build, appointment of consultants, and design then construction. A brief review of the evolution of the project procedures and the organization of professions in Kenya's construction industry may help to explain the contemporary position reached in trying to develop more effective ways of project management. As the organization of the construction process in Kenya and indeed in East Africa is based essentially upon the British model¹ it is necessary first to look briefly at the development of the organization procedures in the British building industry.

2.2 Evolution of process organization in UK

During the middle ages in UK master mason was responsible for acquiring and organizing labour and material and for technicalities of construction. Alongside master craftsmen there existed administrators as clients' representatives. The client would pay directly for the labour and materials consumed. The relative stable conditions in which building industry existed in medieval period did not create conditions for change in the building pattern.

The industrial revolution with its increased demand on the construction industry lead to clearer identification of the role of the architect, and the associated complexity resulted in an increasing tendency to let building work on a contract basis.

The activities in construction industry during the industrial revolution created a concentration upon the specialist skills of the members of the building industry. Thus was differentiation according to specialisms. The importance of the engineer emerged; there was further separation of the architect and builder as specialists; quantity surveying skills were more firmly identified and engineering was subdivided into civil, mechanical and electrical skills.

In the early twentieth century, although no important changes in the way building design and construction were organized occurred, there was tremendous consolidation of the main professions through the establishment of professional qualifications and codes of conduct which reinforced adherence to the established pattern of project organization.

Specialization between building process participants and strict separation of participants at various stages was exaggerated by the hierarchical nature of the system of rules, regulations and procedures that emerged to govern the relations between parties in the late 19th and early 20th century.

The industry regarded itself as a series of different parts roughly consisting of professional advisers, specialists, contractors, specialist contractors, suppliers, operatives of various crafts and skills.²

The traditional approach to the building process whereby the client appoints his principal designer who becomes the leader of the team and advises the client on appointment of other members of the design team and selection of contractor was established. The only contractual relationships of the professional team was with the client as is that also of the main contractor.

Problems of uncertainties in the growing complexities of the construction industry have led to review of the performance of the industry and to the growing concern within the industry and governments over the traditional organization procedures.

In the UK there have been numerous criticisms levelled against the conventional organization procedures pertaining to and evolving from the arrangements in the industry during the early twentieth century. There have been a succession of official as well as unofficial reports on the topics of project organization procedures.

The first report was the Simon Report (1944)³ which, seeing need for modification of traditional conventional patterns of project organization to fit changing circumstances recommended the use of selective tendering as opposed to open.

A Report on Working Party in Building Industry known as Phillips Report (1950)⁴ drew the attention, for the first time, of the industry to the need for greater co-operation between all those involved in design of building and their production.

Emmersion Report of 1962⁵ reiterated the Phillips report regarding the great need to improve co-ordination of the members of the building team. Emmersion Report criticised the construction process for lack of liaison between architects and other professions and the contractors between them and the client.

The Banwell Report of 1964,⁶ a major contribution in the direction of the evolution of the pattern of project organization had its major concern on the unnecessarily restricted and inefficient practices of the professions leading to over-compartmentalization (differentiation) and failure of the industry and its professions to think and act together - to co-ordinate and integrate the organizations and professions involved in the building process. Higgins and Jessop's work at Tavistock (1965)⁷ focussing investigation on the interorganization problem of communication in construction suggested that overall co-ordination of design and construction should be exercised by a single person. Thus they were voicing the idea of differentiating project management system from the project operating systems.

The NEDO Report, "The Construction Industry" (1964)⁸ on the construction industry stressed the need for improvement of management of the construction process and the co-ordination of activities of the members of the construction team.

The Tavistock Report 1966⁹ on uncertainties and interdependence in construction process reiterated all the above reports on the need for co-ordination and integration of activities of the participants in the construction process.

Bowley 1966 in a study of "The British Building Industry"^{9a} saw the problem of conventional project organization to be responsible for lack of innovation in the industry. She concluded that "the separation of responsibility for design and construction not only creates obstacles to innovation but also diminishes incentive to innovation".

"The Public Client and the Construction Industry" NEDO Report (1975)¹⁰ echoed the recommendations of the Banwell's earlier report in stressing the need for more attention to be paid to the problems of the interface between the construction participants. The report criticised the traditional approach for "being too rigid and sometimes used in inappropriate circumstances". There was need for more attention to be paid to the structuring and management of project organizations, it concluded.

"The professions in the construction industry", NEDO Report (1976)¹¹ recommended further study to analyse existing project patterns in the use of alternative methods of organizing of design and construction process.

This spate of activity and concern with performance and organization of the industry was further accelerated by economic expansion, rapidly developing technology, changing attitudes and increases in costs of construction. Government concerned with the rate of provision of construction service to industry commissioned a party which in its report, "Construction for Industrial Recovery" 1978¹² concluded that "participants in construction process are excessively concerned with their own roles *vis a vis* other participants and insufficiently respond to environment".

NEDO Report, "Faster Building for Industry" (1983)¹³ was initiated by the industry because of their concern over the speed and ease of procurement of new industrial and commercial buildings in the UK using traditional methods. The report identified use of the traditional methods of procuring and organizing projects as the factors which hamper progress.

The external pressures that have caused the professions and the government to reconsider organisational arrangements for projects have also come from organizations of private sector clients. The British Property Federation (BPF) (1984)¹⁴ concerned about the interprofessional inter-organizational problems of building process has criticised the traditional methods of project organization. They see a "clear need for a system which the employer can trust and which provides value for money". They have

published a manual for use with their BFP system which they claim puts the client's interests first. It has been criticised for introducing an overpowering role to be played by the client's representatives, and for playing down the role of some project participants but all said it is a welcome development in the construction industry.

Taken together all these reports and publications have led to a closer consideration and more serious questioning of the appropriateness of the traditional ways of delivering projects.

The construction industry professions have not been completely irresponsible to these pressures. Their response however has reflected the manner in which traditional structures were differentiated along professional lines. Each profession has emphasized a pattern that can be adopted with advantages to their roles. The Tavistock Report (1966)^{14a} observed that "The first reaction of any of the institutions and associations to a new development in the organization of the building team tends to be concerned with implications of its members of the change rather than with the effect on the effectiveness of total building process.

There have been a number of professions's sponsored studies of development to project organization and management: RICS (1977),¹⁵ IOB 1965,¹⁶ CIOB 1982¹⁷. Although all these reports were more concerned with how their professions adapt to the changing needs of professional services required for project administration they all underline the observation made by the rest of the industry that the traditional methods of organising the building process were no longer appropriate for the changing environment, complex client and industry and the changing times.

2.3 Evolution of the project procedures in Kenya

In the early 20th century during the beginning of the colonial era in Kenya there were no architects or general contractors to speak of. Colonial administrators, Missions etc. drew up their plans, produced or purchased their own materials and built with locally available labour. In the 1920s and 1930s most of the buildings in East Africa were erected without the services of the professions. The small general contractors drew up their own plans, and the clients presented their requirements directly to the contractor. Thus building process involved at most two participant's client who in most cases was an individual, and a contractor. There would have been therefore little simple interorganisation relationship and little interorganization co-ordination to talk about.

With the rapid influx of European settlers after World War Two, rapidly rising standards of living of the immigrant population and the increasing demand for government buildings, services of architects, engineers and quantity surveyors came to be demanded. The professions - almost entirely British - began to establish offices in the capital cities. The East African Institute of Architects, modelled on the pattern of RIBA, established the rules, regulations and procedures to be followed in the building industry. The "system", as in Britain, thus came in Kenya to be the only really respected way of organizing the building process.¹⁸ It is worth noting here however that there was a lot of building activity carried out outside this "system" especially African buildings which were erected by traditional methods.

The system as imported from the UK has remained essentially unchanged amidst growing specialisation and differentiation of skills techniques in the building process. Thus a research on the nature and capacity of the construction industry in Kenya in 1972¹⁹ found that "There was a considerable amount of specialisation between constructing firms according to location, size and type of construction projects" and between design firms according to architectural design, engineering design and cost and preparation of tender documents.

These long established building process organization procedures pertaining from colonial times have been criticized for lack of appreciation of the complexity of interorganizational relationships and lack of use of proper integrating mechanisms.

Wells (1972)²⁰ noted that if the system in the UK was wasteful of technical knowledge, intellectual ability and practical organising experience then the system is bound to be much more so in East Africa where these are the very resources in short supply.

David Burgess (1970)²¹ in a report which highlighted the basic irrationalities in the structure of the industry in East Africa charged that development in the use of local materials and technical skills could not be attained within the present organization structure in the industry, but only under a building process organization system where architects and builders were integrated and shared a common objective.

In a series of articles published in Build magazine debate has been conducted among the professionals over the need for those involved in advising the clients on construction to think and develop better project management techniques. In a leading article entitled "The Construction Industry in Kenya - Designers must move over", Mathu 1980²² identified one of the problems in the industry as "the pathetically wasteful separation of design and production process". The same sentiments were echoed by Hernandez 1980,²³ Derrick Flat 1980²⁴ and Stafford 1980.²⁵ Contributing to the same debate they each saw "many of the problems connected with construction could be overcome by effective project management incorporating cost control". To them "that our Kenya building organization needs improvement is undeniable".

2.4 ORGANIZATION THEORY AND PROJECT MANAGEMENT

A number of eminent early management theorists examined the problems involved in establishing smoothly functioning systems of work activities notably Taylor, Urwick, Mooney and Brech. The chief concern of these writers was the development of models or sets of principles to guide the design of structures oriented to task accomplishments. Their studies culminated in a number of principles which have since been incorporated within the body of what is known as management theory. Among the most widely recognised of these principles are: the principle of span of control, unity of command, delegation of responsibility, line and staff relationships, etc.²⁶

The human relations school, also interested in organizations like the other classical management schools, investigated and concerned itself with relationships of organizations and its employees. Researchers in this group were concerned with the study of actual human behaviour and to explore employees attitudes towards work and values.²⁷

The models of organizational structures developed by these traditional management theorists is based upon three organizational concepts²⁸ which are all violated in the management of construction projects, namely:-

- The functional division of management.
- The hierarchical concepts of superior-subordinate relationship.
- A number of the principles of management.

Because of the characteristic nature of construction projects, management concepts and organization models developed by traditional management theorists for business organizations do not handle construction type work effectively.²⁹ Some of these characteristics are:-

- Construction projects are essentially temporary activities for those concerned, with typical lives of six months to five year.
- Normally construction projects involve several departments and organizations of participants from more than one company thus introducing interorganizational complexities and interdependencies.
- Construction projects are unique one-off undertakings which thus give rise to definition of the project organization structures.
- The temporary, complex and often loose nature of the relationship and authority patterns involved in project work, combined with the number of different departments and companies involved whose objectives and management styles may differ, lead to human behaviour problems and tendency for conflict between groups and individuals.

Thus the traditional management theory and general business organizational structure have to be modified in project management. A theoretical framework is required that can handle effectively the dynamic, everchanging relationships and the complexities involved in construction project work.³⁰ Systems theory may provide a medium for identifying such a conceptual framework.

General systems theory has been usefully applied to organizational problems in sectors other than construction industry.^{31,32,33} In construction Morris,³⁴ Handler,³⁵ Napier,³⁶ Walker³⁷ and Barton³⁶ in their studies have illustrated the potential for the application of systems to the building process. Though taking different perspective, each of the researchers has employed the same basic concepts of systems theory viewing the system as an assemblage or combination of things or parts forming a complex "unitary whole", which is greater than the simple sum of the parts. Applying systems concepts to examine organization of various aspects of construction process, they have shown how the medium can provide a useful framework for analysis of construction problems.

2.5 SYSTEMS THEORY AND ITS APPLICATION TO BUILDING PROCESS

Underlying the approach to this study and to the understanding of project organization is a systems and contingency approach. A system has been defined as "any entity, conceptual or physical, which consists of inter-dependent parts. Each of the systems element is connected to every other element directly or indirectly and no sub-set of elements is unrelated to any other sub-set."³⁹ Systems theory sees organizations as complexities of elements standing in interaction with the basic assumption that these elements or sub-systems are mutually interdependent both internally and in relation to their environment.

The success of the construction process depends upon the way in which the architect, engineer, quantity surveyor, contractor, sub-contractors and the client work together. It depends upon them acknowledging that each ones achievement is dependent on activities of the other.⁴⁰

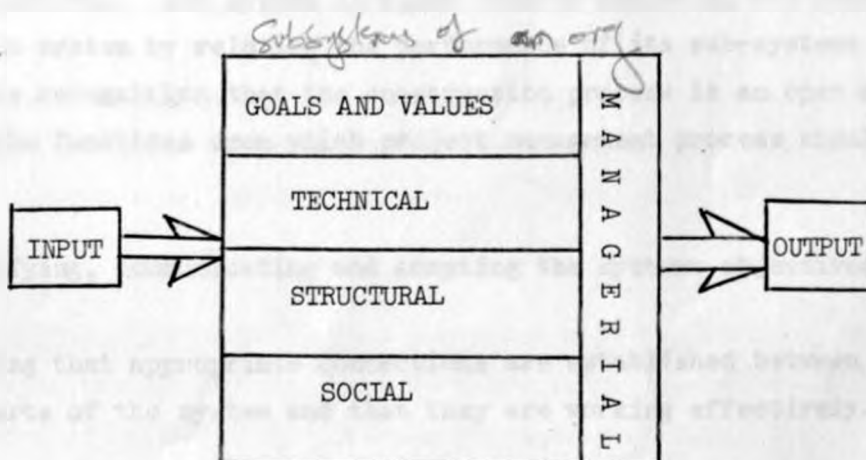
The major emphasis and strength of the systems approach is the effort made to treat the system as a whole. The underlying Banwell philosophy for the construction industry echoes this approach by instructing the industry to "think and act together".

Construction process is a supply system with all its component sub-system functional units each displaying its characteristics and with its own activities and objectives. The properties of these operations and activities retain their identity while the people, material and energy inputs entering the building process keep changing.⁴¹

Organizations are open systems in contact with and exchanging information and energy and material with the environments. They are transforming models in dynamic relationship with their environment.⁴² The system maintains a constant state amidst the everchanging matter and energy entering it and is influenced by and influences its environment.

Construction process imports ideas, energy, materials, information etc. from the environment, then transforms them into its output which is finished buildings, roads, bridges etc. The whole process of designing and constructing a building project can be analysed as an "open adaptive system" which must respond to its environment. However in practice the process is to a certain extent protected from its environment by construction of rules, procedures, codes of practices, and conventions which have been granted validity by public authorities, professional institutions and other bodies. For example in Kenya the construction process is protected from its environment by such practices as use of standard method of measurement, standard forms of contract, standard specifications for materials and workmanship, price control regulations, import restrictions, building material's price fluctuation formulae lists etc.

There have been a number of studies on organizations as open systems but they all typically identify five major organization sub-systems: goals and values; technical, structural, social and managerial sub systems.^{44,45}



The sub-systems are interdependent, with the technology affecting inputs into and outputs from the organization, and the social system determining the effectiveness and the efficiency with which the technology is utilized.⁴⁶

In the organization of the construction process technical sub-systems is the technology required for designing and constructing the project. The goals and values sub-systems is the attitude and values of the members of the process. The organization system is the way in which these members relate to each other (interorganizational relationships). It is concerned with the pattern of authority, communication and flow of work. It formalizes the relationship between sub-systems. The management sub-system spans the entire project organization directing the technology, organizing human resources, relating process to its environment and client.

The technical sub-system predominates in influence and it is possible to differentiate projects in terms of their technical sub-subsystem. For example the technical sub-system for construction of a simple standard domestic house will be different from that for construction of a multi-storeyed office block. It is important therefore that the project organization structure should be designed to reflect the appropriate technical and social system. This demands that a variety of organization solutions should be available to suit the particular project.

Building process is a man made ("contrived") system with human defined objectives. The system is aimed towards achieving the objectives of the whole system by relating the performance of its sub-systems to the whole. Once recognition that the construction process is an open system is made then the functions upon which project management process should focus are:⁴⁷

- Identifying, communicating and adapting the systems objectives.
- Ensuring that appropriate connections are established between the parts of the system and that they are working effectively.
- Relating the total system to its environment, adapting the system as required in response to changes in its environment.
- Activating the systems so that the connections that have been established work effectively.

We have seen that in building process specialists from various disciplines and/or organizations have to collaborate and this requires that a structure has to be developed to integrate the work of the several functionally differentiated specialists.

With the systems approach as a starting point the general research objective is to explore the interorganizational relationship of the sub-systems involved in the delivery of construction projects.

Project organization structures and the range of mechanisms used to co-ordinate and integrate the activities of various building process participants will be examined with a view to identifying and defining the characteristic for attributes and weaknesses.

Jay Galbraith defines the basic objective of organizational design as being to create mechanisms by which an integrated pattern of behaviour can be obtained across all interdependent groups.⁴⁸

One of the distinctive features of construction is its dependence upon the establishment and maintenance of effective working relationships not only across different groups and specialisms but also across different organizational boundaries.

Co-ordination and integration, widely regarded as key elements in internal organizational design,⁴⁹ are even more central and potentially problematic across the several differentiated organizations that are likely to be involved in the construction of a facility in several stages which run from design through to completion and handover to the client.

There have been a number of studies on organization as applied to construction relating to the interrelationships of various parties involved in the design and construction including Architects, Quantity Surveyors, Contractors, Sub-contractors, Engineers etc. Among these the most prominent are:-

- Tavistock study (1966)⁵⁰ which suggested that the industry was organizationally too rigid and proposed establishment of different patterns of relationships between designers and builders.
- Morris (1974)⁵¹ Study in which it is argued that the traditional form of building project structure lacks flexibility and may need to be modified in order to deliver large, fast or complex projects.

- Walker (1980)⁵² in his study established there is need for flexibility in the approach to inter-organizational relationships in building projects which he found was contrary to the commonly adopted approach which assumes that there is only one method of structuring the project organization.

The central element to be explored in the case studies reported here is the pattern of relationships between the interface between sub-systems, the different parties involved on the project and the factors which influence the coordinating and integrating mechanisms used therein.

CHAPTER III

3.0 SYSTEMS AND CONTINGENCY CONCEPTS AND THEIR RELEVANCE TO CONSTRUCTION PROCESS

3.1 Systems Model of Building Process

The aim of this study has been to develop a theoretical model based on organization theory which can be used to study the pattern of organizational problems of managing various interrelationships on the design and construction of public client project.

Morris (1972)¹ has observed that in any discipline to develop some generalized theory or principle which can be used to learn from experience we must reduce the variety of the behaviour of the phenomenon being studied and in doing so concentrate on the essential features of this phenomenon. We must thus develop a model of the building process and in so doing concentrate on the essential features and subsequently generate more knowledge about the system.

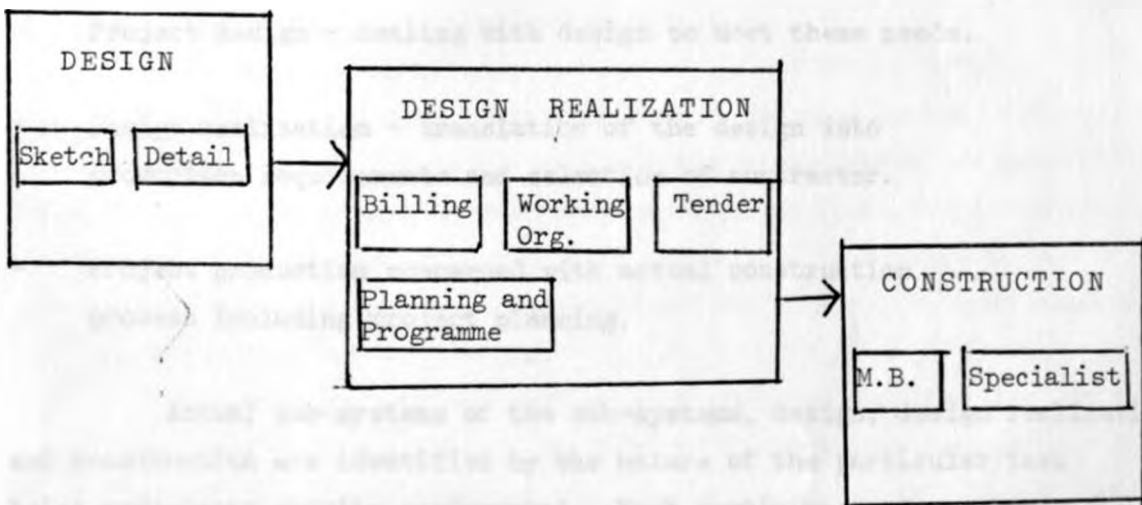
To model a process some generalizable characteristics that will represent the process when applied to any project must be identified. Construction projects are diversified both in terms of their clients, technology, size, complexity, participants and location hence the process has very few fundamental characteristics generalizable for all projects.

A systems model emphasizes wholeness and the interrelatedness of the systems parts.² Every system has at least two interconnected elements. The first task in any attempt to identify a system is to define its boundary and thus a systems model of building process should start by stating its outer limits, the boundary between itself and the external environment.³ The building process has a start point and a finish point which is the completion of the project.⁴ The process of providing a building consists of those events that join these two points. Many sub-systems could be selected within the overall system of construction process for there is no absolute definition of individual sub-systems. "They exist exactly and only in relation to their individual definition which is governed by their sub-system objective or goal"¹⁶ for instance prepare design, prepare tender, incorporate materials and labour on site etc.

Bennet (1983)⁵ sees its constituents as being the separate identifiable tasks each of which can be made the responsibility of a separate team or organization. Thus to him sub-systems of construction process can be defined in terms of tasks performed.

This view of the building process is supported by Morris' model⁶ which is derived from Walters 1960.⁷ This model broadly separates production process into sub-systems, design - realization and construction. The model has thus three sub-systems, DESIGN, DESIGN REALIZATION and CONSTRUCTION each with task sub-systems.

- o Design - 1. Sketch design 2. Detail design.
- o Design realization - 1. Working drawing 2. Billing
3. Tendering 4. Planning and programming.
- o Construction - 1. Main builder 2. Specialist builders.



STAGE MODEL OF BUILDING PROCESS (AFTER MORRIS)

The RIBA plan of work although it has been criticised for its inadequacy as a potential systems model of the building process can with adaptation form a basis for deriving useful models.

It has been attacked for its inability to emphasise feedback between various production phases and for its support of what Tavistock called sequential finality and for its inability to clearly identify site monitoring activities.^{8,9} However the RIBA plan of work has proved useful as an indication of essential stages of a building process and it has formed a foundation for a lot of recent work on communication, control and management in building projects.^{10,11,12}

When looked at the RIBA plan of work can be adopted to give support to the model of the building process derived above. There are four tasks sub-systems that have universal application to all building projects which can be identified from the architects plan of work.¹³

- Project brief - dealing with specifications of the users/ clients needs.
- Project design - dealing with design to meet these needs.
- Design realization - translation of the design into production requirements and selection of contractor.
- Project production concerned with actual construction process including project planning.

Actual sub-systems of the sub-systems, design, design realization and construction are identified by the nature of the particular task being undertaken and its environment. Each participant, for example architect, engineer, contractor or quantity surveyor, will work in a functional task sub-system. In the construction process there are generalizable tasks which Hutton's (1969)¹⁴ calls differentiation according to tasks and groups formed around the principle of professional competencies or specialists. Thus there is the design task with the professions of architect/engineers, project realization with architect/engineer/quantity surveyor and the building production with specialist the builder and sub-contractors.

The functional sub-systems will be differentiated on the basis of:-

- The technical demands of the tasks (technology) which determines the way in which work is divided between contributors.
- The geographical distance between the contributors (territory).
- The sequence of activities required of the participants (time).¹⁵

In the remaining part of this chapter a number of general systems concepts will be used to explore this model's main sub-system's inter-relationships and in the case studies chapters this will be checked for its appropriateness in analysing the organizational problems encountered in the projects surveyed.

3.2 SYSTEMS CONCEPTS

3.2.1 Environment and Organization Structure

The meaning of environment can be understood by adapting the open-systems view of organization behaviour. The open system view accepts that organizations must interact with and adapt to their environment.¹⁷

The notion of open system is that systems exist by virtue of a transaction or transpositions of energy or materials across its boundaries to and from the environment. To describe organizations' environment we must describe the traffic across its boundaries.¹⁹

Mintzberg¹⁸ sees environment as comprising anything outside the organization. Its technology, the nature of its products, customers, and competitors, its geographical setting, the economic, political and even meteorological climate in which it must operate.

For primary task system, design, realization and construction the environment considered is "smaller in scale and attributes". This will be understood in terms of clients environment, the rate of changing his mind, the budgetary constraints etc. The hostile competition faced by the contractor from others tendering for the same project. The number of suppliers the problems of shortages of materials, the weather conditions, the difficulty of defining precisely clients requirements. All these will be the environmental aspects.

The importance of regarding a building process as an open system is that it enables us to distinguish and identify an important area of the total project process which has to do with controlling the traffic across the boundaries. This is called "general management" and has to do with both the characteristics of the environment and internal organization of the process.²¹ It is a job of management at the boundaries and it primarily consists of defining the relation between the process and its environment and managing the flow across the boundary. Boundary management has been defined as being concerned with relations between the enterprise and its environment considered in terms of transactions with the environment, including taking decisions about the required or desired state of these relations.

A number of writers have investigated the nature of the environment and its effect on organizations. Although they have investigated different aspects of environment their common interest was on the organization's ability to cope with the environment, to predict it, comprehend it, deal with its diversity and respond.

Mintzberg²² identifying four characteristics of environment - stability, complexity, market diversity and hostility - has hypothesised a matrix of four basic organization environments. Simple/stable; complex/stable; dynamic/simple, and dynamic/complex. He concludes that environmental variables can have a profound effect on structure often overriding those of age, size and technology. Among those aspects of organization structure most strongly influenced by the environmental contingency factors are the amount of decision making power that must rest²³ at the managing system. In terms of building process it is the power and authority "undistributed" which must rest with the project management.

Burns and Stalker²⁴ characterizing the environment as stable and unstable saw two different types of organizations being appropriate for each environmental condition.

Lawrence and Lorsch²⁵ found that environments which generate different levels of uncertainty require varying degrees of differentiation of organization units and they also require different degrees of integration.

An environment categorised by uncertainty distinguishes building from many other industries. The process operates in a dynamic, hostile and diversified environment. The project is "one off" and this generates need for firms, individual managers and operatives to continuously reorientate in order to accommodate and solve the set of problems posed by each new building project. The project is designed according to clients brief which is established early in the process. The client keeps changing his mind due to changing needs and sometimes due to difficulty of defining precisely his requirements. The contractor at the time of tender constrained by anticipation of other tenderer's behaviour, and the prospects of falling demand of construction work faces a hostile environment. During construction he faces a volatile labour and material market - wages can go up; prices escalate; industrial disputes set in, etc. There is need for the construction process to produce a clearly defined solution at the start of the project and remain flexible and adaptive to satisfy changing environmental requirements.²⁶ The project team needs to be aware that uncertainty and change in a client's environment may require that alterations have to be made to the project in order to respond to them. The team should be aware of the changes in the environment of the construction process and they should be ready to allow such changes to amend the structure of the process if this can be done at an advantage.

The relative importance of the various environmental forces and their impact upon project organization and the construction process will vary between projects and between countries - developed and developing.

Although there is no precise method of quantitatively assessing environmental forces, recognition of their existence and understanding of how they affect construction projects enables those in charge of project management to design project organizations that can respond to them. There is little point in using well tried rigid conventional organizational structure suitable for simple standard repetitive buildings for design and construction of a complex multistorey office block. Equally true is the fact that the UK approach to project organization is not directly transferable to overseas projects.

3.2.2 Differentiation, Interdependency and integration

Every organized human activity from simply making a brick to placing a man on the moon gives rise to two fundamental and opposing requirements; the division of labour into various tasks performed and the co-ordination of these tasks to accomplish the activity. Thus Mintzberg (1979)²⁷ defines structure of an organization "simply as the sum total of the ways in which it divides its labour into distinct tasks and then achieves co-ordination among them". The way in which the building process is divided into preliminary design, sketch design, design of structural work, design of services, preparation of bills, estimating for tender, constructing the structure, installing specialist services etc. and the way in which all these activities are co-ordinated in order to achieve the building.

Open systems move towards a higher level of organization which generates greater differentiation among the sub-systems.²⁸

Walker 1984²⁹ has argued that this takes place in two ways:

- A system seeks to encompass parts of its environment and annexes them as sub-systems.
- Complex and uncertain environments create the need for sub-systems to specialize further in order to cope with such complexity and uncertainty.

Specialization of contributors to construction projects has been occurring throughout the world. For example in UK from the basis of Architect/Builder have evolved quantity surveyors, various specialist engineers, general contractors and a proliferation of specialist sub-contractors; even within these specializations there are further specialist sub-divisions, for example design, detailing, and job architects, take-off and final account quantity surveyors, speculative house builders, scaffolding contractors and maintenance contractors.

When to this is added the way clients are sub-divided into industrial clients, commercial clients, public sector clients etc. then there is high differentiation in this complex industry.

Walker (1984)³⁰ discussing differentiation in construction process adapts a definition used by Lawrence and Lorsch³¹ and defines it as "the difference in cognitive and emotional orientation among contributors to a project who offer specialist skills. The differences in cognitive and emotional orientation of participants (specialists) within construction process are manifest in the way each specialist tends to view his colleague with a certain amount of scorn. The contractor is seen by an architect as deceitful and always harbouring a motive of money making. No member of the building team has a good word for the "financial watchdog", the quantity surveyor.

Reinforcing this differentiation is the influence of a sentient group which arises from allegiance by the members of the project team to a firm, department or to a profession. Sentience is likely to be strongest where boundaries of a sentient group and task coincide, eg. an architect with design task and his profession or department.

As differentiation increases the number of sub-systems boundaries grows, integration needs multiply and communications and co-ordination difficulties increase. The patterns of differentiation become more complex as the environment becomes more complex with each pattern demanding its own pattern of integration. The type of integration may be dependent upon the structural interdependence of subsystems.³²

The reciprocal interdependency of the contributors to the construction process has been acknowledged. Tavistock Institute (1966)³³ found that in building process decisions that design sub-system made sequentially were affected by what had gone before and what had to come.

Hicks and Gullet (1981)³⁴ have shown that interdependence in which outputs for other (reciprocal interdependence) require much more integration than sequential integration.

Why is the differentiation and integration analysis in the building process necessary? There is need to find out where the maximum amount of differentiation occurs on the project since this is the area that calls for maximum amount of integrative attention.

Miller (1959)³⁶ has suggested that management sub-system is concerned with assessment of behaviour of sub-systems at the boundaries' interfaces. To determine the level of differentiation there is need to identify the boundary.

Hutton (1969)³⁷ suggests two ways in which task sub-system boundaries can be revealed. By discontinuity in activity for example between designing a building and assembling it into "concrete" structures on site, and by interpolation of a region of control, a pause for checking measurement of output or quality, submitting a report, approval of building design by client or completion on site.

Because of the contractual relationship used in a conventional project organization the principal organizational discontinuity (differentiation) occurs at the interface between design team and the construction team.⁴⁰ There is no contractual relationship between these two sub-systems although they are all under different contractual terms with the client.

Walker (1980)⁴¹ in his research concluded that the amount of differentiation will depend upon the number of specialist contributors employed on a project and upon interorganizational relationships of the contributors. Differentiation will be high on projects when professional, consultants are from separate firms and they will be differentiated from the construction sub-system to varying degrees depending upon when and how the contractor is appointed. The nature of integrative mechanism used will depend upon the nature differentiation existing.

Choosing the degree of "pooling together" and co-ordination required is always a problem. Lawrence and Lorsch⁴² have dealt extensively with the problem of achieving effective integration in organizations. They have generalized that tighter organizational integration is required when

- The goals and objectives of an entity require different groups to work together closely.
- The environment or enterprise is complex or changing quickly.
- The technology is uncertain or complex.

3.2.3 Means of achieving Integration in the Building Process

Lawrence and Lorsch (1967)⁴³ have defined integration as the "process of achieving unity of effort among the various sub-systems in the accomplishment of organizational tasks". Adapted for construction process this is the process of directing, co-ordinating and controlling the task activities of design, design realization, and construction.⁴⁴

The subject of co-ordinating mechanisms in organizations has received treatment from a number of researchers. Mintzberg (1979)⁴⁵ investigating structuring of organization identified five fundamental ways in which organizations co-ordinate their work: mutual adjustment, direct supervision, and standardization of skills, work or process.

Thompson (1967)⁴⁶ arguing there is connection between co-ordinating mechanisms and the type of organizational interdependence, has suggested a parallel of three types of interdependence with the co-ordination that one may expect:

- (i) Pooled interdependence - standardization
- (ii) Sequential interdependence - plan
- (iii) Reciprocal interdependence - mutual adjustment.

March and Simon (1958)⁴⁷ have suggested that as an organization's structure increases in diversity its degree of interdependence also increases since greater structural flexibility is thereby obtained. They therefore have argued that the emphasis in co-ordination moves towards mutual adjustment as structural flexibility increases.

The implications of this^{to} building process are that on a building project where there is reciprocal interdependence in a multi-disciplinary group mutual adjustment by the project team is more appropriate but where there is sequential interdependence the co-ordination could be by standardized procedures or by direct supervision.

Walker 1984⁴⁸ has suggested that need for integrative effort in the construction process is high and can be provided by someone solely concerned with project management.

The managing and operating systems should be differentiated although the managing system itself should be undifferentiated.⁴⁹

Hutton (1969)⁵⁰ concurring with this view has argued that there should be a separation of basic operations from that of co-ordinating and planning resources. He states that this differentiation may be repeated hierarchically at lower orders. That is any one operating system may itself differentiate further into operating and managing system, containing services and control agencies. For example in the design sub-system there will be management and the operations of an architect's office, and in

the construction management of the firm and the operations down to site management by the site agent. A systems diagram showing differentiated project management sub-system and the hierarchical repetition is shown in fig. 1.

The differentiated managing system working through the operating systems, establishes and monitors the goals of the operating systems in terms of functional time, cost and quality requirements to the satisfaction of the client.

3.2.4 Feedback and Control (Homeostatis) Systems

Modern theory views an organization as an adaptive system which must, if it is to survive, adjust to changes in its environment.⁵² This view is consistent with von Bertalanfly's 1972⁵³ finding that open systems would react to their surroundings and if they were to remain efficient they would have to adapt accordingly. Open systems are able to maintain stable state in a dynamic hostile environment, thus displaying homeostatic behaviour, by means of feedback mechanisms that ensure stability.

The concept of feedback is important in understanding how a system maintains a steady state. No matter in whatever way the building process is modelled allowance must be made for feedback. The type and the amount of feedback designed into a system are the key to the system's stability and economy. Feedback points should be carefully designed into the system so that appropriate action can be taken at the right time.

Feedback is the basis of systems control function. It is through feedback and subsequent action that achieved outcomes can be compared with desired outcome so that adjustments in the behaviour of the system can be made.

Objectives are ends towards which processes are directed, the purposes for which the system has been organized and towards which everything is aimed.⁵⁴ Orientation of the construction process towards provision of a facility acceptable in terms of human needs, wants, social and symbolic, our environmental conditions and all timely, within pre-determined costs and quality standards, is achieved through feedback. The feedback process must provide a facility whereby output of the production is compared with the standards or criteria, and if control is to be effective, measure and correct deviations from what was planned.

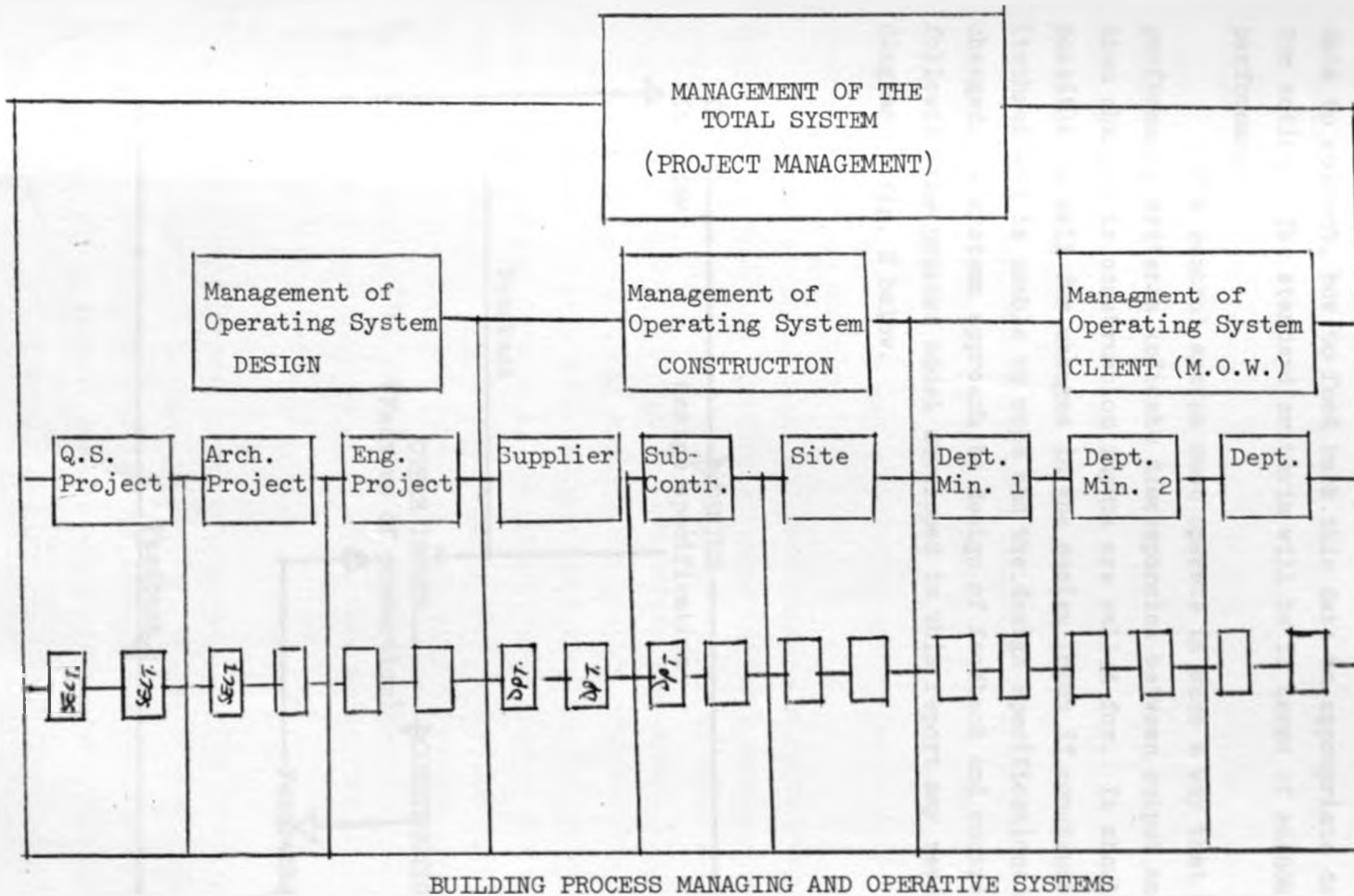


Figure 1

Any effective control system requires that a procedure for testing samples against the objective be designed with appropriate method of measurement of sample and with ability to give feedback and take action.⁵⁵ Thus it must be decided what the standards (frame of reference) is, what data to collect, how to feed back this data to appropriate decision centres for action. The standard criteria will be in terms of economic or technical performance.

The control system must operate in such a way that should the performance criteria indicate discrepancies between output and objectives then changes in construction inputs are called for. It should also be possible to call for changes in the design input if construction know-how (technology) is unable to cope and the design specifications must be changed. A systems approach to design of feedback and control system following the process model developed in this report may resemble the diagram on fig. 2 below.

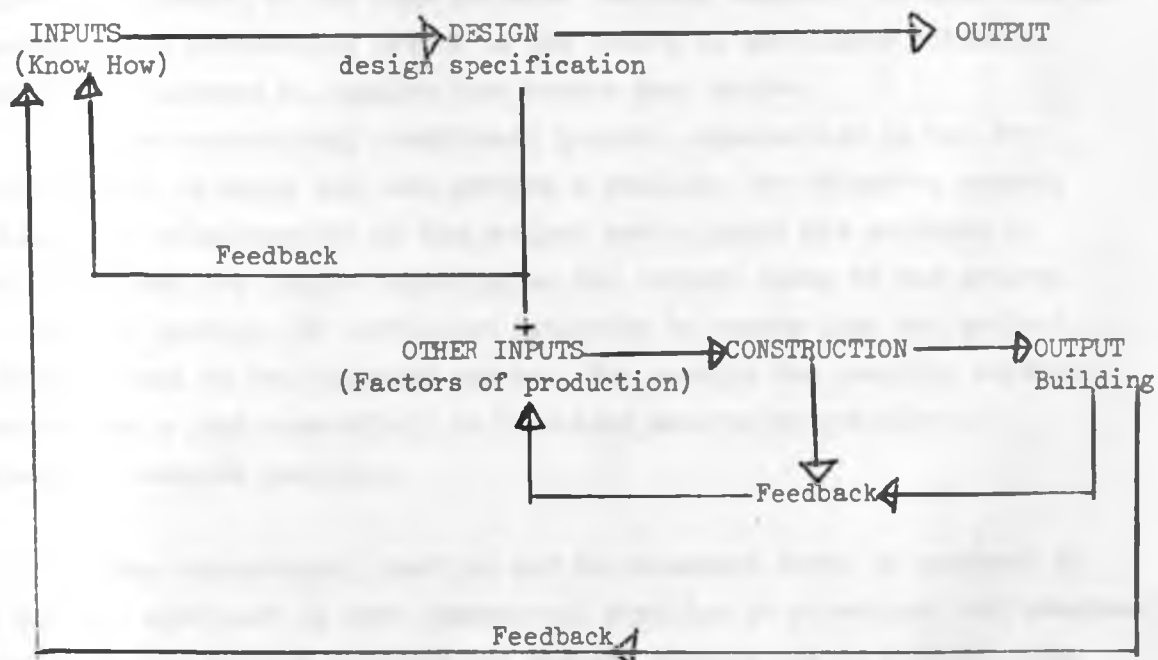


Fig.2 FEEDBACK WITHIN AND BETWEEN BUILDING PROCESS SUB-SYSTEMS
(after Handler)⁵⁶

Feedback can be positive or negative. Negative feedback is based on informational input which indicates that the system is deviating from a prescribed course and should readjust to a new state.⁵⁷ Most feedback control systems in use in construction are of this kind which try to correct deviation from costs, time or the design of the project.

Each process subsystem will be operating its own feedback control system and it will be correcting data for this purpose. For example the construction sub-system, concerned with handling of materials, putting them together and jointing, will be collecting data on productivity costs, various tests etc. and it will be ordering its decision centres to take action. The quantity surveyor will be collecting data on projected costs of materials, proposed architect's changes and variations and the engineer, information,^{on} structural strengths, stability, etc. The managing system of the total process will need to design feedback system that can make use of this data, monitor it and ensure that appropriate action is taken to ensure project is on plan.

The project manager will not only be concerned with the state of project development at the time he takes feedback samples; he must also be concerned with forecasting events in the future to anticipate potential problems and attempt to resolve them before they arrive.

The conventional traditional project organization in use for public sector in Kenya does not provide a facility for effective control system. The relationships of the project participants are arranged in such a way that the people reporting on the current state of the project are not in a position of sufficient authority to ensure that the project is steered back to its intended course. For example the quantity surveyor (regarded as a cost controller) is in a mere monitoring position of declaring financial position.

The conventional practice and the standard forms of contract in use put the architect in both operational position as a designer and management capacity as the project co-ordinator thereby placing him in a conflicting position as far as project control *vis a vis* project objectives are concerned.

3.3 Chapter summary and conclusions

This chapter has attempted to illustrate the application of some of the important systems and contingency theory concepts to building process problems.

The building process is modelled as a system comprising three major sub-systems: design, design realization, and construction. It sets out criteria for identifying and defining sub-systems whose interrelationship would be examined in the case study to check the appropriateness of the model. Sub-system of each of the major systems are identified in terms of their tasks, as sketch design, detail design, working drawing, main building, specialists etc.

The concept of environment is fundamental to building process as it is of major importance in structuring project organization in developing countries where the nature of socio-political, technological and ecological characteristics of the environment render it hostile, complex and fast changing. It is vital for the project managing system to understand the characteristics of environment for their role in the project process is that of controlling and maintaining the organization at its boundary with environment.

The factors of environment considered to influence construction process sub-systems and which ought to be considered in project management are examined. Environmental stability, complexity and market diversity and hostility are some of the vital characteristics. They are manifest in the one-off nature of building projects, the often ill defined needs of the client, the competitive nature of the contracting market and the volatile labour and materials market faced by the contractor during construction.

The ideas of differentiation, interdependency and integration are considered. Building process tends towards higher levels of specialization which generate greater differentiation. This tendency to differentiate is reinforced by other factors eg. satience, traditional organization structures etc. As differentiation grows, need for information increases. Types of integrating mechanisms that can be used are considered and the need for differentiating project management role from operating systems is identified. Some type of mutual adjustment in building process where there is multi-disciplinary group is considered more appropriate.

Finally the chapter has considered the ideas of feedback and control mechanisms, without which an open system like the building process cannot survive in the changing environment. The system must gather information about the environment and then adapt. Any effective control system must be designed with a facility for testing samples against standards and for taking corrective measures. The shortcomings of the traditional project organization structures in this respect are considered.

In the chapters that follow these ideas are applied in an attempt to decipher project organizational factors encountered in the two projects surveyed and the construction industry within which they are set.

CHAPTER IV

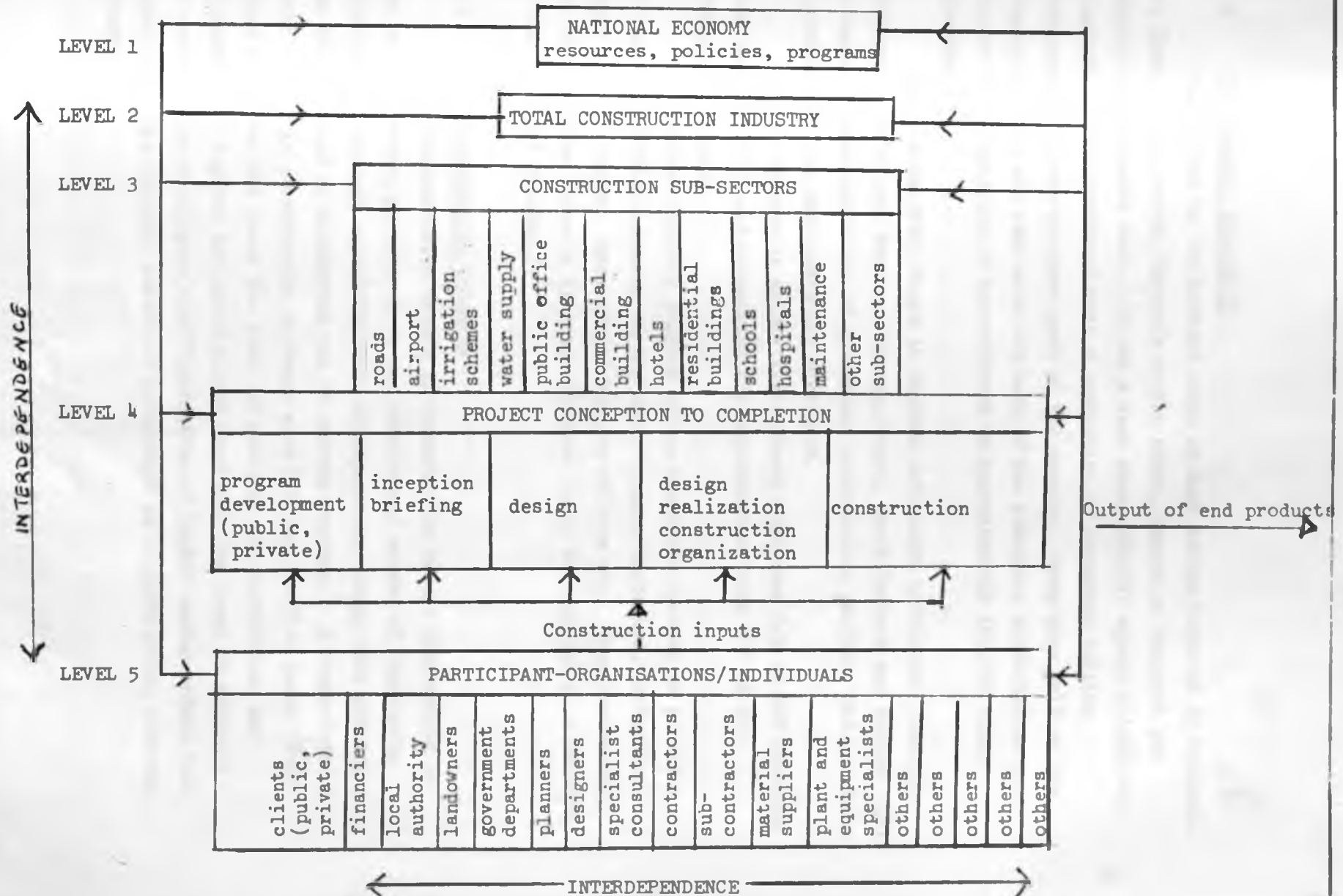
4.0 THE CONSTRUCTION INDUSTRY IN KENYA : AN OVERVIEW4.1 Introduction

This chapter attempts to describe the construction industry environment within which any project is designed and constructed in Kenya. It discusses the place of construction in the economy, the structure and organization of the industry, the government role, the structure and role of the professions, construction sector, the organization of Government departments concerned with construction, and education and training in management for the construction industry.

The construction industry in Kenya like in many other countries is one of the most complex sectors. An integrated systems approach to the total construction industry can be summarised as in the diagram over, fig. 1. The industry may be assumed to consist of sub-sectors, each sub-sector consisting of numerous projects, and each project involving different stages of activities from project conception to completion. The basic process, conception to completion, is regarded as the INPUT - OUTPUT. The input resources of material, labour, plant, finance, information, institutional resources, result in outputs of various "built" products. This process takes place within the extended production system represented by total construction process in the entire national economy. This chapter will attempt to examine briefly the process in the economy at these various sub-sector levels.

The chapter will also examine and identify some of the factors influencing project process. The currency used in the discussion of this part and the case studies is Kenyan pound (K£) which is equal to twenty Kenyan shillings (KShs. 20=). The average exchange rate between Kenyan shilling and the British sterling pound (£) is one sterling pound to nineteen and a half Kenyan shillings, £1 = KShs 19.50.

(FIG. 1) AN INTEGRATED SYSTEM VIEW OF CONSTRUCTION INDUSTRY AND THE CONSTRUCTION PROCESS



42

(Adapted from GANESAN, 1984) 42

4.2 The country generally

Kenya lies on the eastern coast of East Africa bordered by Ethiopia and Sudan on the north, Tanzania on the south, Uganda on the east and Somalia on the north east. It has a vast area, 582,647 square kilometers (including water surfaces) with a population of seventeen million concentrated in the southern part of the country. More than half of the country is arid and semi-arid and much of the resources exploitation to support the population is concentrated on approximately 107,000 square kilometers.¹

Administratively Kenya is divided into eight provinces: Central, Eastern, Rift Valley, Western, Nyanza, Coast, North Eastern and Nairobi City. In terms of administration of government construction projects the provinces coincide with the administrative provinces.

Kenyan economy is mainly agricultural with over 50% of GDP deriving from this activity and accounting for employment of over 80% of the working population.

The infrastructural support of the country's economy is provided by the construction industry in the way of roads, factories, irrigation water supply schemes, dams, administrative offices etc. Thus indirectly the construction industry like agricultural could be regarded as a mainstay of the National Economy.

4.3 The Construction Industry

The characteristic nature of construction demand fluctuating is one of the factors attributed to the traditional nature of organizing construction process especially that of separating design from construction and the practice of widespread use of sub-contractors.⁵ A comparison of gross output in construction in Kenya with GDP for the five years 78-82 shows that over the years the level of activity in construction has fluctuated.⁶ Figures for gross output show that the level of activity in construction oscillates with fluctuation of public sector orders thus underlining the dominant nature of government as a construction industry client.

4.4 Government and the Construction Industry

In addition to its influence as the major client of the industry the government also influences the industry through its economic and other policies. Government assumes direct responsibility for formulating policy guidelines and for management of the industry as a whole. In the 1984-1989 development plan¹¹ the government stated that the "economic activities relating to the building and construction constitute an important component of national economy" and the constraints facing the industry will be ameliorated by improved organization of implementing ministry".

The government's implementing Ministry is the Ministry of Works, Housing and Physical Planning, referred to as Ministry of Works (M.O.W.) throughout the rest of this report.

4.4.1 Ministry of Works - organization and functioning

This ministry is charged with the responsibility of planning and control of the construction industry. Among other things the Ministry:-¹³

- (i) Exercises broad responsibility for the design, construction and maintenance of all government buildings.
- (ii) Advises government on developments in the construction sector and provides a basis for the formulation and review of national policy on construction.

With respect to its responsibility for design and construction of government buildings the Ministry's role can be summarized as:-¹⁴

- (i) Advising client ministries on standards of design and construction of buildings including provision of estimated costs of the projects.
- (ii) Implementation of tender procedures and choice of contractual arrangements.
- (iii) Provision of technical as well as financial supervision of building projects through its own internal officers or overseeing consultants.
- (iv) Provides design and design realization for building internally with its own resources or using external consultants.

The Ministry controls government projects through the agency of an office designated Departmental Representative (D.R.). The D.R. may be either:-¹⁵

- The chief architect who delegates his authority to an architect within his department in the project team.
- A consultant architect or engineer when project is commissioned to external consultants.
- A provincial engineer in whose province the building is to be constructed.

The D.R. who is answerable to the chief architect whatever the case may be is responsible for total supervision of the project.

4.4.2 Buildings Department organization and function

Buildings Department is a multidisciplinary consultancy organization providing a variety of professional services - architectural, engineering, (electrical and mechanical), quantity surveying, estate management surveying, planning and land surveying.¹⁶

Among other functions the department:-¹⁷

- Plans, designs and supervises construction of public utilities.
- Assigns works to consultants and contractors, oversees them, approves, certifies work for contractors, arbitrates between contractor and client or consultants and clients.

The disciplines concerned in the department are fossilised in their procedures, just in the same way procedures in the whole industry are following the British practice adapted during the colonial era. The project teams are usually lead by the architect and they follow the traditional conventional relationship. The use of flexible project organization structures such as involving contractor in design or use of project manager with differentiated role have not been tried.

Within the department there is a curious situation whereby architects appear to enjoy favoured position. The chief architect is head of department and is placed at a higher hierarchical position both remuneratively and in terms of administration. The chief quantity surveyor, chief electrical and mechanical engineer are placed subordinate to him. Within the operational groups the architect is always the group leader notwithstanding knowledge and experience within the group disciplines. This situation is likely to cause interorganizational strains and conflicts which bode ill for the efficiency of the projects. This underlines further the need for use of a project manager who is not of necessity a member of any discipline but selected on the basis of his technical and managerial knowledge, experience and other merits.

The level of detail and quality of production drawings and specifications is a source of irritation for both consultant designers and constructors alike. Drawings seldom provide sufficient solution to practical constructional problems. Most building projects are commenced and completed on very sketchy architectural drawings. The observation made by Ofori (1980) about building projects in Ghana may represent the situation of many Ministry of Works construction projects - "Everywhere drawings are insufficient in terms of detail; clients are impatient to see work commence and end on site, not appreciating the nature of consultants work; tendering periods are too short to allow contractors to price the bills of quantities accurately; contractors do not receive vital production information on time".²⁰ This summarises the experiences on many public projects.

The implications of this situation are:-

- design can be changed sometimes radically at advanced construction stages.
- Contractors wait long periods for information, variation orders are numerous, costs soar and projects are ultimately delayed.

Most construction firms in Kenya are small and few know their rights and obligations under the contract. It is common for contractors to do extra work on the instruction of persons other than the contractually authorized officers.²¹ Most often contractors consider some of the contractual entitlements (eg. variation payments) gratuitous. Their ignorance has given them a feeling of total submission. It is common knowledge that even the present times of hard recession contractors continue to accept contracts without fluctuation clauses or contracts with penalty clauses for delayed completion. It is also common knowledge that many contractors have dropped their contractually supportable claims for fear of being victimized by the architect, quantity surveyor or engineer.

4.4.3 Appointment and Supervision of Consultants and Contractors

The Ministry of Works is responsible on behalf of government for appointments/ ^{of consultants and contractors.} There are laid down procedures for selection of contractors and tendering contained in government circulars. Method used for appointment of contractors and sub-contractors is selective tendering. Prospective contractors are selected from the Register of Contractors. Supervision procedures are contained in circulars issued regulating issuing of instructions, variations etc.

The Ministry maintains a register of consultants from which it nominates the design team. Appointment of consultants is not on the basis of tender or any form of competition and is not as rigid and formalized as that of contractors. Conditions of engagement and remuneration of consultants is contained in standard form of Conditions of Engagement and scales of fees for professional services for building work issued by the Ministry of Works.^{21a}

4.5 THE STRUCTURAL PERSPECTIVE OF THE INDUSTRY

Construction industry can be classified in many ways. For example Hillebrandt (1984)²² discusses the following ways: According to the way in which demand is put to industry; According to the use to which the product is put; According to type of construction, and according to type of contracting firm.

Kenya Government development plan (1970-1974)²³ adopts a division that spans the four categories by dividing it into Building division and Civil Engineering. Most of the report and research documents which deal with the structure of the construction industry in Kenya have tended to be more on building division. This has an obvious reason that most of the contracting firms even those who regard themselves as civil engineering combine it with building.

4.5.1 The Structure of the Contracting Industry

The structure of this industry shows the familiar three tier pattern of the Kenyan economy with a few large foreign European contractors dominating civil engineering and large building projects, the Asian firms mainly in building contracts of medium and large size and the African contractors spanning the whole range from the only two being considered medium size and employing 700 to 800 workers down to one man self-employed artisans.²⁴

There are 2,000²⁵ contracting firms on the Ministry of Work's Register of Contractors and there could be another 400 mostly small contractors not in the register. The firms may be described as main trade contractors and specialist sub-contractors.

The external environment of any enterprise is itself differentiated. Insofar as the contracting sub-system in the industry is concerned the sub environment which constrains and exerts demand on it is the market and the competitors that compete for resources in the same environment.

The extent of competition for any contracting organization depends on the markets in question. The industry as a whole consists of a series of different overlapping markets which may be defined in terms of identifiable services, the size and complexity of contracts and the geographical location of work. Within each market there will be different degrees of competition and each sub-system of the contracting industry will attempt to develop competences in relation to the environment and hence to become different. Thus contracting firms will develop different pricing and tendering strategies commensurate with the market in which they operate.

The government through the Ministry of Works has broken down building contracting markets in the following divisions:²⁷

- (i) Grouping of contractors according to the value of work they can undertake.
- (ii) Grouping of contractors by complexity of the work they can undertake.
- (iii) Categorizing contractors according to the geographical location within which they can undertake work.
- (vi) Categorizing contractors according to the citizenship status of the ownership of the business.

There are markets where very few firms have large market shares especially markets for large complex projects.

4.5.2 Contractors Organizations

The contracting firms do import materials from their environments in the form of staff, new ideas, technology, construction materials and equipment. Thus as an industry they have to cope with the competition from other industries and sectors for the same resources and also with environmental forces inflicted on their environment from other sub-environments, governmental, social, other professionals etc. They attempt to adapt and cope with these external forces by acquiring control over them. This process can be seen in the way contractors have joined together in associations to enable them to negotiate jointly with government, professions, labour unions and manufacturers associations.

The two main contractor's bodies in Kenya are the Kenya Association of Building and Civil Engineering Contractors (KABCEC) and Kenya Association of African contractors (KAAC).

Some of the ways they have tried to influence and control their environment in the past is:

- Negotiating inclusion of fluctuation clauses in standard forms of building contracts.

- Taking part in the establishment of the basic rates of building materials and labour for use in operation of the fluctuation clause.
- Voicing their reaction to government policy affecting construction. The KAAC registered their protest against government directive calling for the abolition of the use of client's nominated sub-contractors in government projects.²⁸

The two contractors' organizations however seem to have been polarized to represent on one side large foreign and non-citizen owned contractors and the other small African contractors. This has not helped the poor indigenization rate of the contracting sector.

4.5.3 The Structure of the Professions

All major construction professions in Kenya have achieved what Child²⁹ calls "protected niche in the environment". This allows organizations comprising such members protection against environmental forces. The major industry's professions have established and enforced a code of conduct and uphold the standards of knowledge of the profession. They do this by setting standards of entry to the profession, promoting the advancement of knowledge by establishing a scheme of study for its education and by conducting qualifying examinations.

The Architects and Quantity Surveyors have the umbrella organization called Architectural Association of Kenya (A.A.K.) which recognizes and regulates qualifications for registration as an architect, quantity surveyor, engineer (structural) or planner. The registration of architects and quantity surveyors is regulated by an Act of Parliament; the Registration of Architects and Quantity Surveyors, chapter 525 of the Kenya Laws. The act protects the term Architect and Quantity Surveyor and lays down rules of conduct for Registered Architects and Quantity Surveyors. However not all registered members need be members of AAK although all AAK members are registrable.

There are 285 architects and 132 quantity surveyors registered in Kenya today while the membership of AAK stands at 205 corporate architects, 143 quantity surveyors, 39 planners, and 29 engineers.³⁰

The code of conduct for quantity surveyors and architects has remained conservative in the same form as when it was adopted from the RIBA and RICS even in the changing times. Even when the RIBA and RICS Codes of Conduct for architects and surveyors in the UK have undergone dramatic changes especially in the area relating to advertising, competition or architects and surveyors becoming members of limited liability companies connected with construction, property or development,³¹ the AAK codes of conduct remain unchanged in these respects.

The engineering professions are set up differently. The main engineering professions concerned with construction are structural engineers, and building services (electrical and mechanical) engineers all which are registered under the Engineers Registration Board established by an Act of Parliament and the professional association is Kenya Institute of Engineers (KIE). However engineers of the structural division can become members of AAK.

There is no profession on the building contracting side as the only organization, Kenya Institute of Building (KIOB) which caters for members who are in contracting has not acquired professional status in the same way as AAK or KIE. This lack of professional status for members of the contracting side has important implications for the way the industry works. It contributes to the builder having a poor public image.³³

Most directors or managers of building companies have worked their way up from the ranks of crafts and technicians. The only obvious source of well educated professional persons for building contracting - the architects and quantity surveyors - are not permitted by their rather outdated professional Code of Conduct to participate in contracting commercial activities.³² Whatever the merits this regulation may have for the prestige, professional standards of ethics etc. of the profession, it is worth consideration by the professions involved for the interest of development of the construction industry. As Mathu (1980)³³ has argued, success of a "truly indigenous based construction industry will depend on rate of flow of professionally trained personnel from design side to production".

4.5.4 The Role of the Professions

The development of professional roles must reflect the substantial increase in size and complexity of projects, the changing technology of building, and socio-economic environment within which the process takes place.

There is need for the professions to consider adapting their system to the requirements of their sub-environment rather than waiting for the environment to adapt. For example the panacea to the problem of contracting firms' inability to realistically price and use contract documents is seen by the professional architects and surveyors to lie in the teaching of contractors how to price these traditionally prepared documents.³⁴ However it is suggested in this report that professions especially quantity surveying should consider evolving new bill formats that most Kenyan contractors can understand and use effectively.

The roles of various professions appear to have assumed some kind of fluidity with the building teams constantly seeking to determine the leader of the construction process.³⁵ Observing this phenomenon in the UK construction industry, Hillebrandt (1984)³⁶ has stressed the need for this leadership to come from outside the team from a person having no other role in the process other than management. There is thus need for the construction process to have differentiated managing sub-system.

This need will demand special skills in project management and the solution may lie in the training of appropriate manpower. It is felt that no justice can be done to any treatment of project management discipline in Kenya without a mention of education and training in this field. In the next section this is considered.

4.5.5 Manpower Development and Education for the Construction Industry

The government assumes full and direct charge of manpower development in Kenya. It bears most of the educational expenditure of public education training institutions. There is no independent body in charge of training for the construction industry. Training for construction manpower is done in several institutions owned by government or "Harambee"* Institutes of Technology. Training entrants into professional status in the disciplines of engineering, architecture, and

* For definition of this term see Reference 40

quantity surveying is offered at the University of Nairobi. Training for crafts technician and semi-professional cadre in the same disciplines is offered at two National Polytechnics in the country as well as in the twelve operational Institutes of Technology run on harambee basis scattered all over the country.³⁷

Some of these institutions have no touch with the industry and training is not well co-ordinated. There is however a real shortage of trained managerial manpower in construction - especially in project management.⁴¹

A major inhibition to the development of project management skills has been the difficult question presented by the education process for the construction professions. The construction industry's professional's courses have been provided in a manner reflecting the traditional structure of distinct professions. At the university both the undergraduates and postgraduates have been educated in watertight compartments which reflect their conservative professionalism. Architects take a course in architecture, engineers in engineering and quantity surveyors in quantity surveying, each with little or no integration with those students of other construction disciplines. Subsequently graduates emerge with relatively little understanding of the skills and contributions made by the people with whom they are expected to work in the project team. This coupled with the fact that very little management techniques are taught at these undergraduate courses means that the would-be professionals have very little understanding of project management. Without a theoretical base when entering the industry it becomes difficult to order the insights of practical experience into proper principles.

This proposition may be ideal and difficult to achieve for three reasons.

- (i) The extent to which courses can be broadened and integrated is limited by time and resources as long as the industry expects a partly trained professional to emerge from the undergraduate courses.

- (ii) Inclusion of broader courses at the already existing undergraduate courses will mean providing graduates with lower level of professional skills. This is certainly unacceptable to the industry's employees and to the country's economy.
- (iii) Project management skills at undergraduate level may be difficult given the undergraduates inexperience in the industry. They may find it difficult to understand and relate management theories to practical problems and issues.

This multi-disciplinary training approach has been tried at Kumasi University in Ghana whereby all degree courses in architecture and quantity surveying have a common course in first year and some common subjects in third year. This approach has been found to do much in providing students with an appreciation of interdependence of the various participants in the construction process and to break the professional differentiation barriers.³⁹

Within these constraints it would appear the alternative that is being tried at the Department of Land Development University of Nairobi³⁸ is a viable solution, providing project management skills at postgraduate level. However this course at the university needs to have a strong broadening component as well as more rigorous management studies applied to the building process. There is need also to break down the professional barrier within the course.

Another problem that faces training of professional personnel in construction industry in general and in construction management in particular is lack of appropriate teaching materials. The content and background of courses has a lot of foreign influence especially from UK industry. Text books, references and examples are usually from foreign industry and practice. This situation is made worse by difficulties involved in obtaining foreign exchange and import licences. This has meant that sometimes books and teaching aids used are out of date with the obvious implication that students may be taught principles and procedures which no longer apply even in their places of origin.

Attempts by staff at the university to write textbooks, cases etc more applicable to local scenes have not succeeded for a number of reasons.

- Lack of incentive and encouragement from the authorities; with already too low salaries for teaching incentives for research and publication is minimal to say the least.
- Lack of willing publishers for such material especially given the size of the market for such books.
- Lack of funds to finance, research and general teaching workload for the would-be researchers.

CHAPTER V

5.0 THE CASE STUDIES5.1 Introduction

Two projects have been surveyed in an attempt to investigate interorganizational relationships in the building process. Having proposed a systems model of the process of building provision, defined its major systems, and identified its main sub-system boundaries and sub-systems interrelationships, it is proposed to check the model against the two projects in order to establish whether the model adequately identified their organizational features and whether it explains systematically their nature.

5.2 Data and Data Collection

In order to obtain raw data for testing the hypothesis the general context of the construction process was obtained from project drawings, formal correspondence between participants, official summaries of minutes of site meetings and researcher's own experience on the projects.

The objective in searching through this data was:-

- To provide a catalogue of project participants, their roles in the process, their relation to the project and to each other, their authority and lines and forms of communication.
- To provide information on the level and nature of differentiation of various sub-systems activities and their integration.
- To provide information on the way in which the major contributors (project organizations) to the project perceived the project management role.
- To provide a catalogue of significant events on the project within its time scale, and information on how these were controlled. The events are the start and completion periods, issuance of major variation orders and their timing, original contract sums and estimated or actual final accounts.

In each case a short project synopsis is provided followed by a detailed description of the project organization. There were however a number of drawbacks to the collection of this data.

It was found to be impossible to obtain correspondence relating to the earlier stages (the design stages) of the two projects for three reasons. One reason is because the designs of the projects were done such a long time in case of project 1 that the job files had been misplaced. The project 2 designs were standard drawings that had been done a long time. The second reason is that due to confidential nature of government projects it was not possible to secure and carry away files from government offices, and given the time and resources limit and logistical problems of location it was not possible for the researcher to examine all the files at the government offices.

However it was found that for the task set by this pilot study project the data obtained from the minute files job correspondence was sufficient. A further research into the modelling of interorganizational relationships in construction process would benefit from examination of more correspondence and administration of a more comprehensive questionnaire.

5.3 Projects' General Features

To avoid the reader identifying the firms or personalities involved and thereby committing breach of confidence, no names or identities of the projects, firms or client ministries are revealed in the report.

The two projects are a contrast in terms of complexity, size, technology, time span, and geographical location thus:-

- (i) One is a large multistorey office block of complex structures, high standard finishes, and with complex mechanical and electrical installations.
- (ii) The second project comprises of many small simple single storey construction units, with simple finishes, traditional construction, and minimal installations. The sites of this project are scattered over a large country.

The two projects are public sector client projects with the central government as the client.

14
27 $\frac{5}{14}$

16 $\times \frac{100}{44}$

10 $\times \frac{10}{55}$
14
15
76 $\frac{100}{14}$

5.4 Project Organizations generally

The Ministry of Works acts as a service ministry to all other ministries. It plans, designs, supervises construction and maintenance of all government buildings. The Ministry may render most of these technical services internally but in many cases it uses external consultants for either design or supervision only, or both.

The Ministry controls the design and supervision of government projects through the agency of the DR. The DR, who is answerable to the Chief Architect whatever the case may be, is responsible for technical tasks of supervision throughout the period of construction. Depending on the size and complexity of a project a clerk of works may be used whose responsibility is day to day supervision on behalf of the DR. He acts in the interests of the client to ensure that quality of materials and workmanship is maintained.

The DR's responsibility is spelt out in the conditions of contract and in the government general specifications for building works.¹ He is overall responsible for other participants who act on the project through his office. All communication between participants including instruction for design team to contractors and sub-contractor must pass through his office.

The DR may issue instructions and authorize any variations relating to quality of materials or workmanship. However where such instruction or variations have cost implications the DR must seek approval of the client ministry and in all cases of large variations (exceeding 25% of total contract sum) the client Ministry must seek Treasury approval.² The implications of this is that besides the lengthy bureaucratic process which sometimes wastes time, the process inhibits innovation both in design and construction method. The DR co-ordinates and integrates the project participants through the conduct of regular site meetings.

A general project organization for a typical government project is illustrated on fig. 1 below.

PROJECT ORGANIZATION

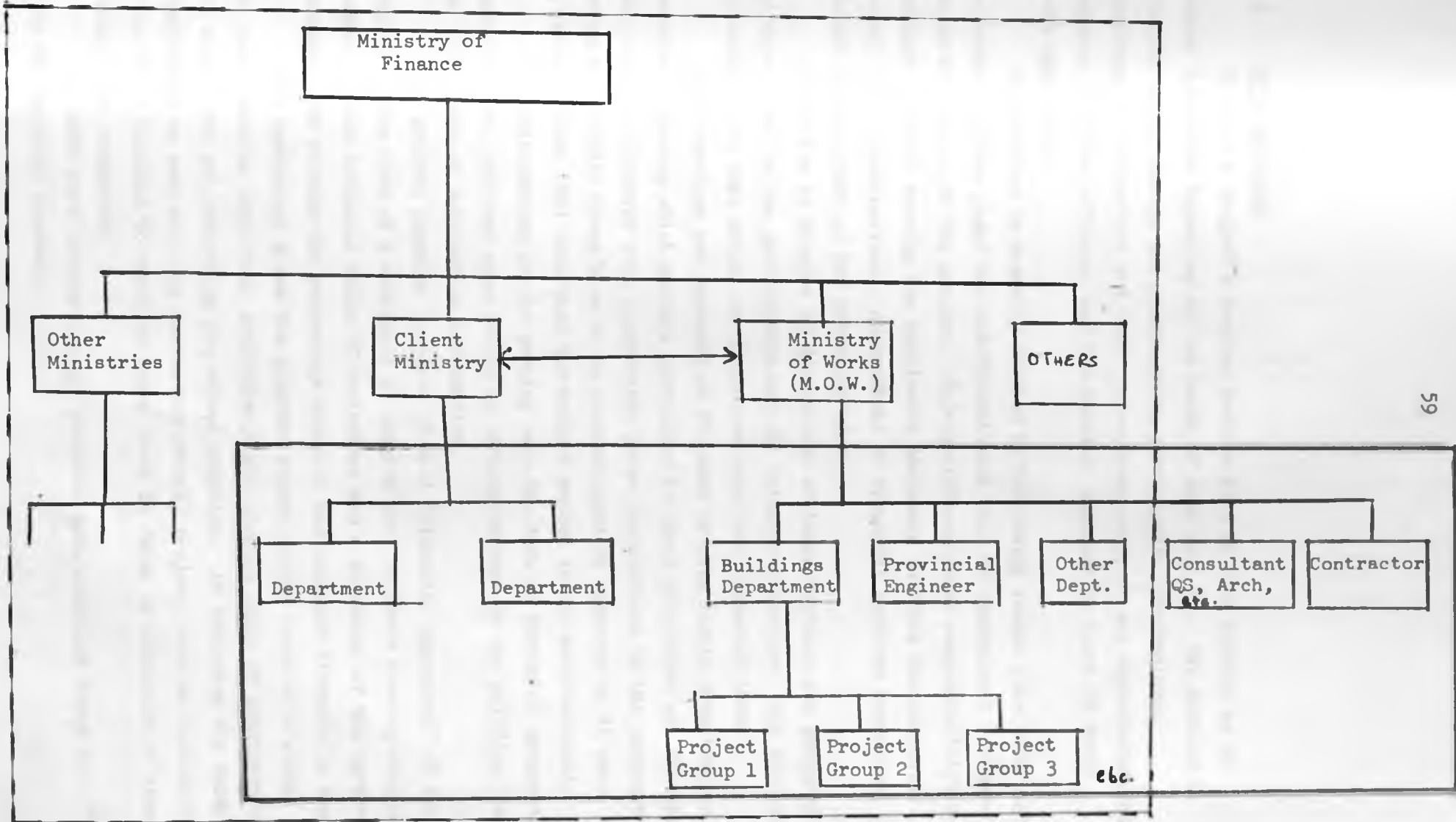


Figure 1

NOTES: GOVERNMENT'S ADMINISTRATIVE ORGANIZATION BOUNDARY
 PROJECT ORGANIZATION TEAM BOUNDARY

5.5 Site meetings

This is a project's regular feature held on site monthly or at shorter intervals depending on the needs of each project. The meeting is attended by the design and construction participants (professional consultants, contractors and their sub-contractors), client representatives, Ministry of Works officials and the resident engineer or clerk of works where applicable.

The meeting is normally chaired by the design leader (the architect). The architect thus plays the undifferentiated role of operational designer and co-ordination of the project. This undifferentiated responsibility sometimes ^{causes} conflict of roles causing the architects dominance to force design issues prevail over constructional, contractual or financial problems sometimes against the interest of the overall project.

Summaries of Minutes of discussions of these meetings are prepared and circulated to the participants and all interested parties. All concerned are required to take action on Minuted matters that concerned them.

Site meetings are preceded or followed by site visits from various consultants during which matters pertaining to their discipline are discussed and resolved. However when consultants issue instructions to the contractor during such visits these have to be countersigned or approved as if were by the architect (DR) even when the subject matter is not architectural.

The discussions in the meeting take the form of review of progress, organizational problems experienced by various members of the building team, and assessment of outstanding information.

The project quantity surveyor gives a "financial appraisal" of the project in the form of a statement of updated cost estimate showing original tender sum and estimated value of variations and a statement of the up-to-date payments made showing the percentage value of the contract financially completed.

The contractor gives the progress report on the basis of a simple bar chart showing individual activities, their planned dates of commencement and completion and indicating the actual position. It indicates the delays experienced on each activity and on the overall project, with an indication of how it is intended to catch up where there is delay or extension of time likely to be requested.

All this cost information and progress data sometimes turns out to be of historical interest.

5.6 Project No. 1

5.6.1 Synopsis

The building which was completed in 252 weeks at a cost of approximately K£9 000 000 was a complex construction of multistoreyed structure incorporating complex mechanical and electrical installations. It involved use of highly sophisticated technology in construction including use of slipform construction technique.

5.7 The Project Team

5.7.1 Clients

The users who ran into seventeen departments representing eleven ministries were led by one client ministry. For the purposes of defining client requirements each department acted as a decision maker presenting its own needs, discussing brief and approving sketch design layouts. Their approval variations or alterations in say floor layouts had to be sought from right down at the departmental levels. This situation led to some departments occasionally issuing instructions direct to the design or construction team without reference to the lead client ministry.

5.7.2 Design and Design Realization Team

The design and design realization team comprised the following:-

- (i) Architectural services initially provided internally by M.O.W. but later responsibility was commissioned to a firm of private architects.
- (ii) Mechanical and Electrical Engineering services provided by a private firm of engineers.
- (iii) Civil engineering and quantity surveying were provided internally by departments of the M.O.W.

Where external consultants were employed M.O.W. took technical responsibility for their supervision. Technical supervision of construction on site on behalf of the client was done by M.O.W. They employed a resident engineer, a clerk of works and an inspector of works.

The role of clerk of works and that of resident engineer was undifferentiated. The agreements used made reference to clerk of works and inspector of works specifying their role as to "act solely as inspectors on behalf of Government under the direction of the DR",¹⁴ but made no mention of the resident engineer.

The jurisdiction authority and responsibility of the resident engineer on site was not clear. On one hand he was responsible to his functional "boss" (chief structural engineer MOW) yet in terms of structural design responsibility the job was under a private consulting firm of engineers.

The project quantity surveyor was answerable to his functional "boss" (chief quantity surveyor) whose office is under the chief architect. In practice and from the correspondence it is clear the project architect (private firm) was subordinate to the chief architect's office in all technical matters relating to the job.

For all technical matters on the job the DR (architects) had to seek approval from the office of the chief architect. It is conceivable that where the project DR sought approval of matters of quantity surveying or civil engineering nature (where these services were provided by the MOW under chief architect's department) the same office that provided services was supposed to approve activities of those services. Thus the managing responsibility was not only distributed but also awkwardly "insubordinated".

5.7.3 The Construction Team

The technological complexity and the size of the project necessitated a highly (specialized) differentiated construction team. Thus although the construction process was let to one main contractor a total of seven nominated specialist sub-contractors, and three suppliers were employed. The main contractor had also five domestic specialist sub-contractors and three suppliers.

Tender procedure adopted for sub-contracts are similar to those used to select the main contractor except that instead of the Government entering into contract with them the main contractor is instructed to enter into such a contract. In the process no privacy of contract exists between the client who chose the sub-contractor and such a sub-contractor or supplier.

The main contractor is overall responsible to the client for construction of specified structure and the consultant ensures as an agent that the client gets what is specified. However the method of construction is left entirely to the contractor. This is so even for nominated sub-contractor's work where the contractor had, so to say, not had any say in the selection of the builder. This raises an interesting situation in the case of specialist work where the main contractor may not have any expertise to supervise this kind of work.

The main contractor is responsible for co-ordination and integration of the sub-contractors and the DR or the clerk of works or resident engineer on his behalf plays no co-ordinative role. The DR in his letter to the main contractor on the subject of co-ordination of sub-contractors works states that "under the terms of contract agreement the main builder has the responsibility to co-ordinate the sub-contractors but the minutes of such co-ordination meetings are not binding to other people".

5.7.4 Evaluation of Project Performance

Judgement of success of the management of a project must be made on the basis of the success of the project itself and is expressed by the following indicators; client's satisfaction; aesthetic function and quality; cost and time. Sidwell (1982)¹⁵ has shown that client satisfaction though clearly a subjective measure is closely correlated with performance on cost and time.

This project was completed at a cost almost twice the original tender and at close to twice the original contract period. It is difficult to make any conclusions from this observation without a further study of actual causes of increases in costs and delays and the magnitude of the increase caused by each factor and without these causes being isolated from the increases caused by general increase on the quality and quantity of facility provided.

However a tentative conclusion to be drawn is that the cost and time control systems were not effective and that in terms of cost and time the project cannot be judged a great success for the client.

5.8 Project No. 2

5.8.1 Synopsis

The overall project consists of design and construction of 194 Rural Health Centres (RHC) with their sites scattered throughout all districts in Kenya. The project spans all districts, provinces and a wide variation of climatic conditions. One typical RHC (site) contract comprises outpatient facility, public health services, and small in-patient services unit. In addition a varying number of staff quarters, kitchen, laundry and mortuary units are included in some of the sites. Some of the sites were tendered for as group contracts. The value of the projects varied according to number of units included in the contract and according to geographical location but they ranged from K£235 400 to the smallest K£39 400. The original contract periods varied according to site location and value but average period was 42 weeks.

All the buildings are single storey with simple conventional construction of light load bearing walls and light roof.

They involved simple electrical installations and minimal mechanical and civil works.

5.9 The Project Team

5.9.1 Client

There was one client ministry who also comprised the user. The financiers however in addition to Treasury included nine international agencies. The donor agencies had also a controlling role shared by the Ministry of Finance. Ministry of Finance is responsible for negotiating and dealing with the donor. However Treasury allocates and controls all funds for the RHC in the country. The donors keep track of project progress through the Ministry of Finance. On the day to day activities the client ministry is represented by a provincial officer. Site acquisition is done by the district administration.

5.9.2 Design and Design Realization Team

The constitution of the team was as in project no. 1 with exception of:-

- The provincial engineer (PE) in the respective provinces was the DR for supervision only, design having been done at Head Office. This is done by a provincial works officer who is normally an architect working in the PE's office.
- Quantity surveying, structural and mechanical engineering services during project construction was provided from the ministry's headquarters.

5.9.3 The Construction Team

The construction team was constituted in the same way as for project no. 1. The number of specialist nominated contractors was less with most contracts having ^{only} one for electrical. Most projects were awarded to small to medium size contractors owned by nationals.

5.9.4 Evaluation of Project Performance

Technical supervision of the projects was shared between the DR, Provincial Engineer and the chief Architect's office at the Ministry's headquarters. This arrangement brought with it co-ordination and control problems for example a surveyor at headquarters prepares payment certificate which is sent to the DR provincial engineer at the province for approval and then sent back to the chief quantity surveyor to counter check and chief architect before being transmitted to the client ministry who holds funds.

Separate financial and physical progress job status reports are prepared, the financial by forward planning office at headquarters and physical by the provincial engineers office. Often these reports contradicted and they hardly could effectively serve the intended use as project control devices.

At the time of undertaking this research, of the 194 projects only 43% had had a start on site, all others were in progress between the stages site acquisition and survey to tender. 67% of those whose work had started on site experienced delays and had been granted official extension of time. Six of the projects started had their contracts terminated for a variety of reasons.

Approximately 20% of the total projects had been completed and handed over to the client some after very long delays. Two of the projects completed had been rejected by the client on account of unacceptable quality standards.

5.10 Findings and Conclusions from the Case Studies

Although the deductions and conclusions contained in this section relate to the specific projects studied, they may be applied to any other public sector client.

The main conclusion was that most of the problems encountered in the project organization, though having a technological base, were related to project co-ordination, integration and control aspects. They had more to do with lack of appropriate co-ordinating and integrating mechanisms and use of undifferentiated managing sub-system with limited or distributed authority. In the following section we discuss different components of some of these interorganizational problems.

(i) There was poor co-ordination and interministerial liaison between and with various bodies. The Treasury, Ministry of Works, client ministry, client departments and the design team.

- Sometimes Ministry of Works (acting as consultant's "project managers" for client ministry) did not know client ministry requirements due to lack of brief from some departments.
- Ministry of Works proceedings design and design realization for projects whose site had not been acquired and cleared.

- Sometimes client ministry transmitted to Treasury project estimates without having ascertained their correctness with the technical adviser, Ministry of Works. Sometimes these happened to be over- or underestimate and thus caused delay in receipt of approval for additional funds from Treasury.

- There were occasional delays in issuing of formal contract award letters for main and sub-contract due to delay by the client ministry in signing letters of acceptances.

- Delay by client ministry in making payments to the contractor caused by client ministries' inability to appreciate the need for honouring these in time or due to poor followup of these certificates.

It is hypothesised that the causes of these drawbacks were *inter alia*:

(a) Client ministries were inexperienced clients, although having undertaken such works before, they did not employ any in-house professionals in the field of either architecture, engineering, quantity surveying or construction. Thus although they purport to control their own projects they did not have expertise to do so. They left the Ministry of Works to manage on their behalf but they did not give them full authority to do so. In the report, Public Client and Construction Industries, NEDO (1975)¹¹ stressed the importance of clients' role in construction process.

(b) There were no proper feedback systems established between the various decision centres, Treasury, client ministry, the Ministry of Works, and the operating system management sub-systems. So project data necessary for control was unavailable or received when it was too late for corrective measures.

- (ii) There appeared to be undifferentiated project managing system with the role of project management and authority distributed between various organizations. The role of administering the project appeared to be shared between Ministry of Works and the architect with the client ministry playing some control role like deciding which tender to accept. The project architect's authority over the project was limited to matters pertaining to supervision of quality. With all other ^{matters} including allowing extension of time and his own drawings he had to receive approval of the Ministry of Works. Because sub-contractors were nominated by Ministry of Works sometimes with no say of the main contractor or the DR (consultant project architect) their co-ordination proved difficult.

This distributing of project management authority appeared to be more problematic in the case of RHC where responsibility for supervision, acquiring site etc. was shared between provincial engineers, project architect and quantity surveyor from headquarters. This sometimes caused conflict of authority with project participants blaming each other for not providing sufficient supervision on site.

Fundamentally the standard procedures used provide that the DR (project architect) will exercise both project management and design roles. This conflicts with systems theory of organization (see Kast and Rosenzweig,⁷ Walker,⁸ Hall⁹ and Open Systems Group¹⁰), which proposes that managing and operating systems should be differentiated to avoid unreconcilable conflicts. This created potential for the architect's design skills to dominate, leading to imbalances as illustrated in the case where the contractor complains about delay in receipt of details and vital project information from the architect or engineers. The architect being the "prosecutor", the "judge" and the "jury" decides the blame for delay lies elsewhere in the contractor's province.

- (iii) Differentiation of task sub-systems was not matched with appropriate integration. Differentiation increases with technology and complexity of organization and the project. As differentiation increases the number of sub-systems' boundaries grows, thus adding to the need for integration. In the office block studied the complexity of the project increased the number of specialist design consultants and specialist sub-contractors thereby multiplying co-ordinating and integrating problems. Various drawings, working details and information required from the numerous consultants need to synchronize the work of many sub-contractors with that of main builder etc. Yet the method of co-ordination used was direct supervision of sub-contractors by the main contractor with all of them irrespective of their specialty responsible and answerable to the main contractor. In one letter from the architect it is stated for "clarification" the role of co-ordinating sub-contractors is entirely that of the contractor and nobody else.
- (iv) Project feedback and control systems used appeared to be inappropriate and ineffective. The techniques were mainly bar charts and project "situation reports" in the form of historical cost data - presented and discussed at site meetings. For feedback and control system to be effective the feedback points should be designed in the building process to coincide with either decision points or sub-systems discontinuity.¹³

The feedback and control system ought to monitor environmental conditions and provide a facility for corrective action. Thus the project team ought to have been in a position to anticipate delays caused by delay in obtaining import licences, price controls, wage rises, and ought to have had sufficient authority or facility to avert these delays.

An effective control system requires samples to be taken and tested against objectives. The project setting can provide initial cost breakdown of the project in a manner that these can be tested as work progressed.

(v) There appeared to have been lack of appreciation of the nature of environment within which the project's processes existed by those charged with the responsibility of managing the project. The client's changing needs appeared to have caused a lot of delay. The process ought to have anticipated these changes and built in a mechanism for mitigating these effects. Possibly by involving the client more effectively at the design stages.

The two projects investigated were organized on similar conventional traditional project procedures although the projects were subject to different environmental forces and were of substantially different complexity.

Integration is the process of directing, co-ordinating and controlling. Co-ordination and control by standardization is good where there is pooled interdependence while reciprocal interdependence is best handled by mutual adjustment (informal relationships). In the cases surveyed lengthy, formal bureaucratic procedures thought suitable for general business organization were used. There were standard forms of contract used thus standardizing the obligations expected of each party irrespective of the nature of the project and its environment. For example standard clauses required the main contractor to provide attendance, and general supervision to all sub-contractors. Although for simple building with general sub-contractor this was feasible, for more complex projects requiring highly specialized sub-contractors it proved difficult to determine what extent of attendance the main contractor was required to give and to what extent he could be held responsible for sub-contractor's work supervised.

There were standardized methods of reporting and communications. Approvals had to be applied for in routine defined pattern. Site instructions had to be issued through various hierarchical stages with appropriate confirmations. The criteria for evaluating tenders was defined, only lowest tenders had to be considered for acceptance with very little or no room for objective or subjective opinion allowed.

However these requirements are necessary in the interest of public accountability but public accountability requirements must be weighed against the cost of the procedures demanded by it. It is possible for all strictest canons of public accountability to be adhered to and yet extremely poor value for money obtained due to the waste of resources inherent in the public accountability procedures.¹⁶

Public clients often have to satisfy many criteria which cross departmental/sub-unit boundaries and it is at these interfaces that projects become more problematic. Those responsible for managing public client projects must appreciate this and design project organizations that anticipate this and facilitate interdepartmental/unit consultations.

- (vi) Co-ordination, integration and control problems created by the passive role given by the project procedures to the project managing sub-system and to the managing sub-systems of the individual operating sub-systems.

The standard forms of contract used give to the architect only a passive role during construction. The contract is between builder and client, the architect can only advise the client on extension of time upon application by the contractor for such extension.¹² There is nothing positive he can do to avert deviation from the desired completion time.

The nomination of sub-contractors by the client gives the main contractor and the architect (those in charge of project management) only a passive role over the sub-contractors. Use of nominated sub-contractors created conflicts of allegiance and duplicated conflicting management responsibilities. Although contractually responsible to the main contractor and therefore required to follow his instructions, nominated sub-contractors tended to refer directly to the Ministry of Works where the appointment originated. Lines of communication sometimes by-passed the main contractors to the detriment of the whole project.

CHAPTER VI6.00 IMPLICATIONS OF THE RESEARCH AND CONCLUSIONS

6.1 The conventional project procedures in Kenya construction industry have developed historically on the basis established by various professional organizations and the government department concerned with building. This research has demonstrated that the procedures have not been responsive to the increasing influence of complex and changing socio-economic environment. They do not take account of the uncertainty surrounding projects caused by situational factors or the inherent complexity of the types of buildings required.

The whole environment surrounding construction projects in Kenya presents a direct challenge to the building industry's professions and those concerned with project administration to rethink about the whole industry. More thoughts need to be put on development and design of project organization structures and procedures based on a "unitary whole view of the industry". There is need to re-examine certain legislation, practices and government policies affecting construction in the light of the industry as a whole rather than in particular reference to one sector of the industry. As a movement in this direction two recommendations are suggested:

- (a) A review of the Architects and Quantity Surveyors Act chapter 525 of Kenya laws which prohibits professional architects or surveyors from participating in the production side thereby reinforcing differentiation of design and construction.
- (b) A review of government policy on shifting control of industry to indigenous people so that this does not only stress "indigenisation" of the contracting side but also the design professions.

6.2 This research has tentatively identified a key factor in assaying the success of project management for public sector projects in Kenya. It is that project success is a function of the organizational framework established between the Treasury, Ministry of Works, the design team and the construction participants.

The project procedures adopted for public sector client have the potential of creating undifferentiated management system but which is itself differentiated. There is need in government projects to establish differentiated project management system which must incorporate the client system effectively rather than cast it in a "relatively passive role" of transmitting information to design sub-system at its request. To this end, to ensure that the client retains some degree of control of their projects and still return appropriate interministerial/departmental relationship it suggested that a senior permanent officer of the user departments who has some expertise in either architecture, engineering or quantity surveying should be appointed the client's representative.

6.3 The research has shown that for public sector there is need to re-examine project administration procedures designed to handle different types of projects under different socio-economic environments. Especially the standard documents in use (eg. standard forms of contract) on which conventional procedures are entrenched:-

- (a) It is suggested that in this regard a review of existing standard forms of contract in particular those clauses dealing with roles and powers of the DR, architect, external consultant when used, the clerk of works and the resident engineer.
- (b) It is suggested that the use of nominated sub-contractors and the contractual relationships relating thereto be reviewed in the light of the changing technology and complexity of projects. Acknowledgement needs to be made that nomination of sub-contractors and establishment of contracts separate from or parallel to main contract are likely to create significant problems in managing projects under conventional competitive arrangements.

6.4 In the project we have identified the problem of bureaucratic project procedures in construction process. These are necessitated by the need for public accountability which is even more important in building process due to the amount of documentation and the sums of money involved. However it is our view that there is need to balance the view of public accountability. It should form a "wider range of decisions throughout the design and construction process"⁴ than that of construction selection procedures and supervision which it seems mainly concentrated.

It is suggested that procedures for appointment engagement and supervision of design teams who play a major role in determining the "value for money" should be more rigid and formalized. More guidance to public officials responsible for appointing and controlling consultants and contractors as to the requirements of public accountability should be considered.

6.5 This research has further identified the need for project management to be pursued in education, training and research. Providing this course at the existing institutions is inhibited by constraints noted in the report. One feasible solution appears to be in the introduction of project management as a postqualification course. This could take the form of professional continuing development course conducted on short term basis. This can be organized by professional institutions in conjunction with the university and the Kenya Polytechnic.

It is further suggested that a course on construction project management to train officers involved in administration of Government projects should be introduced at the existing Government Institute of Administration (K.I.A.).

With regard to teaching and research and development in this discipline further work along the lines started by Tavistock,¹ Morris,² Walker,³ would be extremely beneficial as means of developing theoretical framework which can be applied to develop appropriate procedures. There is already an infrastructure set at the University of Nairobi for the base of this kind of work. Encouragement and support should be given to this by both the industry, professions and government by way of providing scholarships, and research grants to encourage development in this field.

There is need in Kenya for those responsible for project administration in construction industry in Kenya to think about the process and its sub-system as a whole and in the light of the environmental factors influencing the process when designing project organizations.

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