

THE IMPLEMENTATION OF PUBLIC BUILDING PROJECTS:
A CASE STUDY OF
MINISTRY OF WORKS, HOUSING AND PHYSICAL PLANNING.

BY

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A Thesis Submitted in partial fulfilment for the
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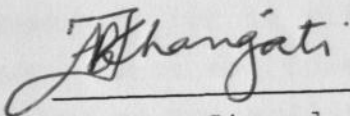
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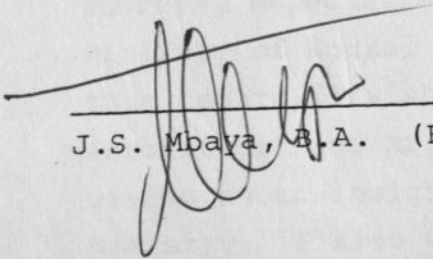
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This thesis has been submitted for examination with my approval as University Supervisor.



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A C K N O W L E D G E M E N T

This study has been successful mainly because of the enormous amount of assistance I received from various sources. Despite my desire to mention each one of them, I regret that this is not possible mainly because of the limited space available. Suffice therefore to say that I am indeed grateful to each one of them for whatever assistance was rendered to me, and sincerely wish them all well in their future endeavours.

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A B S T R A C T

The construction of buildings and other related infra-structural facilities has been identified as one of the means through which the Government of Kenya can realize its objectives, i.e. to alleviate poverty, create enough employment opportunities, and also, improve health standards. As a result, this aspect of national development receives a lot of priority, especially in the approval and funding of its programmes.

Despite the good intentions and priority in funding that the building construction activities receive, there is general discontent about the way the activities are implemented. It is observed that those charged with the responsibility do not carry it out as efficiently as would be required. As a result, many building activities are completed behind the scheduled completion time and after having generated a lot of unnecessary costs. It is out of the need to verify this assertion, and if true provide solutions to it, that this study was borne.

The study can be logically divided into two: the first part which deals with Literature review and formulation of the theoretical framework, and the second part which presents the findings of the survey. In the second part, there are also recommendations. These are made in the light of the findings and the theoretical background provided.

In respect to the survey and findings made, it is noted that the hypothesis of the study is proved valid, but with qualifications. It is noted that lack of proper planning and control is not the only factor that causes delays during the implementation of projects.

Other independent factors such as poor organization of Ministry of Works, Housing and Physical Planning; bad funding methods by the Treasury, conflicting priorities by the Government - especially in respect of African Contractors and poor organizational methods by contractors on site also play a significant role. As a result of the study, solutions are offered. The most critical solutions are mainly two, i.e. the Ministry should adopt better planning and control procedures, and two, it should also streamline its works programme so that the amount to be done can be handled by the existing staff without overloading.

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CHAPTER I

INTRODUCTION

The Problem Statement

The Construction Industry

Since Kenya attained its independence in 1963, it has made substantial progress in pursuit of its social and economic programmes. These programmes have been specifically formulated to utilize to optimal levels the meagre resources available from both internal and external sources, and have above all aimed at improving the welfare of all "wananchi" in the country. Most of these programmes have fallen within the framework of various policies spelled out in the 5 Years Development Plans. One such policy which has consistently appeared in the previous 4 Development Plans and still features prominently in the current one (1984-1988) is the utilisation of the available resources on the infrastructural programmes which do not only provide facilities which meet the basic needs of the populace, such as water and power supply, roads, waste treatment and disposal, hospitals and other rural health facilities, schools, housing and other structures to shelter various social and economic activities; but also provide gainful employment which in turn help in alleviating poverty. One sector of the economy which has been identified as a vehicle for the realisation of these objectives is the construction industry.¹

A look at the performance of the industry over the last 20 years shows that although it has not been operating at full capacity, it has still contributed significantly to the growth of the National economy.

In 1979 for example, it was responsible for 42 percent of the capital formation and its share of GDP was 6 percent.² This is quite modest considering that GDPs for developing countries usually vary between 3-8 percent.³ Although the industry's contribution to the GDP fell to 3.8 percent in 1983 due to National economic difficulties caused by the global economic recession, it has been projected in the current Development Plan that by 1988, it would have recovered to 5 percent.

It has also been projected that the construction industry at this growth level, will be able to employ 67,000 people which in effect, will be 5 percent of the total formal employment opportunities in the country.

Table 1.1 GDP Growth Targets - Construction Industry

Year	1982	1983	1984	1985	1986	1987	1988
Level K E M	118.2	114.7	114.7	116.4	121.1	126.5	132.9
Growth Rate %	3.0	0.0	0.0	1.5	4.0	4.5	5.0
National Total Enter- prises	2299.9	2380.6	2474.5	2589.5	2721.3	2867.9	3033.5

Source: Ministry of Finance and Economic Planning,
5th Development Plan 1984-1988, Table 3.2, p70.

To effect the realisation of the above, it has been noted in the Development Plan as follows:-

The industry has faced a number of constraints in the recent past which will be addressed to during the plan period. These include shortage of technical manpower, limited availability of locally manufactured materials, and various impediments to timely completion of projects. These constraints will be ameliorated by improved organization of the implementing Ministry, standardization of building materials and practices and increased support for training and job creation programmes.⁴

The plan goes ahead to summarise the strategies to be employed as follows:-

- (i) Standardization of building designs to be undertaken which will result in a more efficient construction process.
- (ii) Proper maintenance of buildings to be given high priority and maintenance procedures to be streamlined by establishing a system of information monitoring on the state of the buildings and the maintenance works that get carried out.
- (iii) Government to continue giving support towards the establishment of a strong and viable construction industry manned by the indigenous constructors through the National Construction Corporation.
- (iv) Encourage import substitution of building materials while at the same time keeping an eye on the quality produced and the prices at which they are sold.

- (v) Rationalise and co-ordinate research activities to ensure saving of the available manpower resources and achieve set targets.

Need for Efficiency

From the foregoing it is quite evident that the Government is not only interested in the expansion of the construction industry through fiscal measures, but also with the establishment of an industry with a local base; stable and efficient in its operations.

The aspect which of late has however received alot of emphasis, is efficiency. Need for efficiency has not only been stressed in the construction industry; but practically in all economic sectors of the nation. For example, the Minister for Finance and Economic Planning has in the last Budget Speeches been advising all people to "tighten their belts ... worse times are to come". This in essence has been and still is, an appeal to all people to utilize their resources optimally.

Although it is generally agreed that efficiency lacks in most operations of Third World Countries, it is manifestly clear that this aspect is lacking in significant proportions in construction activities, especially those pertaining to building. Concern has been shown in various Government Circles about the inability of the implementing agencies to deliver to the people planned facilities at the earliest possible time and at the originally envisaged costs.

Mr. Y.F.O. Masakhalia, the then Permanent Secretary, Ministry of Economic Planning and Development, in circular No. 1 of 20th January, 1982 observed that while the Government was finding it difficult to finance development activities due to limited resources, there were several cases of delayed projects. This, he noted, not only withheld the realisation of development objectives, but also had other negative consequences such as: the tying up of limited budgetary funds, increases in project costs, and delayed receipts of foreign exchange where donor financed projects were concerned. He further noted that since delays stemmed from insufficient scheduling of project activities and unavoidable time lags in the implementation process, the situation would be rectified if operating Ministries adopted more serious planning and implementation procedures.

Concern about poor implementation of Government projects has been shown in other quarters too. The main Government agency, Ministry of Works, Housing and Physical Planning (MOWH & PP), which is charged with the overall responsibility of mobilising public resources earmarked for building construction works, has been severely criticized from several quarters. Politicians have been in the forefront accusing the Ministry for inability to undertake and complete projects in good time, thus denying Wananchi facilities they have paid for in form of taxation.⁶ Client Ministries on their part have complained about disruption or holding back of programmes due to non-completion of the required infrastructural facilities.⁷ Some of them, especially Ministries of Health and Education, and Department of Defence, have been contemplating making representations to the Treasury and the Directorate of Personnel Management, to request for direct responsibility for the implementation of their projects.

Project financiers have also been upset about this phenomena. The Treasury, for example, has condemned underexpenditure of voted funds and on some occasions had responsible officials appearing before the public Accounts Committee to answer why they allowed this to happen. Its point has always been that under-expenditure not only slows down national development, but also overburdens it, since the same amount of money plus an unknown sum due to inflationary effect would be revoted the following year for the same projects.⁸ Other financiers mainly donor agencies such as World Bank, USAID, EEC, DANIDA and SIDA have also expressed their dissatisfaction at the pace at which projects are implemented in this country. They have therefore lately adopted and insisted on certain measures which are supposed to ensure project completion on time. These measures range from direct deployment of their staff on projects under their funding to stiff conditions such as "grants not utilized within stipulated periods will not be revoted in subsequent years".

Results of the Preliminary Survey

In the foregoing discussion, the Government's policy and her commitment to the development of the construction industry, with specific reference to building, has been noted. Attention has also been drawn to the fact that operations of the industry i.e. projects under implementation have not been satisfactorily carried out and the Government Ministry (MOWH & PP) charged with this responsibility has been under constant fire from several quarters. From this, it is easy to note that there exists a serious problem and someone should endeavour to study it with a view to coming up with corrective measures.

But before a decision to this effect could be reached, it was deemed necessary to first of all conduct a preliminary survey mainly in MOWH & PP offices to establish the validity of the aforementioned complaints.

During the survey, a look was made at the various documents used by the Ministry in the implementation of its projects.

Although the Ministry uses several documents, the following which are essentially used during the planning and control of projects, were found relevant and therefore subjected to scrutiny.

- (i) the Annual Works Programme - which is a planning document prepared at the beginning of each financial year. It contains information on projects as follows: project names, item and job numbers, locations, description and scope of works, estimated value, sums of money voted by the Treasury and the physical and the financial status of the projects. See appendix 1.
- (ii) the Job status Reports - which are prepared at the end of every quarter of each financial year and contain progress information. The recipients of this document are mainly the client Ministries and the Treasury. See appendix 2.
- (iii) the Job Cost Summary Sheets (JCSS): these are prepared by team leaders and Provincial Works Officers and show in greater detail the financial progress of the projects. They are prepared on monthly basis and essentially are inputs into the quarterly Job Status Reports. See appendix 3.

- (iv) the project files - which contain documents like minutes of design liaison meetings, site weekly reports, copies of site instructions, etc.
- (v) the job status cards, contract payment cards and progress sheets - all which are updated in an adhoc manner and contain information on the day to day progress of the projects, payments made, etc. See appendices 4, 5 and 6.
- (vi) the job programming sheets - which essentially are bar charts, are supposed to show how various project activities are scheduled over their implementation periods. They are prepared by Architects, supposedly in collaboration with other professional members of the building team at the beginning of each financial year. For all practical purposes, they form the major planning and control document used by the Ministry. See appendix 7.

A casual examination of these documents revealed first and foremost that they were not properly maintained. Preparation and updating seemed to be done haphazardly and as a result there were many glaring information gaps. For example a look at the randomly sampled Job Status Cards revealed that practically all cards were not up-to-date with the relevant project progress information. The results of the 200 cards analysed are shown in table 1-2. The table gives the number of projects in relation to the information gaps expressed as intervals in terms of weeks.

No. of Weeks (Interval)	No. of Cards (Projects)
1-12	24
13-24	103
25-36	37
37-48	17
49-60	16
Over 60	3

Table 1-2: Projects information gaps as noted on the Job Status Cards.

Of the 3 Job Status Cards indicated in the table as having not been updated for a period of over 60 weeks, one had very interesting revelations. On the card the previous remark recorded on 2nd March, 1982 read as follows - "Phase I now complete, Phase II builders work complete, Phase III commenced and scheduled for completion on 3rd March 1983". This remark was followed by another remark on 13th May 1984 which read "contract period extended from 3rd March 1983 to 26th April 1984". Understandably the extension to the contract period was granted after the contractor putting in a convincing request. The question which however arises is: since the management did not have complete history on the performance of the project, on what basis did they grant the contract extension period? The survey indicated that there were several projects where some form of remedial action had been taken on incomplete information or dubious grounds. These examples create an impression that the Ministry does not utilize any systematic or scientific methods in the planning and control of its projects.

A further scrutiny of the documents revealed that there were 7 critical stages where projects were delayed during the implementation process. The stages are listed below:-

- (i) Confirmation of construction sites by Ministry of Lands.
- (ii) Confirmation of briefs by the Client Ministries.
- (iii) Documentation of projects by MOWH & PP.
- (iv) Confirmation of funds by the Treasury.
- (v) Acceptance of the contractors and their tender figures by the Client Ministries.
- (vi) Construction on sites.
- (vii) Final Accounts.

It was observed that these holdup points or bottlenecks existed as a result of a number of management problems which the Ministry was having. The problems are briefly discussed below under the topics coordination, organization, planning and control.

(i) Coordination: In normal Government building projects, there are various parties which are involved in implementation at various stages. These parties include the Client Ministries, which are the owners of the projects, and are responsible for acquisition of sites, provision of briefs, negotiation of funds and issuance of acceptance to the contractors; Ministry of Lands which allocates sites; MOWH & PP which is responsible for designing and documentation of the projects, coordination of other concerned parties, and the supervision of the construction works; the Treasury which is responsible for funding;

consultants - who help MOWH & PP in designing and supervision of projects, and finally, the contractors and subcontractors that do the construction work on site.

In order to achieve efficiency, all these parties should meet their responsibilities promptly. From the documents examined, it appears that these parties are however not very well coordinated and often fail to fulfil their responsibilities at the required time. For example the Annual Works Programmes contain several projects without essential elements such as sites, detailed brief and funds. There are also some projects without sites and yet funded, and vice versa. One officer in MOWH & PP noted that they resent this situation and in the past, they have been trying to streamline it. According to him, the Ministry would like to have an Annual Works Programme with active projects only - projects with all necessary requirements. They believe that projects such as the ones mentioned above simply crowd the Works Programme and unnecessarily draw the management's effort and attention from active projects. The best solution therefore would be to get rid of them and advise the responsible Client Ministries to resubmit them when all necessary requirements have been attended to. This has once been tried, but unfortunately, met with a lot of resistance from both Client Ministries and the politicians. The Client Ministries insisted that their projects should remain on the Works Programme while they negotiated for funds and sites. Their fear was that projects out of the Works Programme might not receive consideration during funding by the Treasury. They therefore gave false impressions that funds and sites would be forthcoming when in actual fact nothing of the sort was in the pipeline.

Politicians on their part view removal of projects on the Works Programme, especially those in their areas as effort by the Ministry's officials to frustrate development in their areas and possibly ruin their political careers. This state of affairs which does not permit order to be instituted in a working system is very bad and points out to a serious lack of mutual understanding on the part of various parties involved in project implementation.

As already indicated above, the survey noted some projects which were fully funded but due to lack of certain necessary requirements, implementation could not go on. On the other hand, there were projects whose performance had been slowed down by non-availability of funds. When an MOWH & PP official was questioned on this, he stated that some Client Ministries preferred to negotiate with the Treasury for funds without involving his Ministry. The result was that some projects were funded without any due regard to their present status and anticipated physical performance.

(ii) Organization: The Survey also revealed that MOWH & PP has been fragmented into various departments based on the professional training of their respective personnel. The departments are Architectural, Quantities and Contracts, Electrical, Structural, Housing, Physical Planning and of course Administration. These departments are expected to make an input into the project implementation, but their diversified, uncorresponding internal structures make it very difficult.

The result of this has been that design liaison meetings and sitemeetings were difficult to organize. There were some projects which had taken a long time to design and document because design teams had collapsed several times as a result of regular changes of personnel.

(iii) Planning: This is the most important function of project management as it allows those involved in project implementation to develop a deeper understanding of their responsibilities, and also to know when and how they should be carried out if the objectives of the projects have to be met. Through the survey, it was noted that MOWH & PP uses the Job Programming Charts to plan and schedule its projects. When well done, these charts should clearly indicate in logical sequence the interdependence of various activities. It appears however that very few Ministry officials know the usefulness of these documents and what amount of seriousness should be put in at the preparation stage. This view was reached after an examination of several projects' charts revealed that even where projects had the same scope of work, both utilized standard designs and were to be constructed in the same location, there were big variances in the allocated contract durations. A good example of this was a case of two Health Centres in Western Province with basically the same facilities. The first was allocated a contract duration of 32 weeks while the second was allocated 50 weeks. The variance of 18 weeks, given the similarity of the projects, is too high and automatically creates an impression that officers in MOWH & PP are not really serious about planning projects.

This point is made firmer by the revelation that of all the Job Programming Charts which were retrieved and examined, some dating as far back as July 1979, none of them had been updated. All had been prepared and then very neatly stored to gather dust.

The other interesting point which surfaced was that each department prefers to plan its project activities without much consultation with the other departments. This means that at the beginning of each financial year each project has several sub-plans based on departmental responsibilities. Unfortunately no effort is made to interface these sub-plans and they remain inconsequential in value.

(iv) Control: This was revealed by the survey as missing in great depth. One explanation for this could be lack of well thought out plans to form a good basis for effective control. Alternatively it could be lack of a sound control system; or both. Whichever the case, it was noted that as a result of lack of control there were several consequences. Three main ones are discussed below.

Finalisation of projects' accounts was noted as one area which was completely chaotic. Practically half of the projects completed, some as far back as 1980, had not been finalized for no apparent reason. The trend it appears is to complete the required facilities and hand them over to their respective Client Ministries for use without bothering to close their accounts and delete them from the Works Programme. Since the Treasury provides funds which cover this item and it is not regularly done, it becomes one of the causes of under-expenditure.

Cost overruns of very high magnitude were also noted on several projects. Examples of this include a project at AHITI, Ndomba for Ministry of Agriculture which had been submitted in June 1978. At that time, it was estimated to cost KShs.21,500,000. Documentation was completed in October, 1979 and construction commenced in February, 1980. The project was scheduled for completion by 27th July 1982 (100 weeks). As at February, 1985, the project was not financially completed and its tender sum had risen from KShs.25,204,000 to KShs.42,082,000. The second example is the MOW/MTC Headquarters at Nakuru. Construction commenced on 17th December, 1979 with a contract sum of KShs.20,631,800 and was supposed to be completed after 94 weeks. At the time of the survey the project had not been completed and the contractor was claiming up to KShs.53,000.000. MOWH & PP had agreed to pay up to KShs.42,000.000. The final example is a K.A.F. project at Nanyuki which was scheduled for completion in October, 1982, but at the time of the survey was 80 percent complete. Initially it had been estimated that the required flooring materials would cost KShs.800,000. At the time of procurement, however, KShs.1,700,000 was required. Since not enough money had been set aside for this, the suppliers refused to lay the materials, thus causing further delay and also exposing the materials to the danger of being ruined as a result of moisture. The contract has had 7 variation orders.

The three examples cited above adequately substantiate the point that due to lack of control, projects suffer cost overruns. But this should not give an impression that there is generally incidences of overexpenditure on building projects on annual basis.

It is noted that the implementation of building projects has been noted, and through the preliminary survey, verified as containing substance.

On the contrary, there have been perennial cases of underexpenditure on the total vote for building projects. See table 1-3 below. There is no doubt that this is also a product of poor control of projects during the implementation process.

Financial Year	Value of work on the Annual Works Programme (£)	Voted funds in the Dev. Estimates (£)	Spent (£)	%
1976/77	99,286,155	19,398,000	16,713,000	86
1977/78	138,382,139	29,651,00	17,543,000	59
1978/79	204,159,532	40,148,00	20,148,000	49
1979/80	249,989,558	46,111,146	32,000,000	69
1980/81	348,840,383	59,174,000	37,000,000	73
1981/82	390,683,701	64,577,111	43,518,000	67
1982/83	454,426,111	64,535,428	41,980,000	65
1983/84	464,235,537	46,217,815	46,675,117	101

Table 1-3: Building Development Programme - Expenditure of funds, 1976/77-1983/84

Source: Forward Planning Group MOWH & PP Job Status Reports Summary.

The above table and the other examples cited to illustrate the inadequacy or lack of various management functions, clearly indicate that the complaints registered on the poor implementation of building projects are not completely unfounded. They are justifiable and require serious attention.

View of MOWH & PP on the poor implementation of projects

So far views on the unsatisfactory performance of MOWH & PP on the implementation of building projects have been noted, and through the preliminary survey, verified as containing substance.

What remains at this stage of problem identification is to note, once again in a preliminary manner, whether MOWH & PP recognizes that it has problems in meeting its responsibilities or not.

The Chief Architect of the Ministry in his paper entitled "Constraints on the implementation of Government projects implemented through Ministry of Works, Housing and Physical Planning" presented in November, 1984 at a Seminar at the Kenya Institute of Administration (K.I.A.), Kabete, fully agreed that his Ministry was not meeting its obligation of providing buildings and other auxiliary facilities in good time. He however attributed this phenomenon to several external factors, most of which were completely impossible for his Ministry to control. He cited the following factors:-

- (i) Lack of adequate professional and sub-professional staff to undertake the documentation and supervision of projects. The main cause of this was that the local University of Nairobi, was not producing enough professionals, and the few produced were competitively shared with other East African countries and the private sector. The problem has even been compounded further by the poor rate of remuneration offered by the public service to its employees. This means that even officers recruited do not put in their best because their morale is low and have their minds set on entering the private sector. Most of them actually do leave in the middle of their services, thus abandoning projects they had started and generating confusion in the implementation process.

According to the Chief Architect's estimates, the Ministry for example requires not less than 150 Architects and twice as many Architectural Assistants in order to effectively undertake all design work in-house. The present position is that only half of the required number exists, 20% being expatriate staff. The position is made worse by the fact that half of the Architects available are still fresh in the profession and require regular guidance.

- (ii) For a long time the inadequacy of professional staff has been alleviated by the provision of consultancy fees by the Treasury for commissioning of projects to private consultants. In the last 3 years, however, the amount made available under this provision has constantly reduced and presently can hardly cover the fee notes for consultancy services on on-going projects.
- (iii) Non-compliance with the necessary procedures for planning and execution of building construction projects laid down in the Treasury Circular No. 5 of 7th May 1974 by the Client Ministries is one of the strong points advanced by MOWH & PP. The circular stipulates first and foremost that projects should be submitted to MOWH & PP 12 months in advance of the year in which they will be funded to give MOWH & PP enough lead time to plan and document them in readiness for physical implementation. This provision is hardly observed as projects are submitted in an adhoc manner and then pressure mounted by Client Ministries to get them started immediately.

Other aspects of non-compliance with the Treasury circular include submission of projects without confirmed sites and adequate briefs. This makes it difficult for MOWH & PP to draw clear implementation programmes for such projects.

- (iv) Poor budgetary control by the Client Ministries is another point noted for causing delays during project implementation. Client Ministries often make budgets without involving MOWH & PP. The end effect of this is that some projects are over-funded while others are under-funded. On over-funded projects, cases of under-expenditure occur, while the inverse occurs on under-funded projects. Projects which are normally under-funded generate a lot of contractual problems. The contractors sensing that they have exhausted the available funds for the projects within a particular period usually decide to "go-slow". In serious cases they simply desert sites or transfer the available plant and labour to other sites. Since the Government is short of cash to pay the contractors their outstanding payment certificates, it loses the required control and the projects suffer.
- (v) Projects are also delayed due to non-availability of imported materials. Some building materials are not locally available and orders have to be made from overseas countries. These orders have to be scrutinized by the Central Bank before import licences are issued. This takes time and affect project performance.

- (vi) The Chief Architect also adds that there is generally a problem of availability of G.K. vehicles to transport officers to various projects' sites for supervision, valuation and general inspections.
- (vii) Finally, the Ministry finds it difficult to implement two Government policies which are incompatible. The first policy is about the provision of infrastructural facilities which meet the needs of the populace at minimal costs and within the shortest time possible. The second policy requires the ministry to deliberately develop an indigenous construction industry.⁹ This means that local African Contractors should be deliberately promoted through the following identified means:-
- training in contract management aspects.
 - provision of credit facilities on easy terms.
 - preference in the awarding of contract especially on small projects - say with an estimated total cost of less than £.250,000.

The problem which disturbs the Ministry is that despite its clear knowledge of the fact that African Contractors perform very poorly on sites, it is obliged to consider them while awarding tenders. Most of them considered end up causing delays on their projects simply because they do not have sufficient technical knowledge to undertake construction work, and also lack other necessary resource inputs. The Ministry is empowered by clause 27 of its Standard Contract Agreement to terminate the Contractor's employment when his performance is unsatisfactory.

(iii) There are cost overruns experienced on building projects.

Or alternatively apply the liquidated damages clause to levy fees from contract payments to enable it recover funds lost due to delay in completion of projects. It however finds this difficult to do as most affected contractors would simply collapse, and this would not be in the interest of the Government. Even without that consideration, some of the contractors are members of the Association of Kenyan African Contractors and when in problems, they implore the Association to make a lot of noise on their behalf on how the Ministry was being impassive to the plight of the local contractors. Sometimes politicians also step in and make an issue out of the subject and MOWH & PP is left with no other alternative but to compromise by granting extensions to contract periods.

Due to the conflicting priorities, the Chief Architect notes that small projects frequently suffer delays during implementation and comparatively have more contractual problems than big projects which are exclusively undertaken by well established construction firms.

Formulation of Hypothesis

The sources of information so far examined reveal the following points:

- (i) Public building projects are delayed.
- (ii) There is a case of perennial under-expenditure on funds provided by the Government for building projects.
- (iii) There are cost overruns experienced on building projects.

- (iv) The construction industry (building) despite the goodwill from the Government is still in the doldrums because of lack of local manpower with the capability to undertake construction works efficiently.
- (v) The Government's objectives of developing the construction industry as a catalyst for rural development and for generation of employment opportunities will not be realised in the short run because of Ministry of Works, Housing and Physical Planning's inability to play its role as a key actor in the industry effectively.

Having noted these points, it becomes possible at this preliminary level of the study to create a framework within which an examination of the problems facing public building projects to be made and suitable courses of action prescribed for corrective purposes. But before this is done, it should be noted that the critical point of discussion is efficiency and how it can be achieved. It is an obvious fact that the level of efficiency which goes into the implementation of projects determine their success. Efficiency is a function of management. It is the ability to achieve optimal results, products, etc., with available specified inputs. Management on the other hand can be defined as "the process of planning, organizing and controlling activities". Its main task is the integration of diverse; sometimes co-operative, sometimes conflicting elements into a total organizational endeavour. This involves the co-ordination of human and material resources towards objective accomplishment.

the resources required rationally allocated. Care is also taken to ensure that desired goals are met with the specified resources. These details the use of appropriate modern management tools such as networks and computers.

When people talk about management, they refer to people at the higher echelon of the organization system, but the usual connotations suggests group effort with four basic elements (i) towards objectives (ii) through people (iii) via techniques and (iv) in an organization.¹⁰

It is through these four basic tenets that a look at Ministry of Works, Housing and Physical Planning and its operations can be made. The guiding questions are:

- (i) how does the Ministry organize itself towards the accomplishment of its given responsibilities?
- (ii) does its organizational set-up provide for the utilization of modern management concepts?¹¹

With the above in view, it now becomes possible to formulate an hypothesis which should help in giving focus to the important aspects of this study. The hypothesis is that Poor Planning and Control of Public building projects is responsible for their inefficient implementation.

Assumptions

The above hypothesis is based on the following assumptions which are pure management theories:

- (i) Planning and control are the two management functions which largely determine the efficiency involved in implementing activities. Through these two factors, activities are defined in a logical manner, their contents noted well in advance; strategies to be applied formulated, and the resources required rationally allocated. Care is also taken to ensure that desired goals are met with the specified resources. These entails the use of appropriate modern management tools such as Networks and computers.

These tools enable managers to produce quantitative solutions to problems and to predict accurately the penalties or benefits involved in certain omissions. In cases of holdups, escalations, etc, points where corrections should be made are accurately determined and the required remedies such as "crashing" and "variations" applied. This assumption is based on the findings of the preliminary survey which indicated that MOWH & PP had no systematic planning procedures and possibly as a result, failed to develop an efficient control system. Incidentally planning and control are so heavily inter-dependent on each other that the absence of one makes the operation of the other simply illusory. This is a proven management fact which is adequately illustrated in figure 4 in chapter 4 of this study. For the time being it is enough to note only what Kast says about control.

The control function monitors the system, keeps things in line and facilitates the intergration of activities. Organizational control is inextricably intertwined with planning. Planning provides the framework against which the control process works. On the other hand, feedback from the control phase often identifies the need for new plans or at least adjustments to existing ones. Typically, individual and organizational behaviour involves a continuing sequence of planning-implementing-controlling cycles.

- (ii) The second assumption which is equally important is that for any organization to achieve its goals or objectives, the management should develop and utilize a sound communication system which enables it to monitor the operations of the organization effectively.

The management should determine the levels or points at which it should be informed of the progress of its projects. For example, it should as a matter of policy be informed of say - projects newly submitted by the Client Ministries, projects ready for construction on site, projects completed, projects delayed by more than 10% of the contract time, projects with possibilities of incurring cost overruns, etc. Specific reports should be prepared and given to the top management for their consumption. On the basis of these reports, the management should precipitate corrective measures and generally bring pressure to bear upon culprits. This is called "management by exception" and provides the necessary control that is usually required to get activities well done within any organization.

Modern writers refer to this communication system as "Information-decision system". Kast says the following.

The term 'information-decision system' is used to emphasize the fact that information developed should be requested in the light of the decisions to be made throughout the organization. Information decision systems should be related to the levels of the Managerial System-technical, organizational, and institutional and the basic managerial functions-planning, organizing and controlling. Organization is the framework for implementing planning and control; organization is related to communication; and communication is represented by an information-decision system. Thus the key to success in planning and controlling any operation lies in information-decision system. ¹³

A look at the standard forms used by the Ministry of Works, Housing and Physical Planning for recording and disseminating projects progress information to various recipients reveals that all reports prepared, be they on physical or financial status of the projects are meant for the consumption of the Client Ministries, the Treasury and for circulation among various professionals in the Ministry. The top management of the Ministry, i.e. the Ministers, Assistant Ministers and the Permanent Secretary do not receive any status reports at all. They only keep in touch through adhoc briefings provided by the departmental heads or their deputies. These briefings cover projects which are considered as sensitive.¹⁴

Sometimes their counterparts in other Ministries or contractors approach them with a view of having problems facing their projects solved. In such cases, they request for information from below, and that is how they get to know what is happening on a few projects.

It is clear that this approach does not keep the top management officials well informed and therefore sufficiently involved in the implementation of the projects. The vital pressure expected from their offices, in cases of lapses, tends to arrive late when projects have suffered much damage and very little remains to be salvaged.

For the reason discussed above, it is therefore reasonable to assume that poor implementation of projects is partly brought about by poor communication which is an ingredient of control.

- (iii) The final assumption deals with the aspects of differentiation and intergration of organizational activities. Differentiation is defined as "the state of segmentation of the organization system into subsystems, each of which tends to develop particular attributes in relation to the requirements posed by its relevant environment". Intergration on the other hand is defined as "the process of achieving unity of effort among various subsystems in the accomplishment of the organization's tasks".¹⁵

Through the process of vertical and horizontal differentiation, the activities for organizational performance are separated. They then have to be intergrated. The requirements of the environment and the technical system often determine the degree of co-ordination required. In some organizations, it is possible to separate activities in such a way as to minimize these requirements. In other organizations, particularly those departmentalized functionally, intergration is more important. It is important to recognize the interaction between the need to specialize activities and the requirement for intergration. The more differentiation of activities and specialization of labour, the more the difficult of co-ordination. Coordination of activities is a very important element which enables goals set down in plans to be realised. Litter¹⁶ suggests three primary means for achieving coordination: through the hierarchy, the administrative system and voluntary activities.

In hierarchical coordination various activities are linked together by placing them under a central authority - typical pyramidal structure. The administrative system provides a second mechanism for coordination of activities.

A great deal of coordinative effort in organization is concerned with a horizontal flow of work of a routine nature. Administrative systems are formal procedures designed to carry out much of routine coordinative work automatically. Many work procedures such as memos with routing slips help coordinate efforts of different operating units.

A third type of coordination is through voluntary means. The individual or group of individuals sees need, finds a programme and applies it when deemed necessary. Much of the coordination may depend upon the willingness and ability of individual or groups to voluntarily find means to intergrate their activities with other organizational participants. Voluntary coordination requires that the individuals have sufficient knowledge of organizational goals and objectives, adequate information concerning the specific problem or coordination, and the motivation to do something on their own.

Three approaches have been advocated for as suitable for intergrating activities and generating the required coordination in an organization. They are:

- Use of committees comprising members of different departments or functional areas.
- Use of task forces, teams and project offices.
- Use of "linking pins". This is an idea advanced by Likert who notes that

Increases in functionalization, in turn, make effective coordination both more necessary and even more difficult. The mechanism for achieving intergration is by having people serve as 'linking pins' between the various units in the organization. Horizontally there should be certain organizational participants who are members of both groups and serve as coordinating agents between them. On the vertical basis, individuals serve as 'linking pins' between their own level and those above and below.

Thus through this system of 'linking pins', the 'voluntary coordination' necessary to make the dynamic system operate effectively is achieved. This constitutes a multiple, overlapping group structure in the organization.¹⁷

With the above background given, reflection can be made upon the way Ministry of Works, Housing and Physical Planning differentiates and intergrates its activities. It can be noted that differentiation has been perfectly achieved by setting up six professional departments to deal with all professional aspects of building. The departments are Architectural, Quantities and Contracts, Electrical, Structural, Housing and Physical Planning. There is also differentiation by location which enables projects to be identified and implemented according to the districts/provinces they fall in.

Unfortunately intergration has not been achieved mainly due to the feeling of independence among members of various professions. It is difficult for example to organize Design Liaison meetings or to have fully attended site meetings. Problems affecting the projects are looked up as "the Architects" or "the Electrical Engineers" problems but not as the "project team's problems" as they should be. Because of lack of intergration, the element of coordination becomes difficult to achieve, which in turn makes it difficult to make plans/programmes for projects which are realistic and readily acceptable by all participants. There is therefore a serious lack of the required framework for collective planning. Members of various professions draw programmes without serious consultation with each other. The net effect of this is that there is disharmony in priorities. Plans of different departments do not properly interface and this makes control difficult to achieve.

Study Objectives

The objectives of this study are mainly three:-

- (i) Identify the problems underlying the implementation of public building projects.
- (ii) Suggest practical means of solving these problems.
- (iii) Expose benefits inherent in the use of modern management techniques for project implementation.

Study Area

The area covered under this study is the entire republic of Kenya. Projects considered are drawn from various parts of the country. This is mainly to help in:

- (i) Determining whether the environmental factors have any bearing on the performance of the projects so that the study can propose that they be provided for at the preliminary planning stage and how.
- (ii) Making comparison of the performance of projects handled at the headquarters and those ones handled in the provinces and districts. The critical point here being to determine whether efficiency is in any way related to the proximity of the centres of performance.

Scope of the study

The study is on the implementation of public building projects. Ministry of Works, Housing and Physical Planning is the Government agency charged with this responsibility. Parastatal organizations carry out their own building construction with MOWH & PP involved at a more or less consultancy level.

The volume of work carried out by these organizations as compared to MOWH & PP is quite insignificant, and considering how they organize themselves when implementing their works not only makes the study burdensome, but also too general to be of any significance. For these reasons, the study has practically limited itself to public building projects undertaken by the Ministry of Works, Housing and Physical Planning.

The study has also ignored the implementation of the maintenance projects. Two reasons account for this. The first one is that most maintenance projects are comparatively small in content and utilize little amounts of resources. The projects are also quite varied in nature and this makes it difficult for this study to collectively prescribe for them elaborate management procedures for use, as is intended for development projects. The second reason is that there is currently a study being conducted in this University on the implementation of maintenance projects and it will certainly address itself to "aspects of planning and control."

About new building projects undertaken by the Ministry, the study places emphasis on the implementation stages between "projects conceived" and "projects let to contractors". The major stages involved are 17 in number and are listed below in the order they follow during implementation.

- (i) Brief obtained
- (ii) Site confirmed
- (iii) Site surveyed
- (iv) Sketch design commenced
- (v) Sketch design completed
- (vi) Sketch design approved

- (vii) Working drawings commenced
- (viii) Working drawings completed
- (ix) Working drawings approved
- (x) Spec/BQs commenced
- (xi) Spec/BQs completed
- (xii) Tenders invited
- (xiii) Tenders opened and analysed
- (xiv) Acceptance sought from the Client Ministry
- (xv) Treasury approval sought
- (xvi) Acceptance returned to MOWH & PP
- (xvii) Acceptance given to contractor

The main reason for laying more emphasis on the above stages is that the Ministry, notwithstanding the roles of the Client Ministries and the Treasury, has more control over the projects during these stages. It can influence the project content, pace of design and documentation and through choice of contractors, determine the performance of the projects on the sites. If change can therefore be effected at these stages, significant benefits can be realised even at construction stage.

When construction commences on site, the Ministry is left with the tasks of supervision, certification of work done for payment purposes, and finally preparation of final accounts. The fate of the projects is more or less in the hands of the contractor, although the Ministry can exert itself in a number of ways to get things going well. How this can be done has been discussed in Chapter 4 and 6 under chapter headings "project control" and conclusions respectively.

Research Methodology

The subject of the study was identified in March, 1984. This was followed by some light research work, mainly in Libraries and also in form of the preliminary survey. The purpose of these two was to verify beyond reasonable doubt that the problem existed and formed an adequate basis for a study of this magnitude. Serious work on the subject, however, started in July, 1984 and continued until March, 1985.

In order for the study to be thorough and come up with meaningful findings, it was considered necessary to adopt two approaches described below.

The first approach consisted of the collection of raw data and pertinent information mainly from MOWH & PP offices. Data sought was mainly the type that could help the study in developing a clear understanding on the following:

- (i) How MOWH & PP manages its projects.
- (ii) Major problems underlying the implementation of projects and their causes.
- (iii) Stages where lapses in the implementation occur.
- (iv) Average durations experienced as delays on projects of various magnitudes.
- (v) Voted funds versus expenditure
- (vi) Culprits of this unfortunate phenomenon.

Data to this effect was retrieved from project files, contract payment cards, job status cards, job status reports, job cost summary sheets, job programming charts (Bar Charts) and the Annual Works Programmes.

Before the commencement of this exercise, it had been envisaged that specific field techniques such as stratified random sampling and systematic random sampling would be used. This, however, proved very difficult and could only be utilized on two types of documents, i.e. the Job Status Cards and the Contract Payment Cards, simply because of the chaotic way in which documents are filed in MOWH & PP offices.

The survey started by drawing up two major categories of projects to be examined. The first category consisted of projects implemented between 1972 and 1979. This was further subdivided into two groups: those implemented, i.e. designed and supervised, in Head office and those implemented in the Provinces. The second category of projects consisted of projects implemented between 1980 and the present. Like the former, they were also subdivided into two groups, based on the centres of implementation. In all, there were 5791 projects (Job Status Cards) divided into four groups as follows:-

- | | | | | |
|-------|----------------------|---------|-----------------------|--------|
| (i) | Projects implemented | 1972-79 | - Head Officer= | 2370 |
| (ii) | " | " | 1972-79 - Provinces | = 861 |
| (iii) | " | " | 1980-85 - Head Office | = 1632 |
| (iv) | " | " | 1980-85 - Provinces | = 922 |

The main reasons for categorizing projects as above were two. The first one being to see whether the change in the organization structure of the MOWH & PP in 1979 from Matrix Organizational Structure to Functional Organizational Structure was in any way responsible for the existing problems. The second reason was to establish whether proximity to the project sites had significant advantages during the implementation of projects.

After the cards for projects had been stratified as shown above, it was noted that not all of them could be conveniently examined. It was therefore decided that only the tenth card in the series of each category should be sampled for examination. This meant that in all, 579 cards were available for scrutiny, which was considered an adequate representation.

The contract payment cards on the other hand were sampled randomly without replacement. There were approximately 3,000 cards, out of which 300 were drawn for examination. Some cards were not available as they had been condemned to the archives.

As already indicated, other documents could not be drawn out in any systematic manner which could eliminate bias. It was therefore decided that these documents should serve as supplementary sources of data. For example, the Job Status Cards could first be drawn through stratified random sampling. Then, other documents containing information on the projects recorded on the cards picked, could be deliberately sorted from wherever they were stored. Once retrieved, the contents of the documents could be scrutinized and recorded alongside the one already retrieved from the cards.

The second approach used in the study was to collect data and other pertinent information through the use of questionnaires and in depth interviews. See appendix 8 for the sample of questionnaire.

70 questionnaires were administered as follows:-

- (i) 30 questionnaires to MOWH & PP officers of various professions. Members chosen were the ones with an experience of not less than 5 years in project implementation.

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- (ii) 10 questionnaires to the Liaison Officers in the Client Ministries.
- (iii) 10 questionnaires to the Consultants.
- (iv) 20 questionnaires to the Contractors.

There were two main reasons why questionnaires were administered as above. The first reason related to the total population of the relevant people to be administered with questionnaires. For example, in MOWH & PP there were less than 100 professionals who had been involved in project implementation for over 5 years. Giving questionnaires to 30 of these professionals essentially meant covering one third of the total population, which for practical purposes was considered representative enough. The same argument could be used for Liaison Officers in Client Ministries and also consultants whose population were estimated to be 3 times the samples administered with questionnaires. The second reason had to do with what was expected in terms of useful information from each group of individuals. The contractors who were registered with MOWH & PP were for example over 2,000, but not much was expected out of them in terms of useful information.

Apart from the collection of raw data and other relevant information through field surveys, it was considered necessary to concurrently carry out library research. Library research was mainly geared towards creating an acquaintance with the various project management problems and their solutions as experienced in the technologically developed countries and other third world countries. The interest here lay in establishing whether problems of project implementation experienced in other countries were similar to the Kenyan ones and whether their solutions could also be prescribed here wholly or with modifications.

As a matter of fact, much of what was derived from library research has been given in Chapter 2, 3, and 4. The conclusion is also partly based on the information gained through library research.

In conducting library research the following libraries were visited: University of Nairobi - Main library and the Faculty of Architecture, Design and Development's library; Kenya Building Centre library; Mcmillan library and the Institute of Development Studies library. Literal works looked at are shown in the bibliography.

The final part of the research involved the tabulation and analysis of the data and information gathered. At this point the use of descriptive statistical tools such as frequency distributions, arithmetic mean, mode, proportion measures of dispersion, fractiles and percentages came in handy. The main interest in analysing the data was to establish whether the problems of project implementation in MOWH & PP were hinged on what had been hypothesized as lack of proper planning and control. The second interest lay in determining whether other factors had a bearing, and if so, of what significance? Data analysis was also intended to establish whether the problems noted could be attributed partly to the current organizational structure used by MOWH & PP. The present structure is what is generally referred to as "Functional Organizational Structure". The structure came into use in January, 1980. Prior to this, the Ministry utilized Matrix Organizational Structure. Functional and Matrix Organizational Structures are discussed in greater detail in Chapter 2. The main reason for noting the performance of projects during the different times when the structures were in use was to establish whether one structure provided a better framework within which efficiency in project management could be achieved.

The analysis of the data and other information gathered provides the study with useful observations (findings) on whose basis conclusions are drawn. On this basis the study makes recommendations as to what should be done both in the short-run and long-run to improve the performance of public projects while under implementation.

Definition of important terms

The need to define important terms in this study arise from an awareness of the fact that terms usually carry different meanings when used in various subjects and under different circumstances. Also that certain terms used in the study are not in universal usage, but more or less, coined and exclusively used by the organization under study, i.e. Ministry of Works, Housing and Physical Planning.

Such terms include "Client Ministries" and "Building Development Projects". But before any definitions are made, it can be noted that these terms are referred to as important simply because they are more frequently used and also are used in the definition of the scope of the study.

The first term which should be defined here is "a project". R.L. Martino in his book "Project Management" defines "a project" as;

an overall task which has a definable beginning and definable end. It consists of a number of related and dependent activities, all of which utilize resources and upon which there are imposed internal and external conditions. Basically then, the elements of any project are these:

- (1) Operations - the things to do
- (2) Resources - the things we or others use, consisting of men, money, material, machines and time.
- (3) Conditions or Restraints - under which we must work, such as deliveries and deadlines.

Using Martino's definition, a building project can be regarded as a project whose definable end or product is a building.

Ministry of Works, Housing and Physical Planning goes further than this and categorises building projects into two: Building Development Projects and Building Maintenance Projects. Building Development Projects are the ones which interest this study and are defined by the Ministry as follows:-

a building development project is an item of building or construction work which includes:-

- (a) Labour, material, equipment and installed equipment that will become an essential part of new, or additions to work or buildings.
- (b) Alterations resulting in a change or restriction in the future use or function of a works or building such as:
 - (1) Alterations to structural systems e.g. relocation of bearing walls.
 - (2) Changes in outline plan or profile, e.g. a change in height or usable floor area.
- (c) Restoration or improvements when the cost of the project by reason of the introduction of improved materials will exceed by 25 percent the cost of restoration to as-built condition with materials similar to those previously incorporated in the works or building.¹⁹

Building maintenance projects are on the other hand defined as "works involving the repair or restoration to the original or equivalent conditions of fixed assets".

The other term which requires consideration at this point is "the activity". In some cases this term is treated as bearing the same meaning as the term "the task". In this study the term "the activity" will be preferred and is here below defined by James McMahon as "specific unit of work that can be accomplished without interference or interruption from any other work units".²⁰

Essentially activities are components of a project that bear a logical relationship to each other, and when one refers to project management, all that is meant is the intergration and co-ordination of these activities within appropriate organizational framework to achieve optimal results.

Ideally each activity should be selected so that it is small enough to be visualised as a complete entity for estimating purposes. On the other hand, the size of the task must be large enough to represent a measurable part of the whole project.

Management has already been defined while setting the assumptions of the study as:

'planning, organizing and controlling activities with the main purpose of intergrating diverse - sometimes co-operative, sometimes conflictive elements into a total organizational endeavour'.²¹

When applied on projects, it becomes project management. Project management could be in respect to various activities e.g. farming, mining, transportation, building, etc. Whichever the case, the principle involved, when properly interpreted and applied, does not change. The principle is that for project management to be considered efficient, the aspects of planning, organizing and controlling of the project activities must be done correctly.

As indicated, the study only considers two aspects of project management, i.e. planning and control. Organization is not overlooked, but is viewed as the framework within which the other aspects function and by considering them exhaustively, it too is sufficiently covered.

Planning is defined by Martino as "the determination of the tasks to be done, their necessary sequence and their resource requirements to achieve project objectives".²²

It is also worthy taking note of definitions by other authors. Webster's New World Dictionary defines planning as "any detailed method formulated beforehand, for doing or making something".²³

From the above two definitions, it is clear that planning is therefore the process of deciding in advance what should be done and how. It involves selecting objectives and developing policies, programs, and procedures for achieving them. It has an implication of futurity and implies the use of skill in arriving at plans for objective accomplishment.

Essentially, a plan has three characteristics. First, it must involve the future. Second, it must involve action. Third, there is an element of personal or organizational identification or causation; that is, the future course of action should be taken by the planner or someone designated by him within the organization.

There are various categories of planning and it is important at this point that some delimitations be made about the type of planning under consideration.

Long-range, medium-range and short-range planning deal with the futurity of the present decisions in terms of (1) setting goals and developing strategies to achieve them and (2) translating strategies into detailed operational programmes. Point (2) mainly reflect medium and short-range planning. Long-range planning involves policy formulation and setting up of goals, and spans over periods of 5-7 years and above. Medium-range planning covers periods between 3-5 years; while short-range planning covers durations between 0-3 years.

Short-range planning is also referred to by Kast as "short, derivative and functional which ideally should be based on and intergrated into long-range planning".²⁵ They note further that long-range planning establishes the basic framework within which short-range i.e. detailed programming and operational planning take place. Operational planning in an organization involves setting goals, drawing budgets and determining datelines.

Within the scope of medium-range or short-range planning, three types of planning can be described, i.e. functional, project and comprehensive.

Functional planning deals with the planning of a component or aspect of a large endeavour. Branch notes as follows:

...intricate series of actions which lead to a predetermined result, be it in connection with a chemical process, structural design of a beam, manufacturing a watch, or accounting for the transactions of a large enterprise.²⁶

Project planning incorporates functional planning. It is more diverse and covers a wide range of activities. Examples of this include such acts as the construction of a boulder dam, aircraft-carrier, large manufacturing plant, etc.

Comprehensive planning, finally, describes the ultimate in man's endeavour to perform major achievements, shape his environment, or affect the future. It therefore includes functional and project planning, but transcends them in scope, magnitude and complexity. It includes not only three dimensional accomplishments in space but social mechanism such as laws, regulations, policies and forms of organization - for example, planning for a nation, or an extensive sphere of governmental activities such as agriculture, the military services, etc.

The definition for planning has briefly touched on the various forms of planning. It should clearly be noted that the main concern of the study lies with only one form of planning i.e. project planning.

The next term to define is "project control". First, the word control has several connotations, for example²⁷

- (i) to check
- (ii) to regulate
- (iii) to compare with a standard
- (iv) to exercise authority over (direct or command)
- (v) to curb or restrain.

Several ideas come out of these: (a) control is an important means of co-ordinating diverse activities towards objective accomplishment, (b) it regulates output by measuring actual versus expected performance and (c) it is also concerned with means as well as ends.

The control process is concerned with the effectiveness and efficiency of a system or a process. Note is continuously taken of how well the resources are employed and utilized and at what output levels.

Ivor Seeley in his book Building Maintenance page 276 quotes Ray as describing the "management process of control" as:

- (1) setting performance standards at the appropriate level to achieve a given objective
- (2) measuring actual performance and comparing it with the standard
- (3) taking appropriate action in event of actual performance deviating from the standard.²⁸

The final point to note about control is that it is inextricably intertwined with planning. Planning is a necessary pre-requisite for control. One controls what has been planned.

In this study control will be looked at as it applies to building project management. It will be portrayed as the tool required to ensure the accomplishment of building programmes and projects.

While considering the processes of project planning and control, one general term, i.e. "Management techniques" will be mentioned often. Management techniques in question are the analytical tools used in the processes of planning and control. These include techniques like model building, linear programming, break-even analysis, network analysis, work break-down structure, resource allocation and levelling, inventory analysis, and finally computer use. This list is not exhaustive of the currently available management techniques. But this does not matter as the study will only consider 3 of these techniques in detail and the rest in passing. Greatest emphasis will be placed on Network analysis and under this an exhaustive study will be made of the application and utilization of operational tools like Critical Path Method (CPM), Precedence networks, Programme Evaluation

and Review Technique (PERT) and Graphical Evaluation and Review Technique (GERT).

One term appearing in this study which is not universally used is "the Client Ministries". The first point to note is that among all Government Ministries, it is only Ministry of Works, Housing and Physical Planning which has the responsibility of implementing building construction works. Other Ministries simply submit their building requirements to MOWH & PP. This establishes a clientele sort of relationship, thus necessitating the use of the term "Client Ministries". Since all Ministries have building projects submitted to MOWH & PP, they are in essence all clients of MOWH & PP.

Commissioning of projects is a term with double meaning. In Ministry of Works, Housing and Physical Planning, commissioning of projects means "use of consultancy service on the design and/or supervision of projects". This service comes in when the projects cannot be done in-house due to either their complexity or urgency or both, and often, due to shortage of professional personnel.

Commissioning has also a different meaning especially when in reference to industrial projects. It is the process involving the maintenance and running of a project immediately after the completion of construction works and installation of equipment. The period when the projects are commissioned varies according to the terms of agreement between the developers and the contractors. In Ministry of Works, Housing and Physical Planning, the equivalent of this is the "defects liability period" which usually is 6 months.

As indicated above, MOWH & PP implements building projects on behalf of other Ministries, referred to as Client Ministries. These Ministries like other clients in the construction industry control their funds and before the contract documents are finalized and the contractor invited to enter into contracts, letters of acceptance are sent to the client Ministries informing them of the contractual arrangements in the pipeline and seeking for authority to finalize them. This stage is generally known as "acceptance stage" and subject to the urgency of the project varies between 1-60 days. Unless otherwise stated, the tender validity period expires after 60 days.

Summary/Study Outline

In the discussions presented in this Chapter, the problem of poor implementation of public building projects has been noted. Its existence has been verified as real, and some of the factors causing it brought out in general terms. Consideration has also been given to the organization of the study - the aim being to evolve and maintain a proper methodology of looking at the problem identified and coming up with serious answers to it. In an attempt to achieve this, delimitations have been made to the study under headings: Study objectives, Scope and area. A useful guide has been found in a number of assumptions, which in turn have assisted in the formulation of the hypothesis. Finally, important terms have been defined. This has been done so as to lend more clarity to the present and further discussions.

The subsequent chapters, although owing their existence to the first chapter, are on the contrary quite different from it. Chapters 2, 3, and 4, for example, mainly deal with literature review. Through this exercise, an attempt is made at understanding problems afflicting building projects in particular and the organizational setups under which they are implemented in general. In Chapter 2 for example, emphasis is placed on general management theories such as "identification of Organizational Objectives", "Management by Objectives", "Information-decision Systems", "Structuring of the Organizations", "Intergration and differentiation of resources", etc. The study at this level aims at drawing a parallel between good and bad management practices.

Chapters 3 and 4 deal with two specific aspects of management, i.e. planning and control respectively. In Chapter 3, modern planning techniques such as network analysis and other operational tools are reviewed.

Again the point is to bring out the desirable points. Chapter 4 on the other hand discusses the control procedures such as progress information gathering, reporting, information analysis, use of meetings, corrective action, etc.

The essence of the discussions in Chapters 2, 3 and 4 is to create standards, basis as it were, on which findings documented in Chapter 5 can be compared, thus making it possible for deficiencies to be noted and corrective action pointed out.

Chapter 5 contains findings of the survey carried out through data collection and analysis, and face to face interviews.

Chapter 6 is the final chapter and is a conclusion to the study. It contains in summary form the observations arrived at after noting the findings. Most of all, it presents what are considered, in view of the findings and observations made, as the logical remedial measures. Most of these corrective measures are based on or derived from the discussions contained in the literature review chapters.

Footnotes

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2. Ibid
3. Fred Moanzadeh and Frances Hagopia, "The Construction Industry and Economic Growth," National Development (for) Middle East/Africa, Intercontinental Publications June/July 1984, P. 56.
4. Ministry of Finance and (Economic) Planning
5. Ministry of Economic Planning and Development, M.E.P.D. Circular No. 1: "Implementation Scheduling and Monitoring of Development Projects", (Nairobi, January 1982) P. (i)
6. The Daily Nation Newspaper, 12th November, 1982. The Standard Newspaper, 18th November, 1982.
7. Intake at Eregi Teacher Training College was held up 2 years due to late completion of the accommodation facilities.
8. Treasury Circular No. 3 of 5th September, 1980.
9. The development of an indigenous construction industry has two aspects: Promotion of Local African Contractors and, development and utilization of local building materials.
10. Kast & Rosenzweig, Organization and Management A Systems Approach, (International Student ed. New York) McGraw-Hill, 1970, P. 6

11. Modern Management Concepts have been developed and propagated by two schools of thought, i.e. the behavioural science school and the Management science school. The behavioural science school places emphasis on the psycho-social system and the human aspects of administration such as leadership. The management scientists on the other hand emphasize the use of quantitative methods and the application of computer technology.
12. Kast and Resenzweig, OP. cit. P. 466
13. Ibid, P. 361
14. Sensitive projects are those that have attracted or are likely to attract the attention of politicians and Senior Government officials. They are projects whose delay is likely to become a matter of public concern.
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CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

Management in General

Conception

Most people have heard and used the term management. In the usage of the term, there have been no restrictions: farmers in the rural areas have talked about managing their farming activities; traders their business; organizations their affairs, and even sportsmen, their sporting activities. In all these cases, successes and failures have been attributed to good and poor management respectively. This conception is correct.

The question which arises however is; apart from these people, organizations, etc. being aware of the fact that management, or rather its quality, is responsible for the kind of results achieved in any endeavour, how many of them know in practical terms what it is all about and can practice it? The question is prompted by an awareness that all over the world, and particularly in the so called Third World Countries, there is a general dissatisfaction about the way scarce resources are being utilized.¹ It is felt that most ends which could be accomplished with less resources, are currently being achieved with more to the detriment of the existing finite reserves.²

Concern about the management of resources, although now being expressed in firmer terms, is not a new one. It is an area which has drawn human beings attention since time immemorial. Various theories, some dating back to the great days of the Roman Empire, have been propounded. In all of them, attempts have been made to show how people can organize themselves to accomplish their undertakings with minimum effort.

It was however not until the emergence of the Industrial revolution and the experiences gained therefrom, that most of these apparently loose theories, and ideas were redefined, given more meaning and presented in a forceful manner. By the turn of the century the subject had taken shape and was being researched into very vigorously. The people who have been responsible for this development include Fredrick Taylor, Max Weber, Abraham Maslow, Jane Mouton, Fredrick Herzberg, Robert Blake, B.F. Skinner, Rensis Likert and Dauglas Mcgregor.

Ideas advanced by scholars of management have not been correspondingly similar but can be placed into three categories: (1) the bahavioural sciences which emphasize the psycho-social system and the human aspects of administration (2) the management sciences which emphasize quantification, use of mathematical models and application of computer technology, and (3) the latest approach known as the systems or contingency approach which lays emphasis on the drawing and unification of the essential elements from the first two approaches in order to meet a given situation.

In this chapter a review is made of the literature currently available (on the local scene) on the subject of management with emphasis placed upon the aspects relating to the implementation of building projects. The review aims at bringing out what various authors have said about problems affecting the smooth implementation of projects, and how they can be overcome.

As a starting point, it is better to revisit the definition of management.

According to Kast,³ it is "the coordination of human and material resources toward objective accomplishment." Youker⁴ puts it that management has five important aspects, i.e. defining objectives, planning activities, allocating budgets and resources, motivating personnel and controlling progress. Two points emerge out of these definitions: one, there have got to be objectives which should be met through the intergration of disorganized, unrelated resources of labour, materials, plant, money, time and space; and two, the intergration process should be achieved through the use of appropriate techniques and within a suitable organizational framework. These two points are important and to a large extent create the framework within which this review is made.

Definition of Objectives

Youker defines an objective (or goal) as a statement of where an organization is going, what it is trying to accomplish and what are being aimed at.⁵ He further adds that "the effective articulation of the objectives is the single most important factor in organizational effectiveness".

Most management thinkers agree with the views expressed by Youker, but add the following points about objectives:

- (i) they should be ranked in terms of priority.
- (ii) they should not be regularly changed. This results in wasted effort and personnel disillusionment.
- (iii) everybody in the organization should understand and work towards achieving them. Personal objectives should be kept at bay.
- (iv) they should be backed by budgetary allocations.
- (v) they should be provided with parameters necessary in effecting control in the organization. The parameters should enable quantitative and qualitative measurement and comparison in terms of results achieved or outputs as apposed to inputs to be utilized.

David S. Brown⁶ notes that defining and understanding objectives enables managers not only to seriously think about their projects but also to get them into "meaningful and measurable terms". Over and above this, he notes that it makes it possible to instal in an organization the Management By Objective (MBO) system; a system which has various advantages such as: encouraging forecasting and planning, efficient utilization of human resources, acting as an incentive, setting standards which can be used for control purposes and finally, encouraging dialogues between various administrative levels. Of the final point he notes:⁷

In the majority of organizations, private as well as public, a shockingly small amount of discussion takes place between levels with respect to objectives, with not too surprising results. The standard explanation is that it is not needed - objectives are already known and understood, if not followed. This is not so. There are substantial differences over what is wanted - and why; and the like. MBO has encouraged discussion and consultation by requiring meetings between those at different levels.

Before this discussion on objectives is brought to conclusion, it is important to note whether the non-adherence to this particular aspect of management has anything to do with the poor implementation of projects, especially in this country. Jon R. Moris in his paper entitled "The Transferability of Western Management Concepts and Programmes, an East African Perspective", observes that although the Western world has been extending a lot of assistance in terms of funds to African Countries "it is only possible to identify a number of small projects which are successful, but difficult to find examples of successful big projects or rural development programmes".⁸

He attributes this widespread phenomenon to poor management skills. He notes two key issues which are relevant to this discussion. First and foremost, objectives of most programmes, projects, etc. are not clearly understood by the implementors, thus making planning and control very difficult. This leads to Management by Crisis. The explanation for this lies in the type of education available to almost all professionals of which he has the following to say:

Management has been the missing function in the education of the service professionals (doctors, agriculturalists, engineers, and resource scientists), just as rural development has been a missing sector in management education. Amidst a rather large volume of formal instruction supposedly conveying management skills to middle and upper-level trainees, management as such receives relatively little emphasis. The real essence of effective management never becomes explicit: 'Management' remains a mysterious residual factor to trot out at the end as one of the preconditions for effective implementation of rational planning.⁹

The second issue relates to the formulation of policies, plans and strategies which have to be used in achieving the defined objectives. More often than not the implementors are not involved in this exercise and therefore end up uncommitted. Moris notes that:

Increasing decision-making takes place among a relatively small circle of people at the top of each organization. A sizeable portion of each country's 'high-level manpower' is being either disused or misused. Before decisions have been announced, they are 'sensitive' and 'confidential' - not suitable for discussion, but once launched, they become 'policy', which is equally sacrosanct.¹⁰

One other reason why most organizations in Kenya and other parts of Africa, particularly public ones, are shrouded in confusion and vagueness is the fact that the few individuals in managerial positions are overburdened with heavy workloads undertaken in a heavily bureacratized system full of unmotivated staff.¹¹

Appropriate Techniques

These vary considerably, depending on the technological advancement of the country in question. In the context of this study, they are techniques falling within the various management functions such as planning, organizing, directing and controlling - which can be easily applied or utilized in Kenya. Most management writers provide for the quantitative, if not, qualitative measurement of work or the values therein. Operational Research techniques such as the Critical Path Method (CPM), Project Evaluation Review Technique (PERT), Linear Programming, Statistical decision theory, etc. are therefore favourably discussed. Model building and computer use are also looked at in the same light.

Most of these techniques are discussed in greater detail in chapters 3 and 4 of this study under chapter titles planning and control respectively.

Organizational Frameworks

It has already been noted that in pursuit for efficiency organizations should define objectives clearly and identify proper techniques for use. It must be added that success can only be guaranteed when all these are being done within the framework of a suitable organizational structure. Youker brings out this point very emphatically in his paper, "organization Alternatives for Project Managers".¹²

Most of the ideas he raises on organizational frameworks or structures are discussed at length in the later part of this chapter.

Project Management

In the foregoing introductory part of this chapter, an attempt has been made to bring out some of the key issues in management which are directly relevant to this study. These provide an adequate background for tackling project management which essentially form the subject of this study.

Definition

Project management has been described by some authors as an art and by others as a science. Whichever description is accorded to it, it is not deprived of its role which essentially is the application of management concepts on projects during their implementation with a view of achieving efficiency. J.W. Huang in his attempt to define project management describes it as follows:

In broad terms project management plans and directs the process of development of a project to enable it reach, in the best possible way (and with the best possible way) and with the best possible results the intended objectives of the project.¹³

Although this definition is acceptable, one observation can be made about it: it fails to bring out the element of control which is a management function in its own right, not really part of directing, and a very important one especially when discussing project management.

In respect to building projects Oberto Orbeti describes project management:

...as the work that an architect or an engineer must undertake when an owner finds it appropriate to retain him not only to design but especially to organize and carry through a project from the time of property selection and acquisition to substantial completion by the last construction contractor, and during warranty periods, to monitoring of deficiencies and their rectification.¹⁴

Need for Project Management

The following are a few of the reasons why project management is required especially in this country:

(i) Since Kenya attained independence in 1963 its commitments in respect to the provision of the building infrastructural facilities have increased not only in numerical terms but also in scope and complexity.¹⁵ These commitments have had to be met from the scarce resources, which unfortunately have not been available in sufficient quantities due to the correspondingly slower rate of growth of the economy. There has therefore been some strain imposed on the resources. This strain has increased to higher proportions with the years. The explanation for this phenomenon lies partly with the world economic recession which among other things has curtailed the proportions of aids and grants which the country has been using to alleviate its adverse economic position; and partly with the booming population of the country which has made it more urgent for the country to increase its commitments despite its limited resources.

In view of the above facts the need for available resources to be rationally allocated and stringently controlled becomes rather obvious.

(ii) Building construction projects generally consist of many activities. The number varies according to the scope and complexity of the projects.

In order for any project to be considered well done, all the activities must be properly done. This requires the use of appropriate techniques to ensure that coordination in the execution is achieved and project objectives do not suffer. At the implementation stage, the project objectives are normally to complete the project at the least cost, at the earliest possible time and meet the desired quality standards. Project management ensures this by providing good plans for the projects; and through the control system, ensuring that the unexpected and unwanted situations are detected early and corrected.

(iii) Closely related to the foregoing is the fact that building construction projects involve various people of different professions and trades. There is for example the client, architects, engineers and quantity surveyors, the financiers, the contractors and the various tradesmen, the sub-contractors, the materials suppliers, etc. All these people have personal objectives which in most cases are contradictory to each other and those of the projects. They however have to work together, relate to each other harmoniously; achieving their own objectives while at the same time maintaining those of the projects. Project Managers make this possible through their skilful application of the management techniques - both scientific and behavioural.

To drive the need for project management home, it is important to look at other peoples' experiences. A.C Sidwell notes that studies carried out in Australia on Organizational forms reveal that "those with a high level of managerial control and those which were non-traditional (e.g design and construct, Project Management,

etc) performed better on time, gave a higher level of client satisfaction and overran the budget by less".¹⁶

Project Management: Views

Project Management, it appears, is easy to preach but difficult to practice. This maybe explains why the earlier literature on the subject has made insignificant impact and the current writers are placing emphasis on the practical aspects of the subject. Some of the problems which have been identified as lending hand to the slow development of the practice stem from the confusion surrounding aspects such as:

- (i) who qualifies as a project manager for a building construction project?
- (ii) at what stage of project development should he come in?
- (iii) what should be his responsibilities?
- (iv) to whom should he be answerable?
- (v) where should he be based?

Answers to the above five problems (questions) have been varied and in some cases contradictory, thus leading some authors to make the following observations:

Oberti:-

Project Management is a confused notion applied to many different working and contractual arrangements. Often in the field of construction, project management is offered by general contractors as a substitute for traditional contracts to allow speed and flexibility...Arguments have been raised ranging from the necessity of having the project directed by the more experienced contractor to that of having the project directed by the more technically oriented and pure consultant.¹⁷

Oberti's observation is not complete in the sense that it fails to bring out the fact that even among the professional there are wrangles as who should take complete charge of the project. Is it the architect, the engineer, or the quantity surveyor?

Edwin O.O Sawacha in his study carried out on project management also notes that the concept of project management is misunderstood quite alot, even among the so called project managers. In a case study he carried out, some respondents to his interviews conceived project management to involve only the development of the brief of the client. Others perceived it "as a coalition between selected experts/professionals under the leadership of an independent project manager for the sole purpose (of) implementing a single project or group of related projects on behalf of a client". Finally, others saw it as a process whereby a client appoints a project manager after completion of design stages. His role in this case is seen as one of a liaison officer interfacing between the client and the rest of the contributors to the project with the primary role of ensuring that the project is systematically planned and built within an agreed cost, programmed time and to specified quality standards.¹⁸

Sawacha refutes these conceptions and points out that the practice of project management is embodied in the person of the project manager who through the co-ordination of the construction processes integrates all parties involved in construction on behalf of the client. He adds that through project management, attempts are made to achieve the successful planning, co-ordination and implementation of the project to the satisfaction of the client in terms of fulfilling the brief, achieving cost limits, within the time-scale and to appropriate quality standards.¹⁹

Sawacha's views clearly indicate that the project manager should be recruited early enough to enable him participate in the development of the brief. At this stage only two parties exist, i.e. the client and the consultant. The consultant acts in advisory capacity to the client and his interest in the project is quite minimal. It is therefore rational that the project

manager be recruited to work for someone whose interest in the project is significant - someone whose objectives are one and the same as those of the project. The only person at such stage is the client.

The responsibilities of the project manager, assuming he works for the client or owner, partly depends on whether he is an in-house staff or not, and partly on the desire of the owner to be involved in the management of the project. Usually in-house project managers have more authority and do not need to clear with anybody on every decision they make. This is not so with those from outside the organization. Whichever case, Oberti notes as follows:

the project manager must be truly an independent party who will not enter into additional contracts for the project, who will not execute any portion of the construction by himself, but will arrange, co-ordinate and supervise all contracts for the owner, and that the owner will enter into all contracts necessary for the execution of the work including all procurements that may be necessary.²⁰

Oberti further adds that although financial risks and rewards pertaining to a project are to be borne by the owner, the responsibility of ensuring that the budget initially agreed upon is not necessarily overrun, lies with the project manager.

He adds that a project manager appointed from outside the organization can be assisted by a team of inside staff to administer the project right from design stage to construction completion. The inside staff can particularly help him in monitoring cost performance. But this should not be overstretched. The project manager should be left to run the project to his best ability. This has benefits of quickening decision making and also improving communication; which in turn minimises costs and time.

There are two views advanced in respect to who should take

charge of the project. The first view which is traditional²¹, insist on the architect being responsible for co-ordination of all teams involved in a building construction project. This view is however now being rejected and replaced by one advocating for all professionals involved in building construction works long enough to understand the operations of the industry to be accepted as project managers.²² This study finds this view more rational and therefore acceptable.

Finally the question of where the project manager should be based is one which has no clear-cut answer. It is an issue which depends on the proximity of the site to the main offices, the complexity of the project and the amount of control required. A case study carried out in Britain indicated that geographical distance impaired effective communication that require face-to-face contacts²³, which are prerequisites for good project management.

As a complementary point to what has already been stated, it should be added that although project management is the responsibility of the project manager, it is not possible to achieve the objective of the project without the assistance and willingness of all other parties involved. All people should work as a team and assist each other whenever possible. Oberti notes that too often, much time is wasted on the identification of areas of responsibility that belong to the client, to the project managers and to other parties. This leads to "a lack of understanding of the collective effort necessary to achieve the economic objectives which are truly the primary purpose of the existence of the project manager."²⁴

The final point to note about project management in this discussion is that, it is only successful when practised in an organization with the right organizational structure. Sidwell in his paper, "The Measurement of Success of Various Organizational Forms for Construction Projects"²⁵ highlights on the importance of this fact. The subject "organizational structures" and their suitability is discussed in the latter parts of this chapter.

Sources of Literature

In this part of the chapter an attempt is made to review literature on project management in greater detail. For ease of reference, the literature available and reviewed is categorized according to the sources.

Government Publications

Very little literature has been generated locally on the subject of project management, especially in respect to building. Most studies carried out have concentrated on housing programmes and the planning and management of industrial and commercial ventures. Literature on housing has generally dwelt on how the Government can shelter its people. Aspects that have received prominence in the discussions include revision of building by-laws and the general specifications, and the use of cheap locally available materials in construction of houses.²⁶ Other aspects which have been considered include the spartial distribution of housing estates and the supporting infrastructure in major towns, tenant participation in construction work and procurement of finance for housing purchase and construction. The notable omission in these studies is the fact that project management aspects such as the rational allocation of time on various project activities have received very little emphasis. This explains why housing schemes such as the Onyonka, which were conceived far back in 1977 and anticipated to be ready for occupation within a period of two years, were completed in 1983 with tenants being forced to pay extra amounts of money to cover cost overruns caused by delays in implementation.²⁷

World Bank which has been and still is the major financier of housing programmes, has been alarmed by this phenomenon, and has put pressure on the Government to establish a project management unit. This has been done in the Ministry of Works, Housing and Physical Planning. It is hoped that the unit will meet the serious need for planning and control of housing programmes.

Studies on the planning and management of industrial and commercial ventures are equally many. The need for these studies has mainly been generated by external financiers, who have insisted on the production of feasibility studies and other related economic reports before funds are granted. The only scholastic contribution of these reports is the knowledge generated on the planning and organization of industrial and commercial projects. This knowledge is however not complete in the sense that it places no emphasis on the building aspects of the projects which are very critical in so far as the projects' profitability is concerned. To illustrate this point, it is worthwhile noting that there are three types of risks associated with non-completion of projects on time:

- (i) loss of valuable time in putting products on the market. A delay normally gives time to other competitors to enter the market and take away the anticipated benefits. It is an old business whole premises are being rehabilitated or renovated, the long period can be a disaster in the sense that some of the regular customers or clients can be lost with financial consequences.
- (ii) extension of the break-even point of the investment. According to Kharbanda, one year's delay in a large industrial project could be disastrous. The significance of this point is illustrated by figure 2.1. The diagram is about a processing plant project estimated to cost £50 million. Interest rates are estimated to bring final cost to £65 million. The implementation period, i.e. planning and construction, is expected to last 3 years and thereafter the project becomes operational at an annual profit margin of £12 million. At this rate, the break-even point is projected between the first 8-11 years of

operation. However, if the project is delayed by 1 year, the break-even point goes 4 years into the future.²⁸

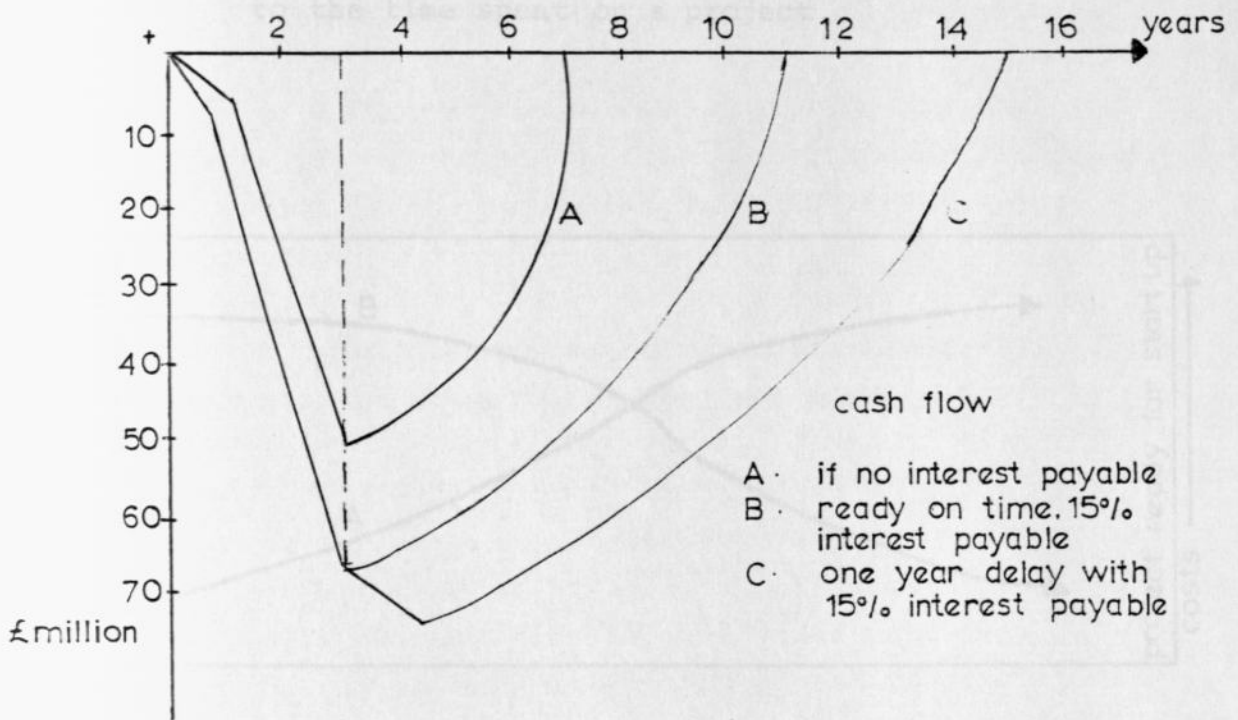
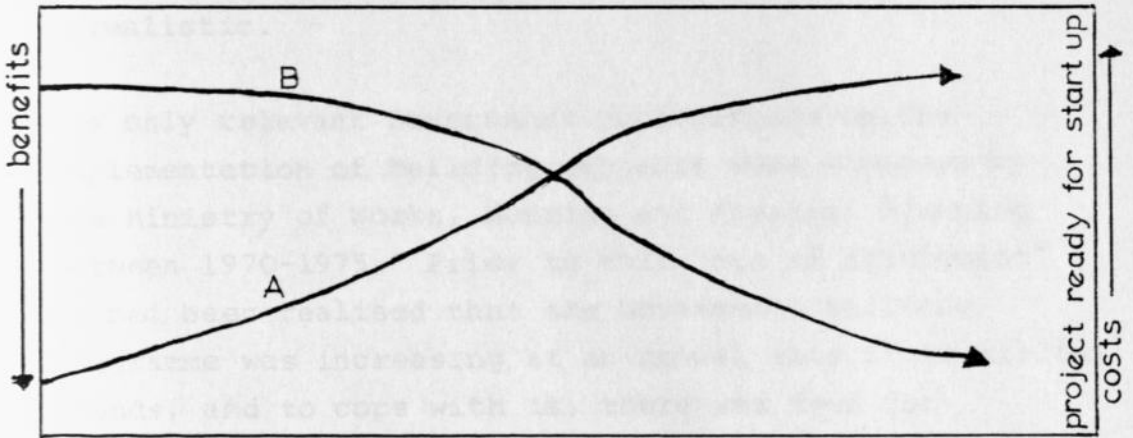


Figure 2-1: Effect of delaying project completion by 1 year (O.P. Kharbanda, Project Cost Control in Action, P. 46)

- (iii) increase in the overall project cost due to overheads. "Overheads" is normally a provision in the budget covering items such as management costs, stationery, transport, etc. As indicated in figure 2-2, overheads are directly related to the time spent on a project.



A - Cost Administration

B - Cost benefit

Figure 2-2: Cost benefit related to time

(O.P. Kharbanda, Project Cost Control
in action, P. 34)

To emphasise the need to meticulously manage the construction aspects of commercial and industrial projects, it is worth noting the experience of the Kenya Chemical Food Corporation Mollases project at Kisumu. This project, initially estimated to cost Kshs.200 million, was abandoned when it was found out about four years later that over Kshs. 1 billion would instead be required.²⁹ Reasons for the escalation were several, including poor management of the project during the early phase of the project. This resulted in the slow implementation of the project, which in turn made the project be caught up by the devaluation of the Kenya shilling and the appreciation of the Swiss franc and the American dollar, thus rendering the feasibility studies carried out unrealistic.

The only relevant Government publications on the implementation of building projects were produced by the Ministry of Works, Housing and Physical Planning between 1970-1975. Prior to this "era of elightment" it had been realised that the Government building programme was increasing at an annual rate of 10 million pounds, and to cope with it, there was need for "improved procedures for project planning, preparation and monitoring, which would lead to savings in time, in funds and better designed buildings."³⁰ A

Reorganization Study for MOWH & PP was launched through the joint efforts of the Kenya Government and the Canadian International Development Agency (CIDA). The study recommended the formation of a planning and programming unit whose functions would be as follows:

- (i) the determination of a revolving building programme for all ministries.
- (ii) the ascertainment of building costs involved.
- (iii) the responsibility for forward planning, including manpower planning.

- (iv) the phasing of projects and expenditure in accordance with the annual rate of expenditure provided for in the Development Plan.
- (v) the review and revision of construction priorities.
- (vi) the preparation of the annual Development and Recurrent estimates.
- (vii) the planning and progress control of development programmes.
- (viii) the preparation of applications for, and negotiations of foreign loans.

It was realised that in order to achieve the above, four issues should be seriously considered.

- (i) the organization structure of M.O.W,H&P.P. and its principal client ministries.
- (ii) the current methods of planning and monitoring projects.
- (iii) establishment of broad information needs of M.O.W,H&P.P. and its client ministries.
- (iv) use of computer for control of projects in the building programmes.

The survey also made a number of observations as follows:

- (i) the scheduling and reporting system was faulty.
- (ii) there was history of underspending brought about by lack of enough lead time on the part of M.O.W,H&P.P. to enable it prepare and submit realistic estimates; and also poor communication, both before and during the construction phase, between M.O.W,H&P.P. and the clients, resulting in delays in approval of drawings and issue of authorities to incur expenditure (A.I.E.)
- (iii) there was lack of consistent methods of liaison between M.O.W,H.&P.P. project architects and the clients' planning officers.

Finally the study concluded that the use of "overall master schedules using the critical path method (CPM) should be developed. The interactions and inter-relationships of M.O.W.H&P.P with client ministries and the ministry of Finance and Economic Planning should be shown. On the basis of these master schedules, cost estimates could be assigned to each activity in the schedule. It was hoped that this would provide a clear method of defining and controlling costs.

The product of the two studies was the establishment of the Forward Planning Group (FPG) with a view of steering the ministry towards the accomplishment of the outlined objectives. The Canadian consultancy team which had carried out the studies was retained for 2 years to run the Group. Subsequent to this were a number of steps taken to improve the management of projects. Projects were properly documented, making filing and retrieval of related data very easy. At the same time, publications were produced with an aim of helping those involved in project implementation work more efficiently. The publications made were as follows:

- (i) the Drawing Mannual
- (ii) the M.O.W. Mannual - Workplanning handbook
- (iii) the critical path handbook
- (iv) the Building organization and operations manual (BOOM)
- (v) the Treasury circular No. 5 of 1974
- (vi) the standard designs and details mannual
- (vii) M.O.W. precedence diagrams handbook
- (viii) Conditions of engagement and scales of fees for professional services for building works

Strangely, most of these publications fell into disuse

almost immediately and some of them which this study considers quite important, e.g the MOW Manual - workplanning handbook, the critical path handbook and the MOW Precedence diagram handbook got lost and are not traceable anywhere - even in the Kenya Building Centre Library. In their absence, one is therefore left to imagine that they dealt with project aspects such as allocation of manpower on jobs, scheduling, the determination of the critical path and the project duration etc. A survey for this study which was carried out in the ministry revealed that there is no single time the ministry has utilized either CPM or the precedence diagram for the planning and scheduling of projects. It is therefore possible that the publications were made, but rejected by the professional staff supposed to use them on projects.

The idea of having these publications must however be complimented as the right step towards ordering the building activities in the M.O.W.H&P.P. The fact that the publications were rejected and easily got lost is rather sad and exposes an urgent need to replace them with similar updated ones. If anything the use of networks for planning and controlling building projects is now much more widespread and acclaimed than it was in 1971.

The other documents published and still traceable have not been in much use either. The "standard designs and

details manual" and "Drawing manual", both carefully worked out to assist architects and engineers working on projects to come up with correct designs and drawings as quickly as possible, have been discarded. The standard design worked out covered building facilities commonly undertaken by M.O.W.H&P.P such as staff houses - from categories A to G and their respective accessories; barracks, health centres, dispensaries, schools, police stations and border posts. The "details" part of the manual covered the approved details for various building components and also the methods of detailing.

In the Drawing manual emphasis was placed on the principles of drawing (part A), planning and preparation (part B) and the drawing techniques. Under the principles of drawing the document advocated the use of "structured method of drawing" as opposed to "the traditional method". It was argued that the former enabled drawings to be produced in an easy and orderly manner since the relationship that exists between the components, the assembly and the location and layout was explicit. The drawings produced could be indexed cross-referenced and filed in that order, thus making retrieval easy where it was desired to re-use some details. It was argued that the use of re-usable details was beneficial in the sense that it enabled the architect to improve the quality and performance of buildings through improved designs made possible by the feedback gained from sites. It also freed him considerably from "everyday detailing", thus allowing a greater proportion of his time to be spent on the design aspects.

On organization of design work and production of drawings, it was pointed out in the document that the

first and most important step was to co-ordinate all information relating to the project. It was noted:

Co-ordination of all information relating to a project becomes of primary importance when the drawings and specifications have to be prepared by one or more specialists in addition to the architect. To avoid duplication of information and therefore reduce the risk of error, it is essential that clear decisions are made about the extent and format of the information to be provided by each member of the design team. This should be achieved by careful planning of working drawings at an early stage in the project.

As soon as the form of building has been determined, i.e at approved sketch stage, a list of drawings should be produced, distinguishing clearly between location, assembly and component drawings, and subdividing by element summary code. The list should include existing drawings which are to be re-used on the project and provisional numbers should be allocated to all envisaged new drawings. This allocation should be on a basis which will allow all drawings to appear in a logical sequence within each element.³¹

It was further added that:-

accurate planning and programming of working drawings can be achieved where there is a clear separation between design (including detailed design) and working drawings. Any attempt to design as working drawing proceed will invariably result in unsystematic presentation and inaccurate programming leading to a great deal of wasted time due to amendments to completed works.³²

The manual, on the sequencing of working drawings preparations, advocates the use of "copy negatives". It states that by taking copy negatives from master negatives at appropriate stages, considerable amount of drafting time can be saved. Secondly where the drawings are likely to contain common details, the technique guarantees accuracy and reduces the risk of errors between drawings emanating from different sources.

The process is as follows: first, information is added to a base negative which in turn is used to produce negatives at different stages of development. See figure 2.3 On subsequent negatives, only additional information should be added. But before this can be done, it is necessary for the architect to agree with each specialist on the precise stage at which the copy negatives are to be taken, the scale and the programme for drawings preparation and taking off.

Figure 2.3 illustrates diagrammatically the sequence of working drawings preparations. Numbers in the boxes from 1 to 5 refer to stage negatives; while numbers 6 to 17 refer to copy negatives and drawings produced therefrom. The numbers in the brackets are activity numbers based on building elements. At every stage negatives are produced and utilized by various specialists, the respective boxes are blackened. Production of drawings becomes relatively easier because all the specialists have to do is to open the catalogue of "re-useable details" and simply insert the number of details as they appear in the catalogue to the copy negatives. The details' drawings are then photocopied and attached to other drawings.

The advantages of using the method are listed as mainly three:

- (i) drawings are produced by various specialists with maximum speed,
- (ii) errors in detailing can easily be isolated and corrected,
- (iii) taking-off can be effected at various stages and when the drawings are ready, the bills of quantities on various elements are also ready. They are simply bound and the project is tendered immediately.

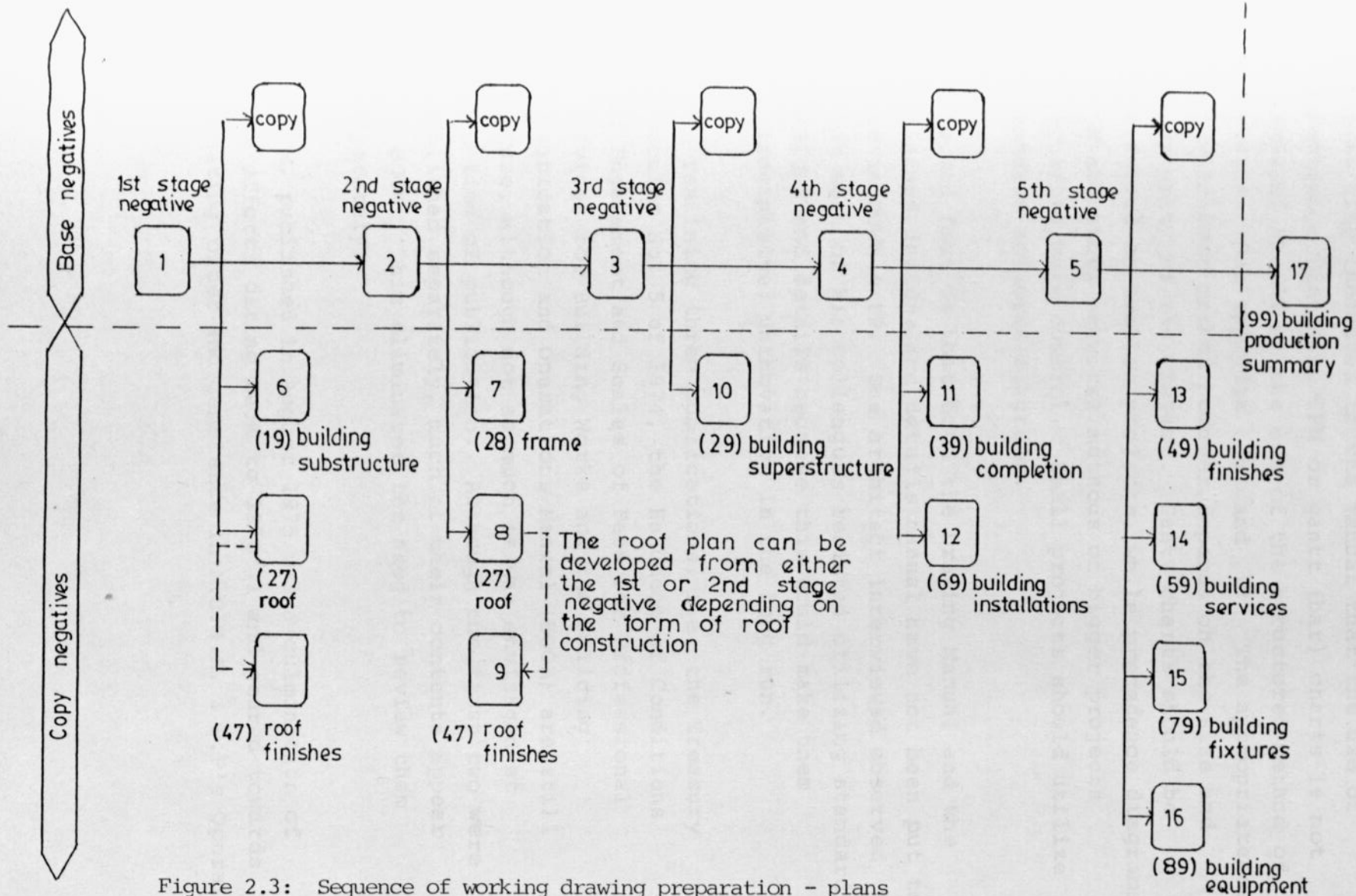


Figure 2.3: Sequence of working drawing preparation - plans

Source, MOWH, Drawing Manual, 1974

It is also indicated in the manual that the use of precedence diagrams, CPM or gantt (bar) charts is not hampered at all by the use of the structured method of drawing. See appendix 18 and 19. The appropriateness of whichever method however depends on the size and complexity of the project. Gantt charts should be preferred on smaller projects, while precedence diagrams, CPM and other networks methods on bigger projects requiring more control. Small projects should utilize standard networks diagrams.

The sad fact is that both the Drawing Manual and the Standard designs and details manual have not been put to use in MOWH & PP. One architect interviewed observed that most of his colleagues resisted utilizing standard designs and details because this would make them unimaginative, uninovative in the long run.

The remaining three publications, i.e. the Treasury circular No. 5 of 1974, the Handbook of Conditions of Engagement and Scales of Fees for Professional services for Building Works and the Building Organization and Operations Manual (BOOM) are still in use, although not as much as was envisaged at the time of publication. Although the first two were published separately, much of their contents appear in BOOM. This eliminates the need to review them separately.

BOOM, published in August 1975 was a culmination of the efforts dating back to 1970/71 and geared towards creating order and semblance in M.O.W.H. & P.P's Operations.

The Manual, often referred to by most officers in the ministry as their "Bible" is in practical terms the only document comprehensive in covering the ministry's operations; and used substantially by both professionals and administrators without antipathy.

The manual consists of 18 chapters plus the Treasury circular No. 5 of 1974. 7 of these chapters were never written, while 1 is a glossary of abbreviations. That leaves 10 chapters plus the Treasury circular No. 5 of 1974 to be reviewed.

First, the Treasury circular No. 5 of 1974. The circular was addressed to all Accounting officers (Permanent Secretaries) of all Government ministries and advises them on how they should identify and channel their building needs. Emphasis is made on the point that MOWH&PP should be given lead time of 12 months to enable it plan, design and document projects and the projects so submitted should be accompanied by site development plans and letters of allocation from the Commissioner of Lands. Contractural procedures are also covered. These touch on the "validity period", Group contracts, scope of work to be undertaken in provinces and variations to contracts. Accounting procedures including: Progress payments to contractors, retention sum and agency services payment are also dealt with.

Like all Government circulars, the Treasury circular No. 5 of 1974 is a set of instructions. The important point is that these instructions were well thought out and created the necessary framework for M.O.W. H. & PP's operations. Most written chapters of BOOM were

based on it. Unfortunately since 1974, it has not been revised and most procedures, especially financial, which have been reviewed now and again are not reflected therein. The most valid point as far as this study is concerned is that the circular stresses the need for enough time (at least 12 months) to be allocated on the planning and documentation of the projects.

BOOM can be separated into two parts for review purposes. In the first part, M.O.W.H&P.P's responsibilities, organization structure, authorities of various senior officers - right from the permanent secretary to the project team members, are defined. The interaction between the ministry and other external organizations such as client ministries, the Treasury, ministry of Lands and Settlement, National Construction Company and consulting agencies is also highlighted.

The second part of BOOM deals with building operations and the procedures to be followed when carrying them out. Under this section, the first item discussed is what is referred to as "Job planning and Control". What is noted as to be done is simply the drafting of the Annual works programmes; estimation of costs of new jobs and submission of the same to the client ministries for their use in preparing forward budgets; collaboration with the Treasury in the preparation and publication of the Development Estimates; and amendment of the Annual Works Programmes. It must be observed that this is not planning in the operational sense. Planning in serious terms entails the use of operational techniques such as CPM, PERT, Precedence diagrams and bar charts.

Project control is also discussed under the same part. It is given in terms of monitoring physical and financial progress of projects, storing the information on Job status cards and preparing and submitting status reports to the client ministries and the Treasury. Physical progress is required to be expressed in terms of percentage of work completed; while financial progress as the ratio of cumulative expenditure to estimated project cost or contract sum.

The only observation which can be made about the control procedures outlined in BOOM is that they are not adequate because they are based on a planning system which is not elaborate. Good plans, where they exist, provide targets which enable progress to be measured and analysed in quantitative terms, making it possible for lapses to be noted and corrective action initiated.

Other chapters of BOOM deal with the procedural aspects of commissioning of consultants, tendering and acceptance, funding of projects, contracting maintenance projects and finally budgetary estimates procedures. Most of these procedures are currently out of date.

BOOM, apart from being threatened by obsolescence is essentially a better publication than any other Government publication on building works. Its apparent omission however is its failure to state in practical terms how building activities should be planned and controlled with a view of optimizing on time and costs.

World Bank Publications

World Bank is one of the major international financial institutions that has played a key role in the funding of development projects, especially in the developing countries. Over the years, it has realised that most of its funded projects are never properly implemented due to a number of factors, ranging from lack of qualified personnel to poor organizational procedures. Poor implementation of projects has in all cases put a heavy burden on the recipients of funds in the sense that instead of the projects generating benefits and meeting people's needs, they have impoverished them through increased debt servicing ratios. Although the bank professes that the ultimate responsibility of project execution rests with the borrower, it has had to intervene in several cases to rectify certain anomalies that would have otherwise worked counter-productive to the interests of the projects. In doing this, the bank's guiding principle has been that it has an interest in helping the borrowers to keep costs down and implement the projects on schedule. This principle rests in its responsibility as a development institution to improve the institutional capabilities of its borrowers.³³

World Bank through its subsidiary organizations; the International Bank for Reconstruction and Development (I.B.R.D.) and the Economic Development Institute (E.D.I.) has carried out research into the problem facing project implementors. Findings of these research and case studies have been published, presented in seminars and some produced in teaching materials form. In this study, a review is made of these publications with a view of finding out what solutions have been offered to some of the project implementors.

Most of the World Bank publications place a lot of emphasis

on the identification of objectives as the first step in project management. They also stress the use of Management by Objectives (MBO) system.³⁴ These two points were reviewed in the earlier part of this chapter and nothing much can be added here. What should be added is the fact that they should be achieved within the right organizational structure. Robert Youker³⁵ notes that most projects fail because they are implemented in a wrong organizational framework, which inhibits instead of progressing the achievement of their objectives. He goes ahead to identify three organizational structures and discuss their merits and demerits. They are (i) the Functional Organization (ii) the Projectized Organization, and (iii) the Matrix Organization.

- (i) The Functional Organization: It is the most prevalent organizational structure in the world today and is basically hierarchical in form. (See figure 2.4). It is the standard pyramid with the top management at apex, and the middle and lower management spreading out down the pyramid. The organization is broken down into different functional units such as engineering, architecture, contracts, accounts and administration.

The structure is based on management theories such as specialization, line and staff relations, authority and responsibility and span of control. According to the "doctrine of specialization", major functional units should be staffed by such disciplines as engineering, accounting, etc. This makes management easier especially when the specialists are put under a head with similar training background.

The strength of this organizational structure is noted to lie in its centralization of similar resources. The advantages inherent in this are two. One, putting

members of the same profession together enables them to receive better training and supervision. Two, professionals working together feel secure and comfortable, especially when the department has well defined career paths. Their security and comfort is also increased by their mutual support provided by physical proximity.

The weaknesses of the structure are also two. When it is used in implementation of multiple projects, conflicts invariably arise over relative priorities in allocation of resources. For example, the engineer in an organization might wish at a particular time to concentrate on supervision and completion of on-going projects, while other members of other professions would like to engage in design work. Secondly, functional departments based on technical speciality often place more emphasis on their own speciality than on the goals of the organization.

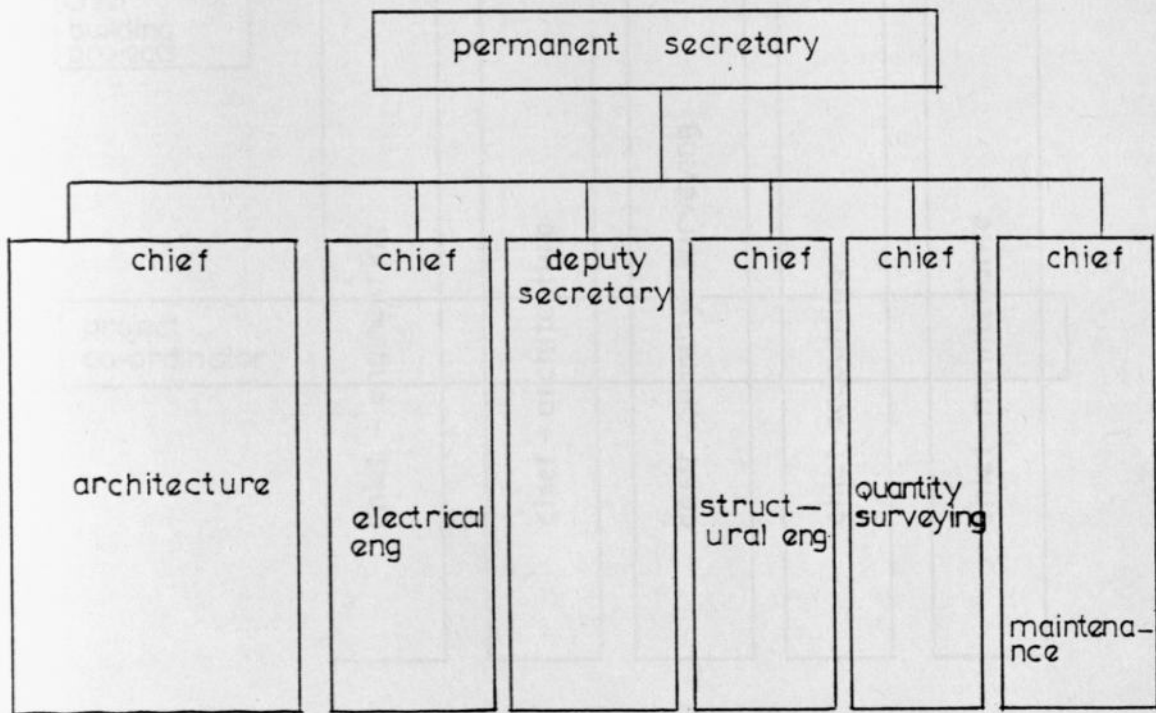


Figure 2.4 - Functional Organizational Structure

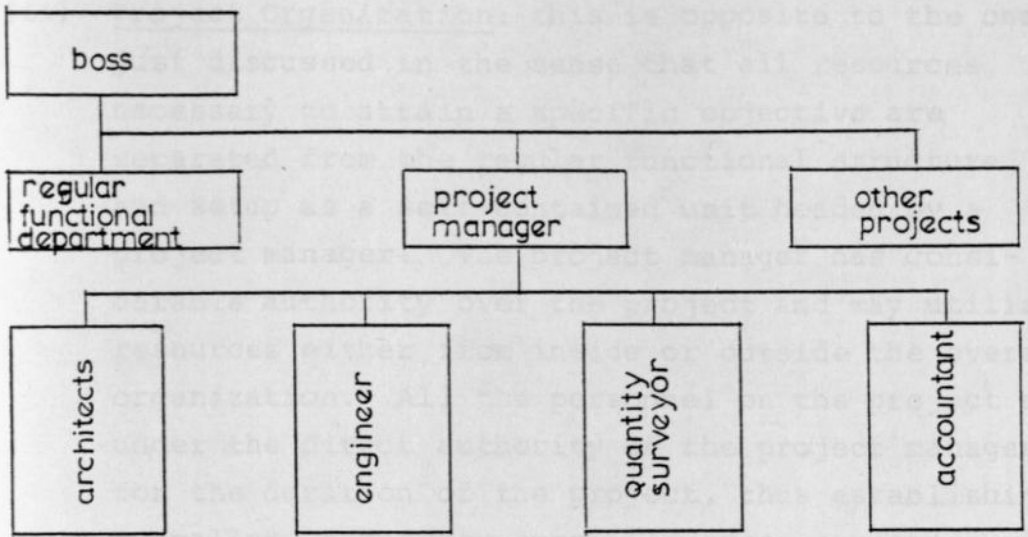


Figure 2.5 - The practised organizational structure

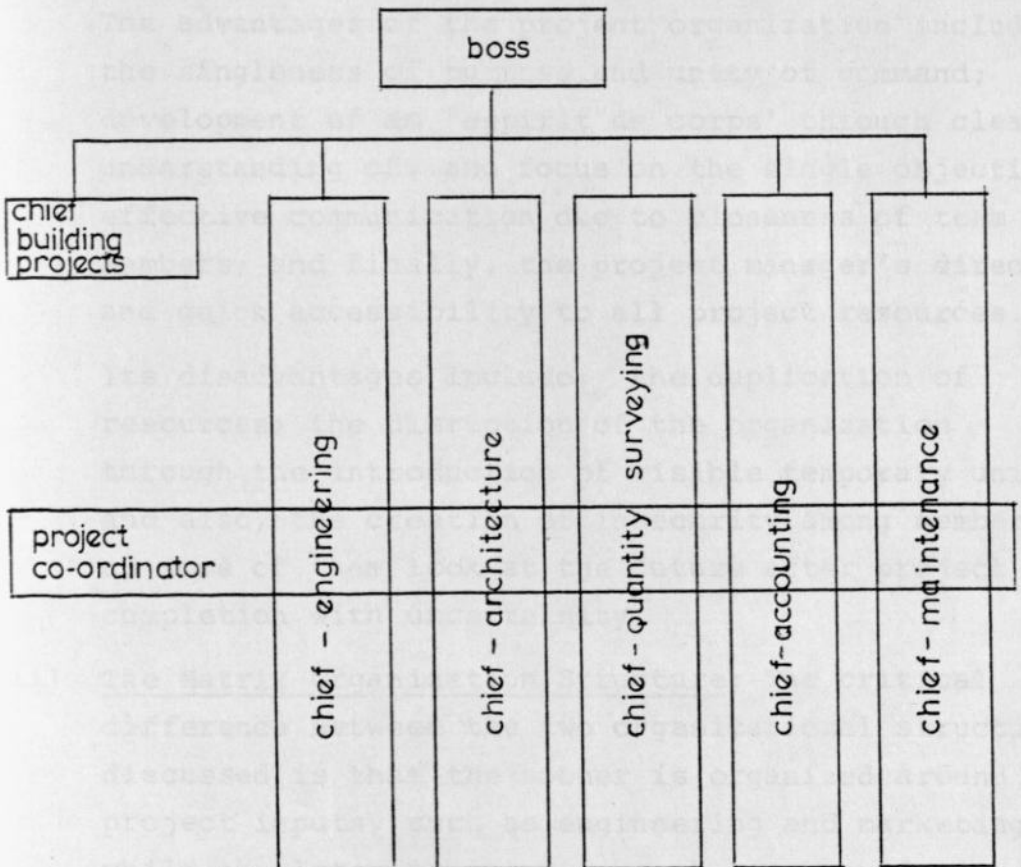


Figure 2.6. The Matrix Organizational Structure.

- (ii) Project Organization: this is opposite to the one just discussed in the sense that all resources necessary to attain a specific objective are separated from the regular functional structure and setup as a self-contained unit headed by a project manager. The project manager has considerable authority over the project and may utilize resources either from inside or outside the overall organization. All the personnel on the project are under the direct authority of the project manager for the duration of the project, thus establishing a smaller, temporary special purpose structure with a specific objective within the large organization. See figure 2.5.

The advantages of the project organization include: the singleness of purpose and unity of command; development of an 'esprit de corps' through clear understanding of, and focus on the single objectives; effective communication due to closeness of team members; and finally, the project manager's direct and quick accessibility to all project resources.

Its disadvantages include: the duplication of resources; the disruption of the organization through the introduction of visible temporary units; and also, the creation of insecurity among members as some of them look at the future after project completion with uncertainty.

- (iii) The Matrix Organization Structure: The critical difference between the two organizational structures discussed is that the sooner is organized around project inputs, such as engineering and marketing; while the later on outputs, such as a new dam or product. Both of them are unidimensional in a multidimensional world and create problems in the

achievement of both long-term and short-term objectives within organizations. The problems can be settled through the use of the Matrix Structure.

The structure is multidimensional and tries to maximize the strength and minimize the weaknesses of both project and functional organizational structures. This is achieved through the combination of the standard vertical hierarchical structure with a superimposed lateral or horizontal structure. See figure 2.6.

The advantages of this structure include: the balancing of the organization's objectives (both long-term and short-term), the visibility of the project objectives through the project coordinator's office and also, the smooth coordination of activities across the functional departmental lines.

The major disadvantage is that the man in the middle works for two bosses. Vertically he reports to his departmental head; while horizontally he reports to the project co-ordinator or manager. In cases of conflicts, he is caught in the middle.

To reduce conflicts between project managers and functional managers in a matrix organization, Youker advocates for adherence to the established relationships as in figure 2.7

The three major organizational structures can be presented on a continuum ranging from functional organization at one end to project organization at the other end (figure 2.8). The matrix form falls in between and include a wide variety of structures, from weak matrix near the functional organization to a strong matrix near project organization.

The Manager of projects is responsible for:

- (1) Directing and evaluating Project Manager activity.
- (2) Planning, Proposing and implementing project Management policy.
- (3) Assuring project compliance with commitments.

General Manager

Functional Manager is responsible for:

- (1) Accomplishing work package tasks within schedule and budget.
- (2) Providing functional policy and procedural guidance
- (3) Providing adequately skilled staff.
- (4) Maintaining technical excellence.

Manager of Project

Functional Manager

Project Status

What (Project Plan)

Project of Manager

When (Project Schedules)

Project-A

How much (Financial Plan)

Representative

Staff

(Project Planning and Control)

Project Managers are responsible for:

- (1) Developing and Maintaining project plans.
- (2) Giving project schedule and financial direction.
- (3) Evaluation and reporting project performance

Status

Work package manager

Work package manager

Responsible individual

This key individual in the focal point of all activity on project-A within the functional organization. He is the alter ego of his supervisor, the functional Manager and performs all sub-functional tasking, and cuts across all sub-functional lines for the total functional effort on project A. He actually plans and controls organizations' efforts on the project.

Work package managers are responsible for:

- (1) Developing and maintaining work package plans for accomplishment
- (2) Establishing work package technical guidance
- (3) Establishing work package detailed schedule and operating budgets
- (4) Controlling and reporting work package performance.

Figure 2.7: Matrix Organization relationship of project Management and Functional Management.

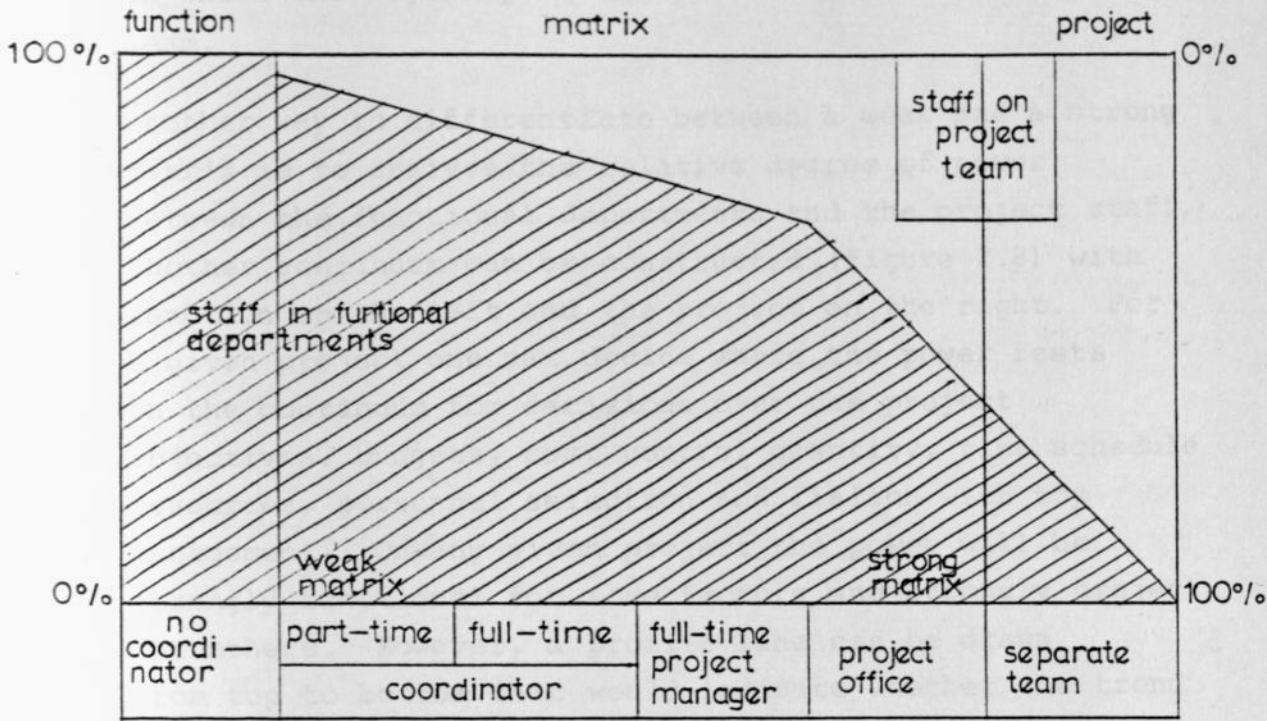


Figure 2.8 - Organizational Continuum.

The continuum in figure 2.8 is based on the percentage of the personnel who work in their own functional department versus the percentage of personnel who are full-time members of the project team. The dividing line between functional and matrix is the point at which the individual is appointed with part-time responsibility for coordination across functional department lines. The bottom line of figure 2.8 shows that a weak matrix has a part time coordinator. The matrix gets stronger as it moves from full-time coordinator to full-time project office that includes such personnel as systems engineers, cost analysts, and schedule analysts. The difference between a coordinator and a manager is the difference between mere integration and actual decision-making.

On the far right, there is projectized organization form. Ordinarily, there is clear distinction between a strong matrix in which most of the work is still being performed in the functional departments and a project organization

in which the majority of the personnel are on the project team.

Another way to differentiate between a weak and a strong matrix is to analyse the relative degree of power between the functional departments and the project staff. Another continuum can be constructed (figure 2.8) with function on the left and the project on the right. For a given project one can decide where the power rests on the continuum for decisions over the project objectives, budgets, cost control quantity, time schedule resources, personnel selection and liaison with top management. On any given project the power will be strongly functional for some factors and strongly project for others. However, a profile line can be drawn from top to bottom that would indicate whether the trend is to the left (weak) or to the right (strong).

In his final analysis of the matrix organization, Youker notes as follows:-

one key problem with matrix organizations is that they tend to overload the functional departments with work. If a functional department makes a commitment to work more man-hours on projects than it has available, conflicts over priorities between projects are inevitable. This problem can be alleviated, if not solved, by better planning.

A matrix organization will not work effectively unless a matrix strategic plan setting priorities on objectives and a matrix budget allocating resources also exist.³⁶

To illustrate this point, the author comes up with the figure 2.9. In this figure the project manager for project A will add horizontally across functional departments to get his total budget. In the similar manner various departmental heads add vertically across all projects for which their funds and resources are

Committed. The matrix budget must add up 100 per cent in both directions. Otherwise overcommitment on the part of departmental heads would result, thus creating friction and disappointments.

"Survival technique in the matrix organization" include the following:

- (i) It is important to have a charter from the top management defining responsibilities and authority for the project manager as well as the role of the functional departments.
- (ii) The project coordinator or manager must anticipate conflicts. Conflicts are inevitable with dual authority, but can be constructively channeled.
- (iii) Since conflicts are inevitable, it is important to develop teamwork and foster informal relationships.
- (iv) The project coordinator's main power comes from the approved plans, budgets and schedule for the project.
- (v) To show their commitments to the budgets, plans and schedules, departmental heads should review and endorse their signatures on these documents.
- (vi) The matrix manager should use his boss when a nasty situation arises, and avoid direct confrontation with departmental heads.
- (vii) The project Coordinator is concerned with "what" is to be done, not "how". He should use a management by objectives (MBO) approach, and not supervise functional departments too closely.
- (viii) Many of the problems of matrix management flow from the uncertainty inherent in the project environment. By definition a project is, to some extent a "new" effort. Careful and continuous planning can help reduce uncertainty.

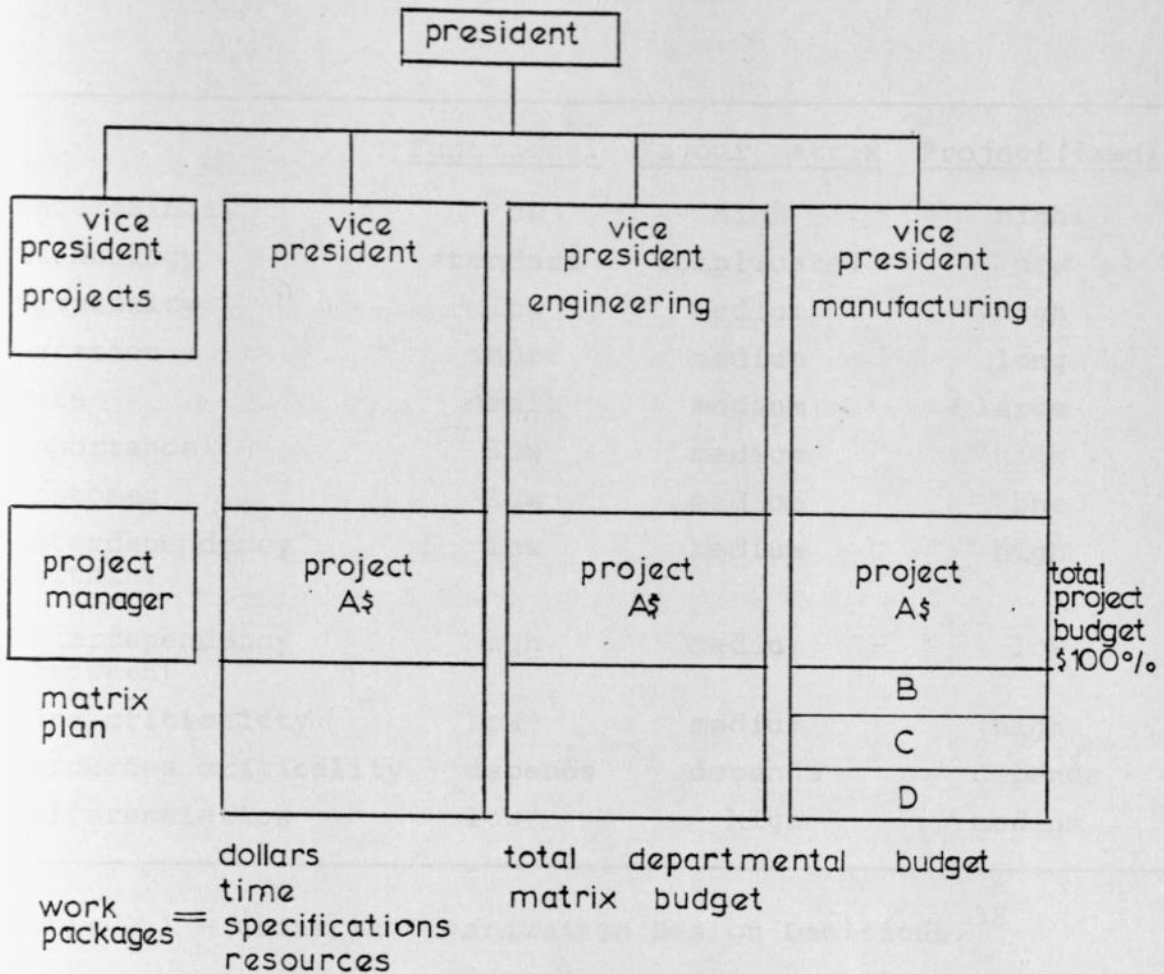


Figure 2.9. Matrix Organization and Matrix Budget.

After discussing the organizational structures, Youker further discusses the criteria of selecting the appropriate one. He notes that:-

In the field of management zealots like to say that their particular model is best. Neophytes want simple and unambiguous answers. Experienced and thoughtful observers, however, know that no one particular approach is perfect for all situations. The current vogue in management literature is the contingency model. This theory states that the best solution is contingent upon the key factors in the environment in which the solution will have to operate.³⁷

In table 2.1, he lists the key factors to be considered.

	<u>Functional</u>	<u>Favour matrix</u>	<u>Project(ized)</u>
Uncertainty	low	high	high
Technology	standard	complicated	new
Complexity	low	medium	high
Duration	short	medium	long
Size	small	medium	large
Importance	low	medium	high
Customer	low	medium	one
Interdependency (within)	low	medium	high
Interdependency (between)	high	medium	low
Time criticality	low	medium	high
Resources criticality	depends	depends	depends
Differentiation	low	high	medium

Table 2.1 - Criteria Organization Design Decisions.³⁸

Youker proceeds to add that it is possible to use all three structures in the same organization on different projects. All three structures can also be used on the same project at different levels; for example an overall matrix structure for the project with a functional sub-structure in engineering and a project organization in another functional sub-area.

Before any choice is made however, consideration should be given to the following factors.

- (i) What is the relationship between organizational design, the skills of the project manager and the project planning and reporting system?
- (ii) Are there ways of improving coordination and commitment in the functional structure without moving to project or matrix structure?

- (iii) What variations exist in the matrix structure and what are the advantages of each variation?

Observations: Youker observes that it is not possible to decide on the organizational design without also deciding whom to select as the project manager and what kind of design one wants for the planning and reporting systems. These decisions are closely interrelated. For example, a successful project organization requires a project manager with the broad skills of a general manager. He must combine technical knowledge of the subject matter with management abilities before he can lead the entire project team. It makes no sense to form a project organization if such a project manager is not available.

The second observation is that usually, planning and reporting in a project organization are simple because the team is in close proximity. The opposite however is of functional organization. Information in form of plans, schedules, budgets and reports is the key medium for integrating a functional organization. Therefore a more sophisticated planning and reporting system is required in a functional organization.

He further observes that some people abandon functional organizations and turn to project or matrix organizations simply because the organization has failed on a series of projects. The best approach is to "analyse the real problems and see if steps can be taken short of re-organization". Methods of lateral and horizontal communication when developed across the functional departmental boundaries help a great deal. Alternative approaches for lateral communication include:

- (i) such procedures as plans, budgets, schedules and review meetings.
- (ii) direct contacts between managers
- (iii) informal liaison roles

These are the intergrating mechanisms which help to break down barriers that seem to separate different disciplinary departments and geographical locations.

Before discussions on organizational structures are concluded, it is important to bring out very clearly the fact that the organizational model chosen creates the framework within which planning and control of the organization's activities can take place. Planning and control are discussed in chapter 3 and 4 respectively, and therefore need not be reviewed much here. Suffice however to note that planning as a management function is brought out by various authors as a pre-requisite for project implementation; an advance choice of the optimal course of action. Stress is placed on the use of modern management concepts and techniques, such as use of quantitative methods, worker participation in setting goals, etc.

Control is noted as a very essential aspect of management. Two forms of control are considered:³⁹ Operational control which is a process for verifying that specific tasks have been effectively carried out within the framework of predetermined norms or directives, and management control which is a permanent information procedure whereby the management can ensure that the necessary resources to attain objectives have been provided and set in motion, and decisions required to correct any differences between targets and performance before the gap widens too much are taken. This later process is considered as an intergral part of the "information-decision-action cycle".

"Management control" is recommended for use in technical organizations.

It entails the use of an elaborate management information system (MIS) which enable managers to receive regular and relevant information. This facilitates quick decision making and allows everybody to play his part effectively. The element of "Management by exception", is one of its outstanding positive elements.⁴⁰

The final point which should be brought out is the emphasis which should be placed on human behavioural aspects in an organization. It is pointed out that defining objectives, choosing the right organizational structures, formulating impecable strategies and plans, and exercising tight control are not enough in ensuring the achievement of optimal results in any organization. Human needs should be looked at very seriously. Concepts like Maslow's hierachy of needs, Herberg's Motivation Hygiene concept, Robert Blake and Jane Mouton's Managerial Grid, Mcgregors Theory X and Theory Y, Dr. B.F. Skinner's "Operant Conditioning" concept, etc. which essentially deal with the manipulation of the human factor in organizations to achieve harmony and optimal results are seriously reviewed and advocated for use by Youker in his World Bank Publications.⁴¹

Other Publications

This part of literature review deals with publications in form of textbooks and journals. As indicated before, literature on project management is quite substantial and therefore very difficult to review exhaustively in a study of this nature.

During library research, an interesting revelation came to light, i.e. there seem to be no comprehensive work covering all aspects of building construction projects.

Most authors, although trying to achieve this, end up dwelling on a few aspects only. Infact the available literal works can safely be placed into the following categories: pre-feasibility and feasibility studies; inception, preliminary and detailed planning of projects, documentation and contracting; site operations; and commissioning and maintenance. The areas of contracting and site operations seem to be of more concern than the rest.

As indicated before, this study focuses on the implementation of building projects by MOWH & PP. Although much of that responsibility lies on the shoulders of the Ministry, one clear fact is that the Ministry does not handle projects at all stages. It deals with projects on day to day basis at pre-contract stages. Once the projects have been let, the contractors take full charge of construction activities and the Ministry is only left to act in a supervisory capacity. It is with this in view that the remaining literal works are reviewed.

The first literary work to be looked at is one by H.N. Ahuja, construction performance control by networks.⁴² Ahuja starts by tracing the need for project planning and control. He states that project planning and control facilitates clear definition of the facilities to be constructed or objectives to be achieved. It creates a framework within which project objectives can be achieved and this paves way for proper utilization of resources.

He also notes that project managers through the use of plans can convey to other professionals the emphasis that should be put to time, quality, cost and goodwill- otherwise most professionals working on projects have different viewpoints of their objectives and without proper plans, communication easily breaks down.

The author also deals briefly with the historical development of planning methods, development of systems approach, comparison of systems design versus project planning; before finally discussing planning and control through the use of networks. He identifies the major network techniques as the Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), Graphical Evaluation and Review Technique (GERT) and Precedence diagrams. He follows this up by a complete discussion of the mechanics of these techniques and how they can be utilized in construction situations to achieve optimality. He also discusses implementation, feedback and control and how they can be effected and used for the benefit of the projects.

Finally he discusses the use of the Intergrated Computer Systems.

Much of what the author discusses is utilized in chapter 3 and 4 of this study and it would cause repetition to go into much detail here.

Another author whose works deserve mention in this study is A. Brearley.⁴³ In his book "The Management of drawing and design", the author notes that in most economies, there is a shortage of good quality designers and draughtsmen. It is therefore desirable that the available manpower be used to the best advantage. This can be achieved through the following processes:-

- (i) reduction of creative work in offices. Brearley notes that "... the more creative the work, the more difficult to supervise it, control it and measure it". Design and Drawing offices should therefore standardize most of their design and drawing work.
- (ii) increased productivity on the part of draughtsmen can be achieved through drawing simplification and individual effort.
- (iii) ineffective use of time should be avoided.
See figure 2.10
- (iv) Unnecessary procedures and documentation should be eliminated.
- (v) increased productivity can be achieved through improved workplace and general office conditions.
- (vi) reduction of the number of drawing errors, and thus the work involved in corrections.

- (vii) standardization of the presentation of drawing instructions
- (viii) reduction of unnecessary high-grade drawing and increase of the use of sketches and written instructions.
- (ix) improvement of the scheduling of production and construction by giving firmer and more realistic dates for the availability of finished drawings and other instructions.
- (x) encouragement of the use of value Analysis and engineering techniques.

In the table below the author gives the drawing office activities and the overall percentage time they consume. To achieve higher productivity they should be properly balanced.

Functions	Percentage of Overall time
New drawing and design	48
Amendments to drawing	11
Checking work	9
Workshop visits and development	8
Correspondence and queries	7
Search for drawings	1
Compiling specifications	10
Special investigations	6

Table 2.2. Drawing office activities⁴⁴

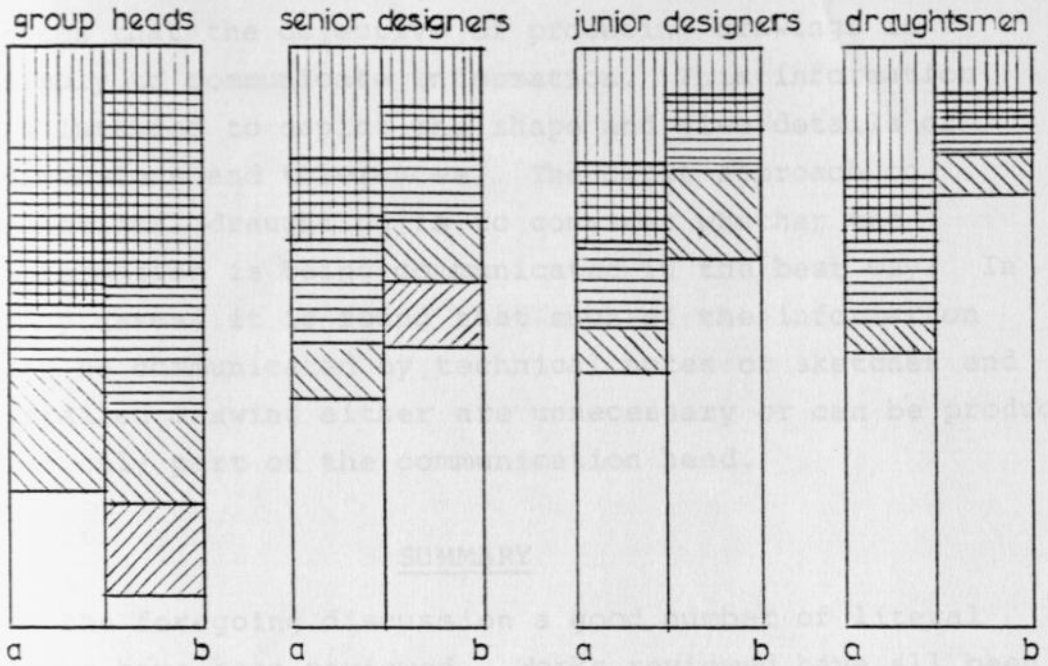
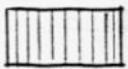


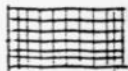
Figure 2.11 Design office work distribution

KEY

- (a) work distribution in a conventional design office
- (b) work distribution in an engineering design office with planning function



Avoidable delays and personal



Contact with other departments



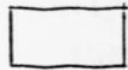
Information retrieval



Give and receive information



Discuss projects



Designing, drawing and calculating

The author also discusses functional draughting. He notes that the objective of producing drawings is simply to communicate information. This information is intended to depict the shape and give details of dimensions and tolerances. The first approach to functional draughting is to consider whether the information is being communicated in the best way. In many cases, it is found that much of the information can be communicated by technical notes or sketches and detailed drawing either are unnecessary or can be produced for only part of the communication need.

SUMMARY

In the foregoing discussion a good number of literal works have been reviewed. Works reviewed have all been on how good organization and management can be utilized in the implementation of building projects to achieve efficiency.

The key points that have come out include the need to Institute the practice of good project management from the time the project is conceived to the time it is completed. It has also been noted that the first step in good project management is the definition of objectives. Objectives should necessarily be ends not means. Secondly, clearly defined objectives enable the management to practice what is known as "Management by Objectives" (MBO), which has enormous benefits as opposed to management by crisis. The literature reviewed also indicate that the basis of good management is the use of good skills - or what is fast being known as appropriate techniques. Some of these are acquired through experience, while most are scientific and can be learnt in a normal classroom situation. Finally, it is noted that the definition of objectives and the use of appropriate techniques is not enough.

Footnotes

There is also need to create a sound organizational framework within which the two can be practiced and achieved. Three models of the commonly used organization structures, i.e. Matrix, Functional and Project have been discussed.

The observation that can be made about the literature reviewed is that although it is based on the experience of other countries, especially the developed ones, it is quite relevant and practical to the Kenyan situation. What remains is the question of how some of the useful concepts raised can be applied here in Kenya, especially in respect to public projects. This is what is attempted in the latter chapters of this work.

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14.

William S. Brown, "Management by Objectives: Promise and Problems", Bureaucrat vol. No.4, 1974, ed. Robert Youker, Readings in Management, (EDI, World Bank, 1980), PP.148-157.

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R. Morris, "The Transferability of Western Management Concepts and Programmes: An East African Perspective", March 1977, ed. Robert Youker, Readings in Management, (EDI, World Bank, 1980), PP.112-122.

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Footnotes

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9. Ibid, P. 120.
10. Ibid, P. 119.

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12. Robert Youker, "Organization Alternatives for Project Managers", Management Review, 1977, PP.46-53
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19. Ibid.
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24. Oberti, Op.cit. PP. 237-238.
25. A.C. Sidwell, "The Measurement of success of various Organizational Forms of Construction Projects", ed. V.K. Handa, Organizing and Managing Construction, proceedings of 4th International Symposium on Organization and Management of Construction, (Ontario: University of Waterloo, 1984) PP. 283-289.
26. Kenya has been treating the subject of housing very seriously. This is exemplified by the large number of case studies carried out; and the papers produced on the subject since independence. Housing Research and Development Unit (H.R.D.U.) has played a key role in this. Most of the literary materials are found in its library at the University of Nairobi. A few can also be found at the Kenya Building Centre Library.
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CHAPTER 3

PROJECT PLANNING

Introduction

In the preceding two chapters, planning as a function of project management has already been brought to light. In this chapter, discussions on the subject are continued, but in a more elaborate manner, with greater focus being placed on the following sub-headings:

- (a) What is planning about?
- (b) Why is planning necessary?
- (c) Principles of planning.

In the later part of the chapter, the techniques of planning are discussed with emphasis placed on their mechanics, strong points and weak points.

What is planning about?

H.N. Ahuja seems to have anticipated this question as in the opening paragraph of his book "Construction Performance Control by Networks", he states as follows:

When a new project has to be undertaken for which one does not have previous experience, it is necessary to visualize all operations of the project, arrange these operations in their proper sequence, achieve confidence that one understands each operation; acquire the know-how and means necessary to perform it; and feel convinced that the method thought out for performing each operation is the most economical. Such confidence is achieved only through systematic planning. However, as a result of over-confidence, many people do not take pains to develop a plan, consequently they resort to 'seat of the pants' management that results in one panic after another and below par performance. Their targets keep shifting from day to day. They present a vivid picture of how a project should not be carried out.

From the above, three concrete aspects come out clearly as subjects for consideration in project planning:

- (i) Project tasks or activities should be visualized and determined before hand. This can be achieved through a detailed study of the job requirements. Normally, the activities determined are numerous and unique in content, but have a "logic" relationship.
- (ii) resource inputs and the appropriate technologies required for each activity should be defined before performance.
- (iii) activities should be ordered in a logical sequence in order to achieve efficiency. Note should be taken of the activities to start first, of those to follow, etc, and among these which ones should overlap. For purposes of easy visualization and assimilation, the established relationships should be presented graphically, by use of bar charts or network diagrams.

Why is planning necessary?

The following points explain the need for project planning:²

- (i) Facilities to be constructed are defined and an effort is made to achieve them within the limits of the available budgeted resources.
- (ii) The project manager, through the use of a project plan, can easily convey to other professionals the emphasis that should be put to time, cost, quality and eventually goodwill. Otherwise most professionals working on the project can easily develop different viewpoints of its objectives and create communication breakdown.
- (iii) Plans are also necessary to ensure timely completion of projects. Untimely completions may result into serious economic consequences such as lose of market or delayed break-even point in cases of commercial enterprises.
- (iv) Efficient planning permits optimal use of limited

resources. Lack of planning or poor planning permit poor implementation of projects which generate cost overruns, long interest payment periods and high overhead costs.

- (v) External factors usually affect a project. Such factors include inclement weather, material shortages, social upheavals, etc. Planning which is not static but continuous helps in providing for these exigencies. The initial plan is amended to incorporate changes and is used to find answers to meet any situation. It should be noted that it is only when a plan exists that modifications can be made to it and consequences predicted.
- (vi) Plans setting out targets against which performance can be measured are prerequisite for "management by exception". Management by exception on its part enables the personnel involved in project implementation to produce reports for the management's consumption on areas where performance does not match the targets set in the plans. This way, a lot of time and effort is spared and can be redirected into other activities of the projects.
- (vii) Projects are usually undertaken by groups of individuals, each contributing his share. Overall efficiency of the group or team depends to a large extent on the performance of each individual. Planning enables this by providing a unity of purpose to the members of the group.
- (viii) Planning becomes absolutely essential when the transiency of the projects' personnel is considered. More often than not, men familiar with jobs leave before the projects are completed. Replacements usually work slowly while gaining experience. Availability of plans gives them direction and the required confidence. It provides continuity

that shortens the learning period.

- (ix) Finally, planning provides the parameters necessary for the execution of the management function of control. It would otherwise be nonsense to talk about project control without appropriate plans.

Principles of Planning

Before this study indulges into the rigorous mechanics of planning, it is important to note the following points:-

- (i) there is difference between plans and programmes. Programmes are produced out of plans and are more action oriented. They consist of events put on a timetable, plus the resources required to achieve them.
- (ii) While making plans and programmes, it is always advisable to involve as much as possible the personnel that will be involved in their execution. When they make contributions to the project, their self concept is enhanced greatly. They also develop a feeling of ownership which lead to intrinsic rewards of satisfaction of accomplishment.

In construction projects, it is now considered prudent to involve over and above the project team members, other relevant parties such as the contractors, subcontractors, various specialists and the maintenance crew at the planning stage. This provides an opportunity of rationally assessing all alternative designs and choosing one which can easily lent itself to the cheapest but efficient technology available.

- (iii) It is very important for project participants to agree with and have confidence in the programmes and plans to be used. This increases their commitment to them.
- (iv) In arriving at the target dates and resource inputs for various activities, the project

managers should seriously refer to the past projects' performance. The historical records and estimates should however not be taken in entirety. This is because some of the projects could have been performed at a low efficiency rate. If planning is therefore based on this, the past inefficiency is carried into the future. To arrive at the best estimates, the project managers should carry out some form of interpolation. They should however avoid guesswork in their decision-making and rely on valid information.

- (v) Finally, after all activities have been put on the appropriate planning diagram, the following schedules should be prepared to complement the plans:
- a) Labour schedules, which show the number of men required in each classification.
 - b) Material schedules, which indicate deadlines for the preparation of shop drawings, approval of shop drawings and samples, beginning of fabrication, date of shipment, receipt and use.
 - c) Equipment schedules, which show the separate sizes and types of equipment required on rent, lease or outright purchase.
 - e) The S curves, which show the forecast and actual cumulative percentage completely plotted on a time scale.

Planning: How it can be done

Under this heading, the various techniques of project planning are discussed. Planning techniques are generally many; most of them falling under the subject of Operations Research (OR). It is difficult for all of them to be discussed within the scope of this study.

Suffice to note therefore that the few discussed here are the ones popularly used on construction projects. They are (i) Bar Charts (ii) Network analysis.

Bar Charts

They are also known as the Gantt diagrams, and form the oldest management technique for planning and scheduling construction projects.

Essentially, they are used in devising and presenting job plans and time schedules for projects. The two elements are plotted on a horizontal time scale noted in calendar days or months. Like in other management techniques, the process starts with a critical analysis of the job requirements. This enables the project manager to identify major activities and also make an estimation of the times required. After this, the project manager considers the most logical sequence in which these activities must proceed. The established sequence of activities is plotted on a graph for better visual assimilation. The result is a bar chart: a series of bars plotted against a horizontal time scale, showing the completion date of the overall project and the approximate calendar times during which the various parts of the job will proceed. Each bar represents the beginning, duration, and completion of some designated activity of the project. Together, the bars make up a time schedule for the entire project. Where the bar chart completion date does not agree with the one set by the owner, the project manager can rework the plan to come up with an agreeable time schedule.

There are some general points to note about bar charts:³

- (i) There is no standard (bar chart) way of presenting project activities on bar charts. Figure 3.1 shows only one version, not necessarily the appropriate one.

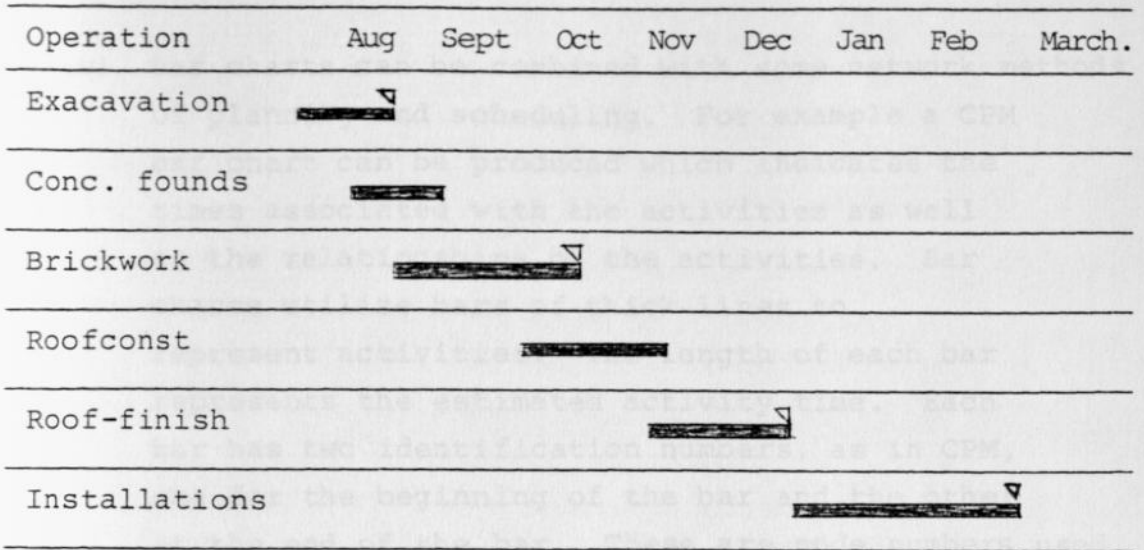


Figure 3 - 1: Bar Charts

- (ii) For purposes of emphasis and clarity in visualization, colours of various types can be used to indicate project performance at different stages.
- (iii) On a large complex project there are hundreds of activities. It is difficult to keep track of the many details of each and every activity. It is therefore advisable to keep tabs on certain targets or milestones. Such milestones can be added to the bar charts. The choice of activities on which milestones should be placed depends largely on the project manager's evaluation of the criticality of the activities or operations.

- (iv) Bar charts can be combined with some network methods of planning and scheduling. For example a CPM bar chart can be produced which indicates the times associated with the activities as well as the relationships of the activities. Bar charts utilize bars of thick lines to represent activities. The length of each bar represents the estimated activity time. Each bar has two identification numbers, as in CPM, one for the beginning of the bar and the other at the end of the bar. These are node numbers used to identify activities on the CPM network.⁴

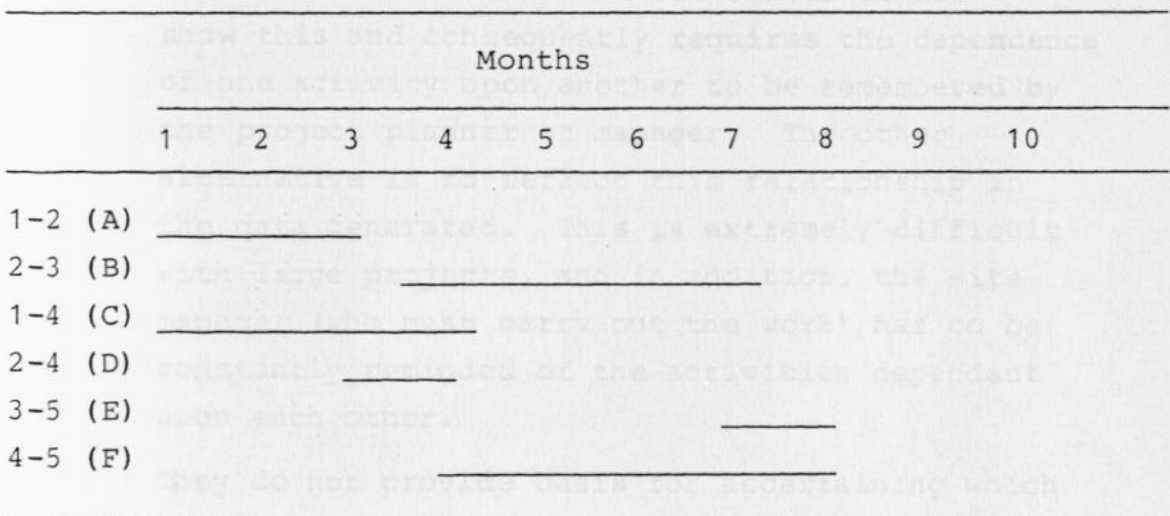


Figure 3.2 CPM bar chart.

(Ahuja H.N. Construction Performance Control by Networks,
A Wiley-Interscience Publication, New York, P. 58).

Advantages:- In terms of visual clarity, they are unsurpassed, and this makes them a very valuable medium for displaying project schedule information. They are easily intelligible to people who have no knowledge of CPM or network diagrams.

Secondly, they afford an easy and convenient way to monitor project progress schedule.

Finally they are easy and quick to draw and involve very little in terms of mathematical computations.

Disadvantages:- The defficiency of bar charts as a planning technique can easily be noted when one is conversant with the recent planning techniques like the networks. Networks will be discussed later in the chapter. A comparison of the two methods of planning reaveals the following inadequancies in the use of bar charts:^{5,6}

- (i) the interdependence among activities are difficult to show. The normal bar charts do not show this and consequently requires the dependence of one activity upon another to be remembered by the project planner or manager. The other alternative is to reflect this relationship in the data generated. This is extremely difficult with large projects, and in addition, the site manager (who must carry out the work) has to be constantly reminded of the activities dependant upon each other.
- (ii) They do not provide basis for ascertaining which activities are critical and which have float time. Consequently each activity receives equal attention with no indication of which activities should receive more focus from the management. In cases of delays and crushing is done, some activities are unnecessarily crushed, leading to excessive project costs.
- (iii) It is comparatively easier for anyone taking over a partially completed project to become familiar with its plan and progress when CPM is used as opposed to bar charts.

- (iv) while using CPM, it is mandatory to study activities and their sequence carefully. This leads to a closer understanding of the project. This is not so with bar charts.
- (v) Finally; planning, analysing and scheduling are separated when using CPM. This allows a greater concentration on the planning aspect.

After considering the networks, mention will again be made about the bar charts, this time on how they can be combined with other features to provide more information about the projects operations.

Networks

Network Analysis describes and includes all the methods which break down an overall task into an arrow diagram showing sequence and inter-relationship of separate activities and events, with time span and resources allocation so that the critical path can be identified.⁷

There are four main variations of networks, i.e. the Critical Path Method (CPM), the precedence networks, the Programme Evaluation and Review Technique (PERT) and the Graphical Evaluation and Review Technique (GERT). Essentially, the approach given to planning and scheduling of projects through these techniques is similar, and as a matter of fact, most authors choose to discuss only one of them and then refer to others in passing. Some discuss them together, bringing out the weak and strong points of each separately. The Critical Path Method is the most popular one, and in this study, it forms the basis of discussion on networks. Other techniques are also considered but with emphasis being laid on unique features.

The Critical Path Method (CPM)

While considering bar charts, it was noted that they have serious defficiencies which make it difficult for project managers to plan and manage their construction projects efficiently. These defficiencies have been associated with the technique for a long time. It is for this reason that the engineering services department of E.I dupont de Nemours and Company, Wellington, Delaware, initiated a study in 1956 into the whole problem of programming and scheduling. The scope of this study was to survey the prospects of applying electronic computers as aids in coping with the complexity of managing engineering projects. The main objectives were to determine to what extent a computer oriented system could be used to prepare a master schedule for a project, revise schedules to meet changing conditions in the most economical way and keep management and the operating departments advised of the project progress and changes.

From this study which was completed, field tested and announced in 1958, a team of mathematicians and electronic computer experts from Remington Rand UNIVAC, headed by James E. Kelley Jr, then developed the Critical Path Method (CPM).⁸

The critical path method incorporates all the features outlined earlier as being essential to any organized planning and scheduling system. It provides for detailed planning, timing and costing; indicates the optimum labour force and facilitates periodic progress reporting. Other important advantages of the technique are:

- (i) it identifies the trouble sports, often in advance, and pinpoints responsibility.
- (ii) it indicates optimum start and finish times for each activity in an operation.

- (iii) it is an important means of training personnel in the techniques of handling operations.
- (iv) it forms a useful, comprehensive record which requires minimum storage space.

Other points to be noted about the technique are:

- (i) although its development is associated with the electronic computers, it can easily be used on projects manually. Infact it is advisable to compute the critical path manually in cases where the projects have less than 200 activities. This is because the complexity of the projects do not justify the resource inputs in the preparation of computer programmes.
- (ii) secondly, that even if alot of glowing tribute has been paid to the efficiency and appropriateness of the CPM, it should be noted that the technique is not a panacea for planning and scheduling problems. Good management and judgement are required to make things work. CPM is a mere tool in helping to achieve these functions.

The Critical Path Analysis:

The Critical path analysis is the methodology used in the critical path method to arrive at the project's plans and schedule.

In arriving at the projects' plan, the following steps should be observed:

- (i) Preparation of a list of all activities to be undertaken before the project is completed. An activity is an operation, and all activities start

and finish at an event, which is a point in time and may be a junction of two or more activities (Fig. 3.3). Activities take time whereas events do not. An activity can not be started before all activities leading into its preceding event have been completed. Activities are represented by arrows and the sequence of arrows represents the sequence of activities. Events are normally represented by circles.

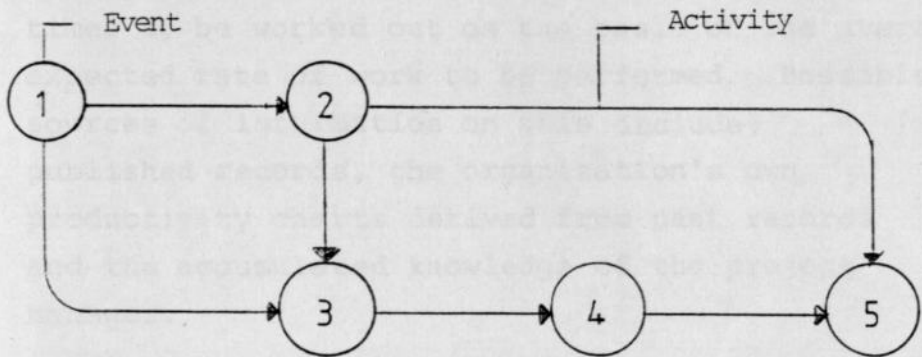


Figure 3.3. Network diagram showing events and activities.

- (ii) After determining the activities and producing a list, the next task in planning is to logically sequence the activities. In doing this there is need to determine which activities should start first, second, etc; which activities should be carried out concurrently, which activities should commence after the partial completion of the preceding ones and finally which ones should start after the completion of the preceding ones. In trying to achieve logic, dummies can be used.

Dummies are activities introduced on the network simply for the purpose of achieving logic and clarification. No two activities can have the same start and end nodes (i and j nodes). Where this is likely normal activities, dummies do not utilize resources.

- (iii) The third step is to construct a network diagram which graphically show the listed activities and how they are sequenced for implementation.
- (iv) determination of activity duration requires possible times to be worked out on the basis of the average expected rate of work to be performed. Possible sources of information on this include; published records, the organization's own productivity charts derived from past records and the accumulated knowledge of the project manager.
- (v) on the basis of the activities' durations, using forward pass and backward pass computations, the critical path can be determined. The critical path is the longest path through the network. Deviations from it result into project delay.

Constructing Networks

The network is composed of activities and events. The resources are added onto these two to make the process of planning through network complete. As already noted, the first stage in preparation of network diagrams is the listing of the activities to be used (see table 3.1). The amount of detail required in the breakdown depends on many factors, such as the stage in planning. One activity in a network, drawn in the early stages for example, may be broken down into a number of activities at a later stage.⁹

Activities relationship can be shown by use of arrow lines.

The lines represent activities and are connected to nodes. The nodes represent events. This means that each activity has a beginning event and an end event. The beginning event is referred to as the i node, while the finish event referred to as the j node and together define those points in time when an activity is started and completed. A node is commonly known as an event because it depicts that moment when all the activities entering that node are finished and therefore all the activities leaving that node can begin. For node numbering it is convenient, although not necessary to use the i-j rule, where the i node number is always less than the j node number.

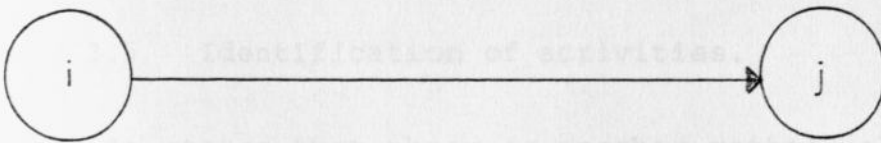


Fig. 3.4 The i-j nodes

To differentiate one node from another, each is given a unique identification number. See figure 3.5. Where identification problems arise because of two activities sharing the same start and end nodes, a dummy, e.g. activity 4-5 in figure 3.5 is introduced.

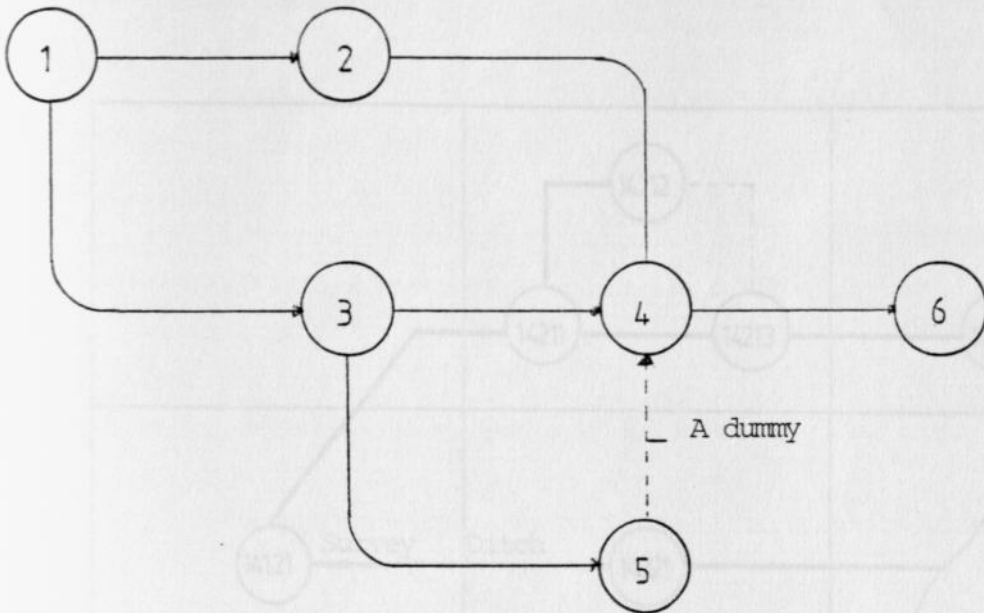


Figure 3.5 Identification of activities.

H.N. Ahuja states that there is another method, almost completely different from the conventional one, of identifying and locating activities on large networks made up of a number of separate sheets.¹⁰ Each sheet is numbered and divided by a grid. The node is identified by a five-digit number. The first two digits give the sheet number, the next the column number, the next the row number; the final digit distinguishes the node from other nodes in the same grid section.

Figure 3.6 illustrates that on a network with 60 sheets, the activity "survey ditch" 14121 - 14221, immediately known to be sheet 14, starting in column 1, row 2, ending in column 2 row 2, and has digit 1 for both the i node and the j node.

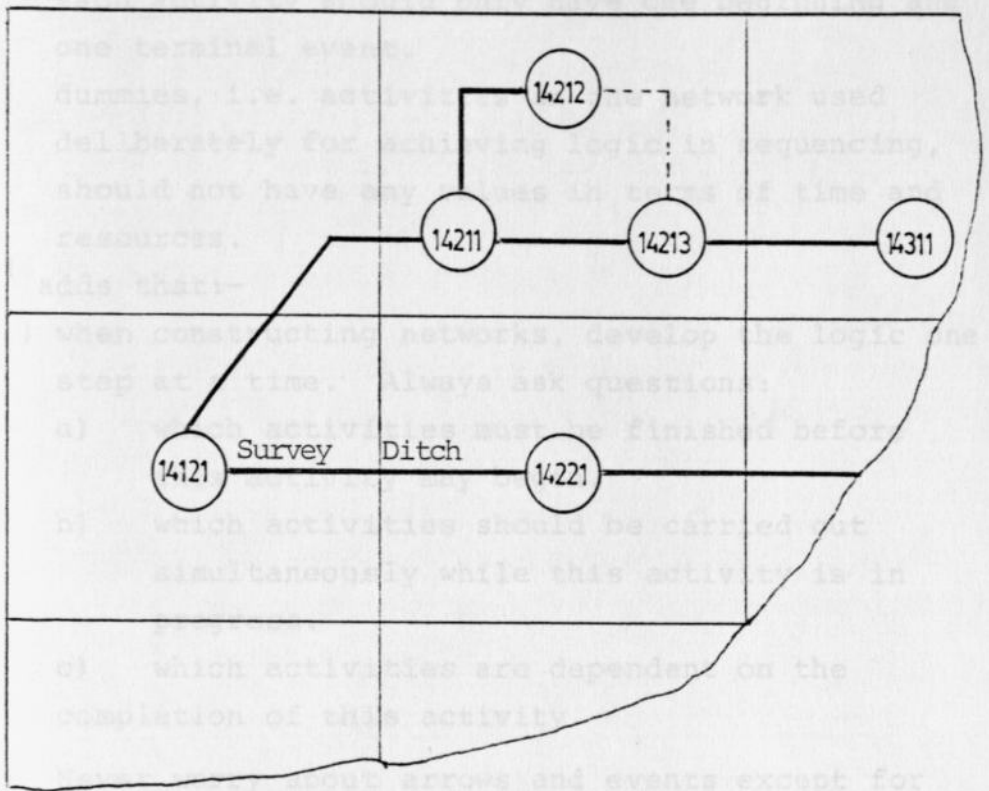


Figure 3.6. Location and identification of activities
(H.N. Ahuja. Construction Performance Control by Networks,
p 27).

The following are rules for constructing the CPM Networks:

- (i) each activity should be represented by only one arrow in the networks.
- (ii) no activity should be shown twice.

- (iii) no two activities should be identified by the same start and end events.
- (iv) there should be no loops or circuits in the networks.
- (v) each activity should only have one beginning and one terminal event.
- (vi) dummies, i.e. activities in the network used deliberately for achieving logic in sequencing, should not have any values in terms of time and resources.

Ahuja¹¹ adds that:-

- (vii) when constructing networks, develop the logic one step at a time. Always ask questions:
 - a) which activities must be finished before this activity may begin.
 - b) which activities should be carried out simultaneously while this activity is in progress.
 - c) which activities are dependent on the completion of this activity.
- (viii) Never worry about arrows and events except for the sake of clarity.
- (ix) dummies may be used freely, but those that are redundant should be eliminated before proceeding further.
- (x) always construct an arrow with at least one portion of it drawn horizontally. The descriptions and durations can then be written on a horizontal plane, enabling them to be read with ease.
- (xi) write the description above the horizontal portion and the duration below so that the two are never confused.
- (xii) for the sake of clarity avoid crossovers whenever possible. This might require rearranging small sections of a network.

- (xiii) number the nodes after the diagram is complete.
This removes the hassle of changing node numbers during planning.
- (xiv) draw the arrow from left to right.
- (xv) to avoid confusion always use a consistent method of presentation.
- (xvi) include a key and title block with a network diagram.
- (xvii) use a sharp pencil and an eraser to develop a network.

To end discussions on the construction of networks, the following should be added. The easiest way of arriving at dependence is to use the following checklist which gives the various types of dependences.

- check for
- (i) logical dependence
 - (ii) technological dependence
 - (iii) conventional dependence
 - (iv) safety dependence
 - (v) strategic dependence

Event Times and the Computation of the Critical Path

Each activity has duration which is usually based on the following sources: published productivity records, the constructor's own productivity charts derived from past projects, the accumulated experience of the construction project managers and the synthetic times based on work study.¹² In considering activity durations, three points should be clearly noted:

- (i) data from whatever source should not be accepted and utilized without serious scrutiny and necessary modifications.
- (ii) to avoid building inefficiency into the plan, provision should be made in duration estimate for overtime, extended workweeks, strikes, late

deliveries, authorization delays, bad weather, acts of God, etc. These occurrences if deemed imminent should be allocated time by including an activity at the end of the network. The schedule should at all time be realistically tight. The project managers with generous tendencies should be reminded of Parkinson's law which states that "work expands to fill the time available". Where one might argue that there is no pressure to complete the project within the so called realistic duration, his attention should be drawn to the fact that project overhead costs are directly proportional to the construction duration.

- (iii) absolute accuracy in time estimation is difficult and unnecessary as there are generally small errors which cancel each other, and have little effect on project duration. It is however, far worse to be 5 per cent wrong on a 50 week project than 50 per cent wrong on a two week project.

The key to all CPM network time computations lies in the determination of event times. Each event is associated with two times; i.e. the early event time and the late event time.

The early event time for a given node or event is defined as the earliest time an activity leaving that node may begin. A computational process known as the forward pass is used to determine the early event times for each and every event. The symbol used in the calculations is normally EET, and the procedure as follows: assume that the start of the project is at event 1 and set the EET = 0. The early event time for the following time is found by simply adding the duration of the succeeding activity to the early event time of the preceding event. When more than one activity enters a node, the finish time of the last activity to finish becomes the EET at that node.

Figure 3.7 illustrates the methodology.

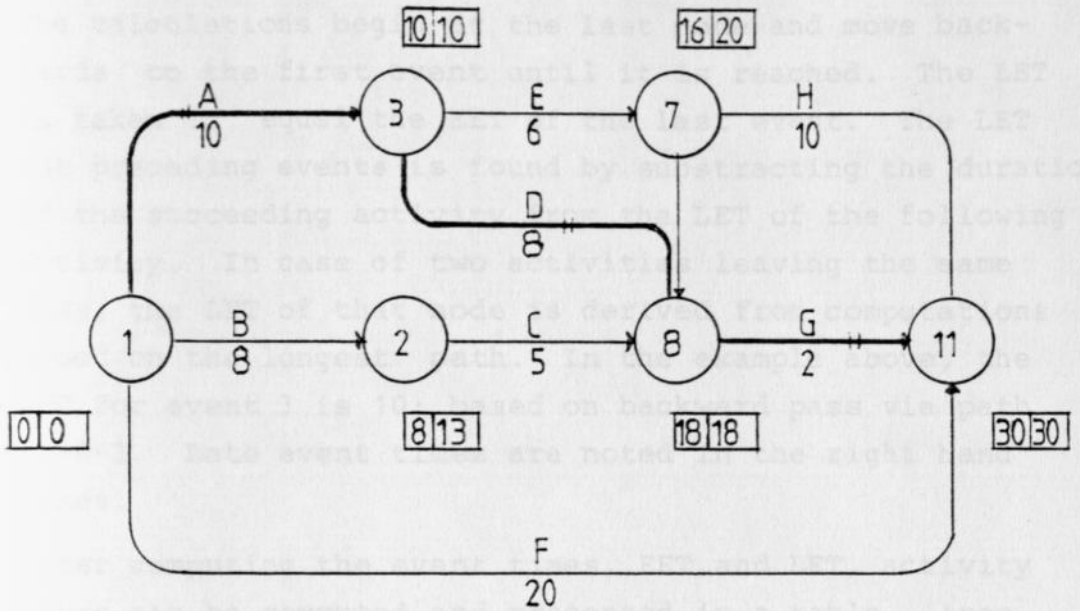


Figure 3.7 Network with early and late event times.

In figure 3.7 the EET at event 1 is 0, noted in the left box; for event 2 is 8. This is arrived at by adding the activity duration between event 1 and 2 which is equal to $8 + 0$. The EET at event 8 is 18. It is arrived at following the path 1-3-8

The late event time (LET) for a given event is defined as the latest time an activity entering that node can finish. A computational process known as backward pass is used to determine the LET for each and every event. The calculations begin at the last node and move backwards to the first event until it is reached. The LET is taken to equal the EET of the last event. The LET for preceding events is found by subtracting the duration of the succeeding activity from the LET of the following activity. In case of two activities leaving the same node, the LET of that node is derived from computations based on the longest path. In the example above, the LET for event 3 is 10; based on backward pass via path 11-8-3. Late event times are noted in the right hand boxes.

After computing the event times, EET and LET, activity times can be computed and presented in a table. (see table 3.1). The earliest start (ES) of any activity is the EET of the node that it leaves. The latest start (LS) of an activity is its LF minus its duration. The earliest finish (EF) of an activity is its ES plus its duration. LS of an activity is always $\geq$ the LET of the preceding node. The EF of an activity is always $\leq$ EET of the following node.

Once the network with both EET and LET is available such as figure 3.7, the following six-step procedure can be used to compute and tabulate activity times:

- (i) list all the activities in column 1 according to the i major, j minor sorting sequence.
(list activities in ascending order by i node first and then for each i node arrange the activities in ascending order of j nodes).
- (ii) record the description of each activity in column 2 and its duration in column 3.

- (iii) record the earliest start time for each activity in column 4. These are the early event times at the i nodes of activities.
- (iv) compute the earliest finish for each activity by adding its duration to its earliest start and place in column 5.
- (v) record the latest finish time for each activity in column 6. There are the late event times at j nodes of the activities.
- (vi) compute the latest start of each activity by subtracting its duration from its latest finish and place in column 4.

Activity	Duration	Start		Finish	
1	1	3	4	5	6
i, j	D_{ij}	ES_i	LS_{ij}	EC_{ij}	LC_j
1,2	8	0	5	8	13
1,3	10	0	0	10	10
1,11	20	0	10	20	30
2,8	5	8	13	13	18
3,7	6	10	16	16	17
3,8	8	10	18	18	18
7,8	1	16	17	17	18
7,11	10	16	20	26	30
8,11	12	18	18	30	30

Table 3.1 computation of activity times.

Once the activity times have been computed and tabulated as in table 3.1 and a network showing the logical sequence of activities drawn, it becomes easy to determine the critical path. The critical path is a continuous chain of critical activities, from the start of the project through its network to the finish. Critical activities are those which control the overall duration of the project. They have no spare time (float) associated with them and a delay in any one will affect all following activities and ultimately the project.

A critical path joins events for which $EET=LET$, but an activity (i,j) lies on the critical path if and only if:

- (i) $ES_i = LC_i$
- (ii) $ES_j = LC_j$
- (iii) $ES_j - ES_i = LC_j - LC_i = D_{ij}$.

In one network diagram, it is possible to have more than one critical path. The main critical path as a whole goes from start to finish in the network, but sometimes short chains of critical activities leave and return to the critical path. There are also sub-critical activities which form the sub-critical path. These are activities with very little spare time such that a little delay makes them critical.

In figure 3.7 the critical path is the thick line running from event 1 - 3 - 8 - 11. The duration established is 30 days.

Floats and their uses

All non-critical activities have some spare time or float associated with them. The existence of float gives latitude in timing the activity with which it is associated.

Floats can occur either before the start of the project or before its finish. They are respectively referred to as start float and finish float:

Start float = latest start - earliest start

Finish float = latest finish - earliest finish.

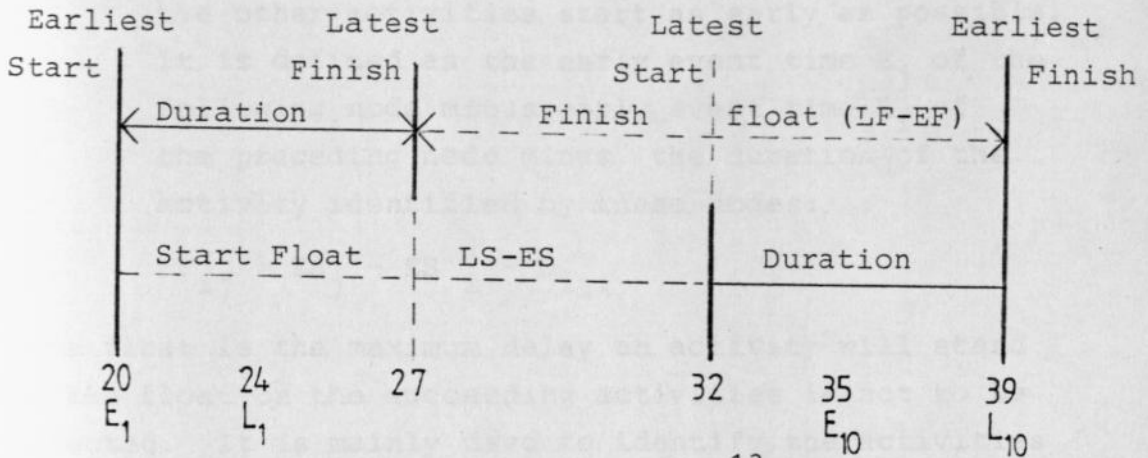


Figure 3.8. Start and Finish floats.¹³

There are four types of floats, i.e. total, free, independent and safety. Only the first two are prominent in computations.

- (i) Total float. This is the most important of all floats. It indicates the duration an activity may be delayed without affecting the projects' scheduled completion period.

Total float (TF) = Maximum time available - activity duration.

$$TF_{ij} = LC_j - ES_i - D_{ij} = LC_j - EC_{ij} = LS_{ij} - ES_i$$

Critical activities, are the only activities with zero total float. But since float is really a property of the chain of the network containing the activity, it is not in general independent of the timing of other activities on the branch. In table 3.2, based on figure 3.8 and table 3.1, the total float for activity 1,2 is 5 days while for 7,11 four days.

The main use of total float is to establish priorities. This will be discussed in chapter 4.

- (ii) Free float: This is the float available when all the other activities start as early as possible. It is defined as the early event time E_j of the following node minus early event time E_i of the preceding node minus the duration of the activity identified by these nodes:

$$FF_{ij} = ES_j - ES_i - D_{ij}.$$

Free float is the maximum delay an activity will stand if the float on the succeeding activities is not to be affected. It is mainly used to identify the activities that can be delayed without affecting the total float on the succeeding activities. In table 3.2, $FF_{1,2} = 8-0-8 = 0$; $FF_{2,8} = 18-8-5 = 5$.

- (iii) Independent float.

(IF): It identifies the activities event if delayed, will not affect the total float of either the preceding or the succeeding activities.

$$IF_{ij} = ES_j - LC_i - D_{ij}$$

Always $IF - FF = TF$

- (iv) Safety float:

It has already been noted that there are network activities with very low floats. Such activities form the subcritical path. The float associated to them is critical. Floats associated to these are called safety floats.

Note that whenever an activity has zero total float, there is also zero free float and zero independent float.

Activity	Duration	Start		Finish		Floats		
i,j	D_{ij}	ES_i	LS_{ij}	EC_{ij}	LC_j	TF_{ij}	FF_{ij}	IF_{ij}
1,2	8	0	5	8	13	5	0	0
1,3	10	0	0	10	10	0	0	0
1,11	20	0	10	20	30	10	10	10
2,8	5	8	13	13	18	5	5	0
3,7	6	10	11	16	17	1	0	0
3,8	8	10	10	18	18	0	0	0
7,8	1	16	17	17	18	1	1	0
7,11	10	16	20	26	30	4	4	1
8,11	12	18	18	30	30	0	0	0

Table 3.2 Activity floats.

Project Scheduling:

The preceding discussions have dealt rather adequately with planning using the critical path method. It has been noted that a project plan establishes the duration of the project, the resources required to accomplish each activity, and the logical sequence of performance of activities. This however is not enough and on its own serve very little purpose. It has to be supplemented with a project schedule. A project schedule gives the start and finish time of each activity. This is achieved by considering and allocating the available resources up to the limit of availability, according to the requirements given by the plan.

R.L. Martino states that although planning and scheduling are complimentary, they should be treated separately. He cites CPM as the best planning and scheduling technique because, unlike others, it enables the two to be considered separately. According to him,

a plan is a model of a job to be done. It represents an ideal approach. When the plan is scheduled we find out whether it is feasible or not. Scheduling tests the plan against reality: where the plan fails to meet the test of practicality, it must be revised. Basically the plan represents a universal approach applicable for any number of workers. ¹⁴

He continues to state that "the schedule represents an approach which is specific for a particular situation. It fixes the activities' time".

From the above considerations, it is evident that criticality in a project can not be completely defined until the resources available have been allocated and the project schedule determined. A project is critical if it has been scheduled; i.e. it has no schedule float.

Resources are normally scarce and this makes the task of judiciously allocating them within time limits tricky. Be that as it may, it is important to note that unnecessary peaks should be avoided as much as possible. It is desirable to have a gradual buildup of resources until a single peak is reached, preferably at the end of the project. The process of assigning resources in the most efficient manner is called levelling.

It is accomplished by taking advantage of the fact that there is often a difference when an activity may start. This variation is called total float and is the most important element in scheduling.

Before total float and its importance in levelling is discussed, it is important to note types of levelling first. Reference again is made to R.L. Martino.¹⁵ He states that there are basically three types of levelling: variable, fixed and combined.

- (i) Variable levelling can best be illustrated by a manpower example. There is a project which requires utilization of plumbers. There is no problem in recruiting them. But the available schedule shows demand fluctuating from 5 on the first day to 20 the next day and 10 the subsequent one. (See figure 3.9). Bringing them in and out of the project is both costly and inefficient. Furthermore, insecurity is created in the minds of the men and consequently labour costs rise, making peak periods difficult to meet. Some of the reliable ones can in the process be lost to employers offering higher wages and security. The best approach in this case is to

start with a constant number and build it up until the peak of the project and then gradually lay off the unwanted ones. (See figure 3.10)

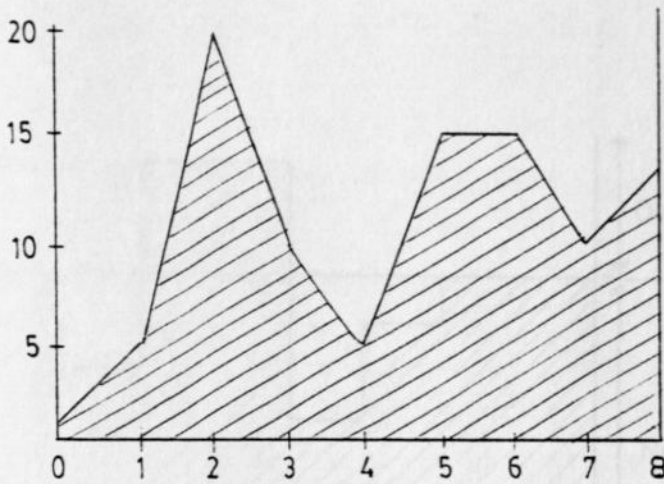


Figure 3.9 : Unleveled work force

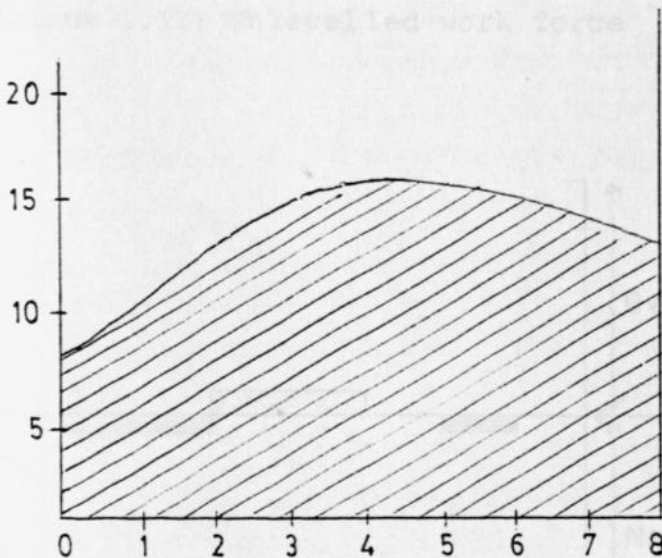


Figure 3.10: Levelled work force

(ii) Fixed levelling arise when there is a fixed number of workers available. The common way of coping up in cases of peak period is the utilization of over-time facility. In cases of low amount of work, some workers are put on stand-by list. This situation where it exists is both costly and inefficient.

The best approach is to establish an optimum fixed number and then schedule them in such a way that they are productively assigned most of the time. See figure 3.11 and 3.12

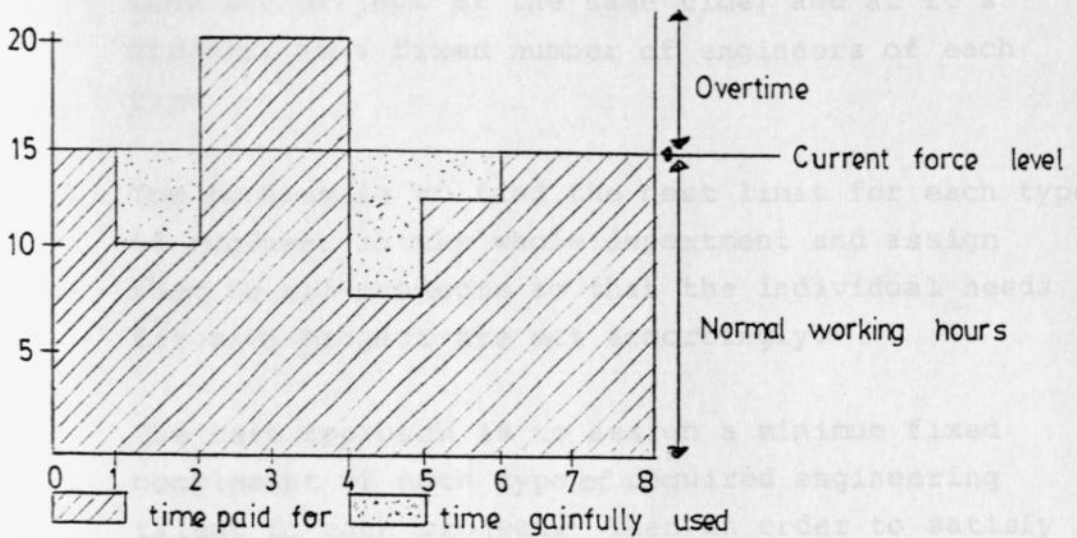


Figure 3.11: Unlevelled work force

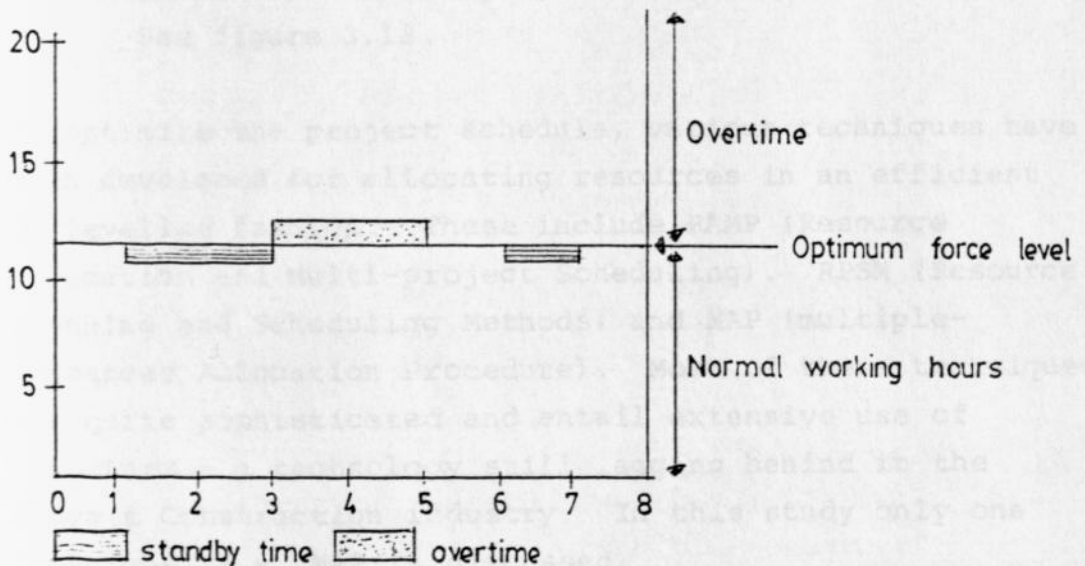


Figure 3.12: Levelled work force

- (iii) Combined Levelling is the best approach. It combines both varied and fixed levelling. To illustrate this point, Martino cites an example of an engineering design firm. Within it is a department, he says, normally engaged in more than one project at the same time; and at its disposal is a fixed number of engineers of each type.

The problem is to find the best limit for each type of engineer in the whole department and assign them to all projects so that the individual needs for each project are met accordingly.

The best approach is to assign a minimum fixed complement of each type of required engineering talent to each project. Then in order to satisfy increasing needs, a variable complement should be assigned to each project. At the same time, however, the limit of each type of engineer available for all projects should not be exceeded. See figure 3.13.

To optimize the project schedule, various techniques have been developed for allocating resources in an efficient or levelled fashion. These include RAMP (Resource Allocation and Multi-project Scheduling), RPSM (Resource Planning and Scheduling Methods) and MAP (multiple-resources Allocation Procedure). Most of these techniques are quite sophisticated and entail extensive use of computers - a technology still lagging behind in the Kenya's Construction industry. In this study only one technique, i.e. MAP is discussed.

MAP is applicable to both single and multiple projects simultaneously. The resources may be fixed, varied or combined; it does not matter as the technique has no limit in applicability to the number of resource types

or number of activities that can be handled.

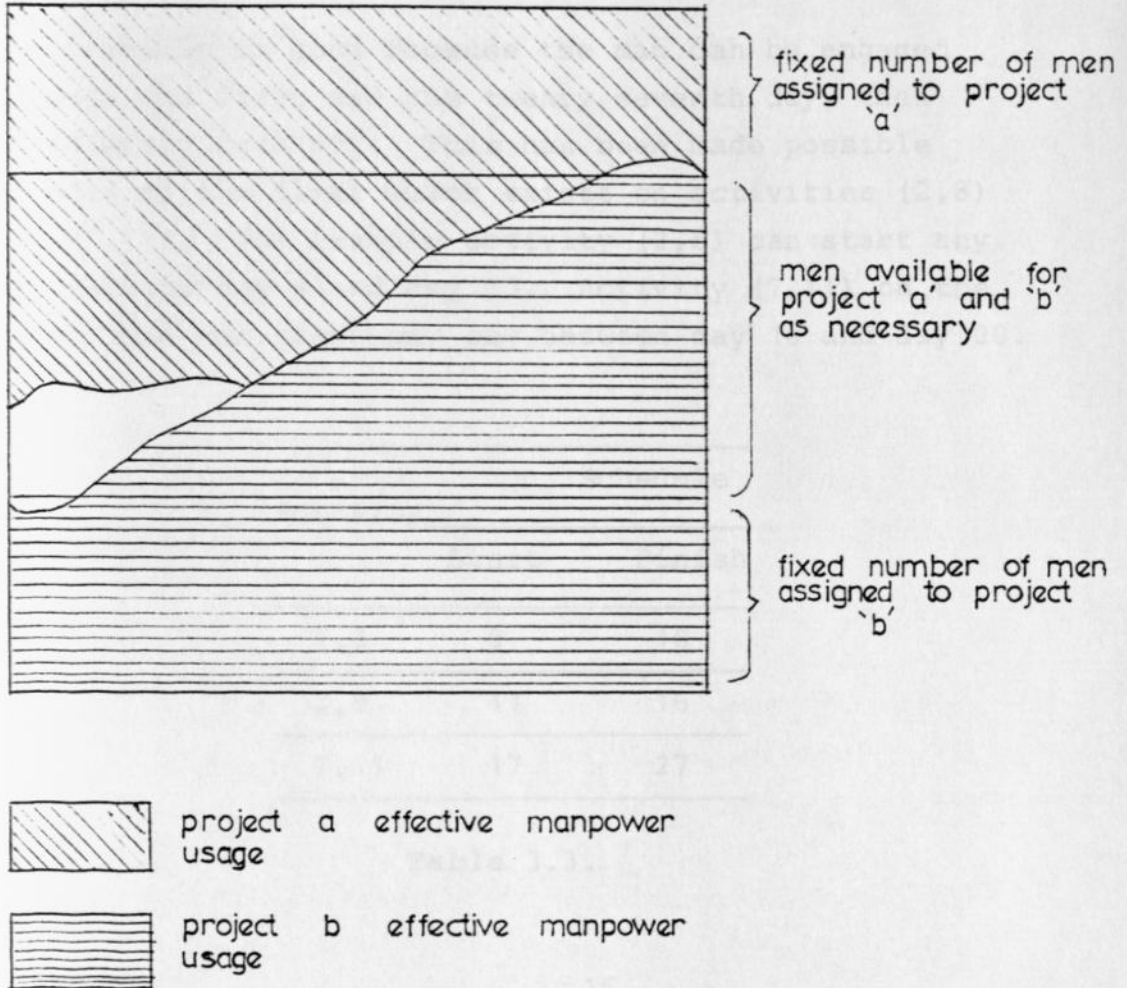


Figure 3.13 combined levelling

MAP schedules starting time for every activity basing on the resources required and resources available. In scheduling priority is given to the most critical activities, and then float is used to schedule the remaining activities with maximum efficiency.

To illustrate the MAP concept, reference is made to figure 3.7. Activities (1,3), (3,8) and (8,11) are critical. Other activities are noncritical and bear floats of varying magnitude. Supposing activities (1,3), (2,8) and (7,11) share the same man. They can be leveled to achieve efficiency as in table 3.3.

The schedule is good because the man can be engaged between the first and the twenty seventh day, then immediately laid off. This has been made possible because of the float which exists on activities (2,8) and (7,11). For example activity (2,8) can start any day between day 8 and day 13. Activity (7,11) on the other hand can start any day between day 16 and day 20.

Activity	Schedule	
	Start	Finish
1,3	0	10
2,8	11	16
7,11	17	27

Table 3.3.

Another example of optimization¹⁶ is illustrated by figure 3.14. The plan is for an 11 day project and the critical path consists of activities (1,2), (2,3) and (3,5).

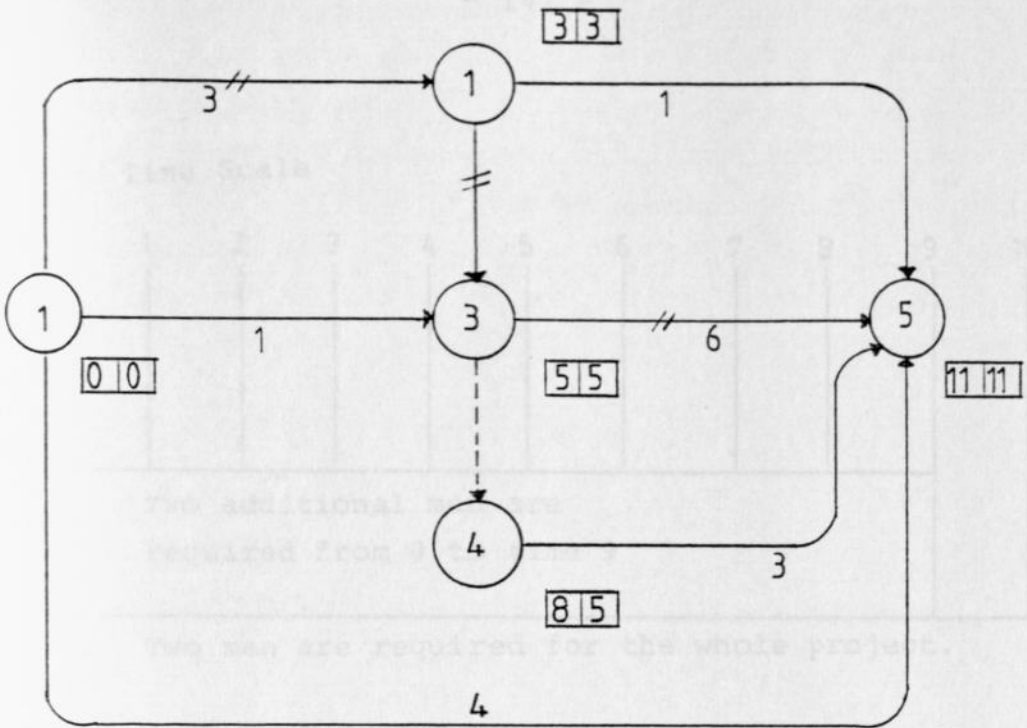


Figure 3.14 Project network

Supposing in the project illustrated by figure 3.14 the limitations are as follows:

- (i) each job require two men.
- (ii) there are only two men.

Assume the project manager is willing to hire two men provided the project can be completed in 11 days.

Scheduling can be done as follows

- (i) Two men for all critical jobs
- (ii) Two men for all noncritical jobs.

In this case two additional men are required for only 9 days, not 11. The resource requirements are shown on figure 3.15. It depicts an efficient use of manpower because the curve rises smoothly to the peak rather than fluctuating throughout the course of the project.

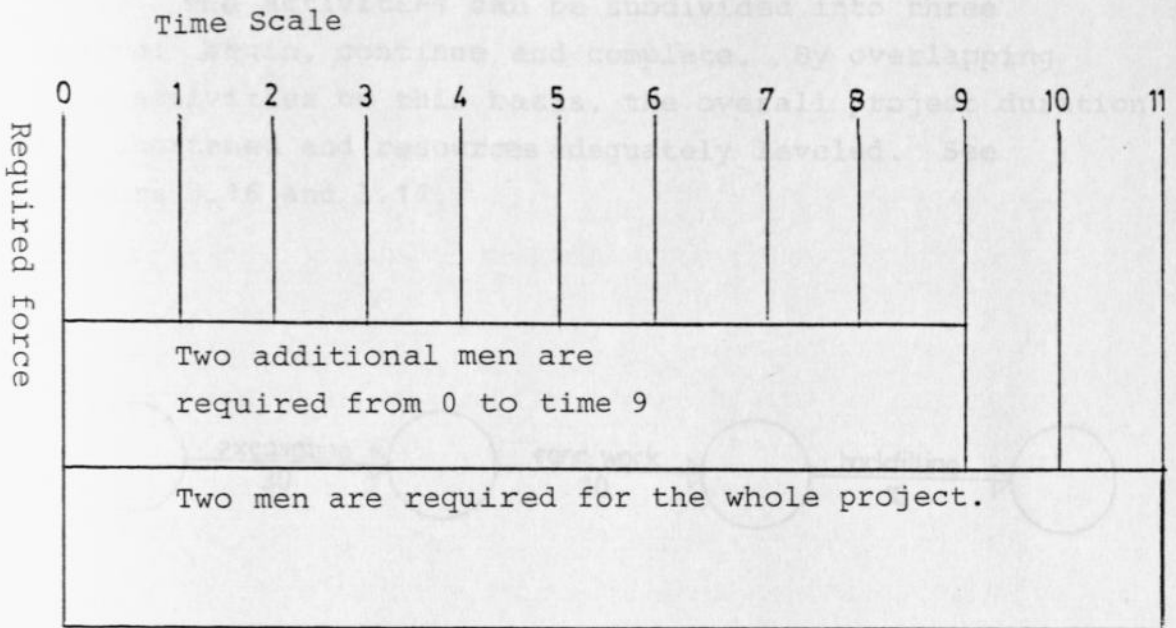


Figure 3.15 - Resource levelling using MAP.¹⁷

Activity size

Before discussions on scheduling are ended it is important to note that activity sizes should in all cases be appropriately determined. Infact the superiority of the plan lies in this. Big activities pose a problem of duration estimation. H.N. Ahuja¹⁸ notes that the factors which influence the criteria of determining the size of activity include the use for which a network is intended, the knowledge that the planners have of the project experience of the planners in similar construction, and the overlap desired in activities.

Where an activity depends on the preceding one, it is important to establish whether the relationship

is based on partial completion, the activity can be subdivided into parts and scheduled in such a fashion as to have both activities overlapping at certain intervals. The activities can be subdivided into three parts: begin, continue and complete. By overlapping sub-activities on this basis, the overall project duration is shortened and resources adequately leveled. See figure 3.16 and 3.17.

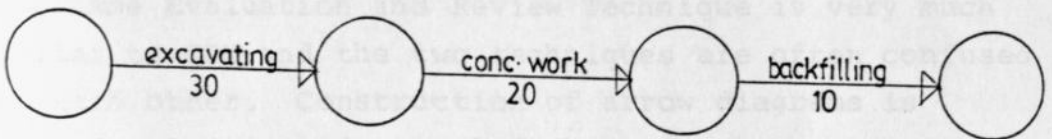


Figure 3.16 - Full activity network

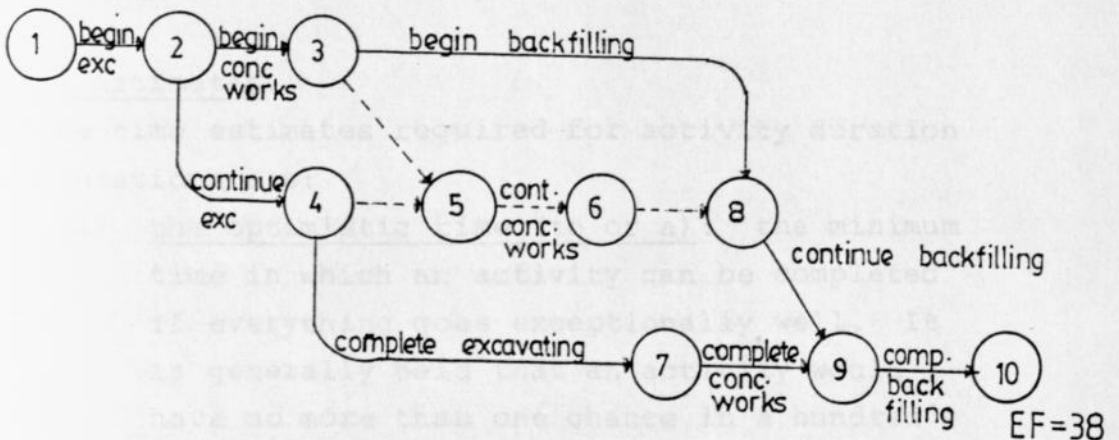


Figure 3.17 Sub-divided activity Network.

Programme Evaluation and Review Technique (PERT)

The history of PERT dates back to 1957 when the U.S.A. Navy's special project office was confronted with a project consisting 60,000 activities. This was the POLARIS Programme in which 3,800 major contractors had to be integrated and coordinated. PERT was specifically developed to meet this requirement. It enabled the management not only to know what was required and who was to do it, but also the probability of completing the activity in time.¹⁹

Programme Evaluation and Review Technique is very much similar to CPM and the two techniques are often confused for each other. Construction of arrow diagrams is carried out in an identical fashion for both methods. The difference is only apparent in the estimation of activity durations. CPM uses only one time estimate, while PERT uses three time estimates.

PERT enables the project manager to reduce the uncertainties associated with activity duration estimation by considering both the optimistic and the pessimistic time possibilities.

Time estimates.

Three time estimates required for activity duration computations are:

- (i) the optimistic time (to or a): the minimum time in which an activity can be completed if everything goes exceptionally well. It is generally held that an activity would have no more than one chance in a hundred of being completed within this time.

- (ii) the most likely time (time or M): this is the realistic estimate of the time an activity might take. It is the time expected to occur more frequently if the activity is repeated several times under the same conditions.
- (iii) the pessimistic time (tp or b): is the maximum time an activity can take under adverse conditions. It is generally held that an activity would have no more than one chance in a hundred of exceeding this amount of time.
- (iv) the expected time (te): is calculated from the three time estimates described above. It is an expression of likelihood and can lie anywhere between the optimistic and the pessimistic time. A word of caution about this is that te is not necessarily a mean of the two times, a and b, and should never be assumed to lie between them. It can however be expressed in terms of statistical probability and the distribution curves representing the frequency of occurrence of various durations if the activities were to be performed a large number of times.

PERT involves the five calculations:

- (i) the expected time (te)
- (ii) the critical path, project duration (TE) and floats
- (iii) the variance ($\sigma^2 te^2$)
- (iv) the standard deviation (σTE)
- (v) the probability of completing the project within the scheduled time [P(TE)]

- (i) The expected time, te.

The first step in the determination of te is to assume a beta distribution curve as shown below.

The calculations of the activity duration as weighted averages of the three times are made. The mid point of a and b is given half the weight of the most likely value.

$$te = \frac{\frac{1}{2}(a+b) + 2m}{3} = \frac{a+b+4m}{6} \text{ which is the formula}$$

for calculating expected duration, usually called expected elapsed time.

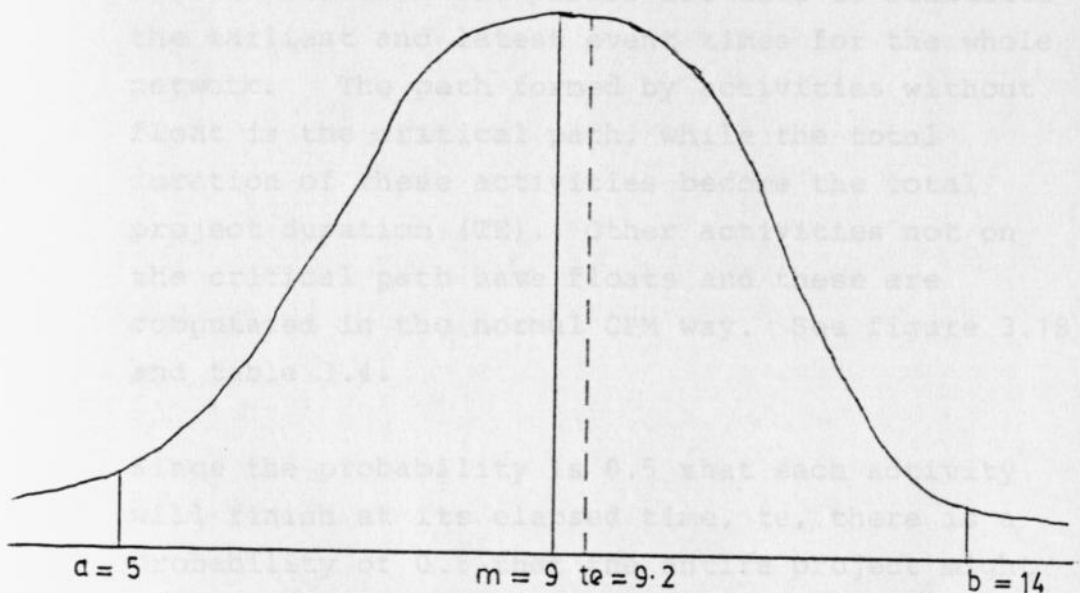


Figure 3.18: A beta distribution curve

For example, if an activity has three time estimates as follows: a = 5

$$m = 9$$

$$b = 14$$

$$te = \frac{5+36+14}{6} = 9.166 \approx 9.2$$

The point 9.2 is the one where the area of the beta curve is divided into two equal parts. It represents a point at which there is a 50-50 chance that the actual activity completion will be earlier or later than te.

Points to note are that when $t_e = m$, it means that the person making the estimate is pessimistic; but when it is vice versa as in the example above, it means he is optimistic.

(ii) The critical path, project duration and floats

Once expected durations for all project activities have been calculated, the procedure for determining the critical path, the project duration (TE) and the floats is similar to the one used in CPM. Forward and backward passes are used to calculate the earliest and latest event times for the whole network. The path formed by activities without float is the critical path, while the total duration of these activities become the total project duration (TE). Other activities not on the critical path have floats and these are computed in the normal CPM way. See figure 3.18 and table 3.4.

Since the probability is 0.5 that each activity will finish at its elapsed time, t_e , there is a probability of 0.5 that the entire project might be completed at time TE. However, the expected project duration times do not follow a beta curve as the project activities. Assuming that the project is executed a large number of times, the resulting population of project durations will approximate a normal distribution; hence the expected project durations may be assumed normally distributed.

<u>Event</u>	<u>Path</u>	<u>Teij</u>	<u>Vij</u>
1	(1,3)	10.2	1.4
2	(1,3,8)	17.4	2.4
3	(1,3,11)	29.6	3.8
		TE=29.6	V _T =3.8

Table 3.5: Total duration and variance.

- (iii) Variance (te): It is a measure of dispersion between the three activity durations.

$$te = \frac{[(b-a)^2]}{6} \quad \text{See table 3.4 and 3.5.}$$

The variance describes the uncertainty associated with large estimates (e.g., when optimistic and pessimistic estimates are far apart), there is great uncertainty. In the example illustrated by figure 3.20, the variance is only 3.8. This indicates a higher amount of certainty about project completion date.

- (iv) The standard deviation (6). In simple mathematical terms, the standard deviation is a square root of the variance. Symbolically expressed thus:

$$TE = \sqrt{\sum 6te^2} = \sqrt{\sum (p-a)^2}$$

In project management, this is important in estimating the amount of uncertainty associated with a project i.e. the probability of completing the project within the scheduled duration.

Normally the TE arrived at through the three time estimates computations does not agree with the scheduled date Ts. To establish the probability of T_E occurring at Ts demands consideration of the standard deviation of the normal distribution curve. Where the standard deviation is high,

it means the probability that $TE \neq Ts$ is high.

In the project above $\sigma T_E^2 = 3.8$, therefore $T_E = \sqrt{3.8} = 1.9$, which is a high standard deviation.

- (v) The probability. t [p(TE)]:- The probability of completing the project within scheduled time can be expressed both qualitatively and quantitatively, although the later is normally preferred.

In PERT, before probability is calculated, assumptions that the Central Limit theorem holds i.e. that T will be normally distributed with mean TE and variance TE^2 irrespective of the distribution of each activity duration, and that the actual project completion time will occur on the critical path, should be made. The probability (Pr) of completing a project within the scheduled time can then be calculated using the formular.

$$\frac{Pr(Z < \frac{Ts - TE}{TE})}{TE}$$

Using the example above and assuming $TE = 32$, then

$$\frac{Pr(Z < \frac{32 - 29.6}{1.9})}{1.9}$$

1.9

$$\frac{Pr(Z < 1.263)}{1.263}$$

$$\frac{Pr(Z < 1.263)}{1.263} = 0.90 \text{ or } 90\%.$$

The example indicates that the project stands a 90 per cent chance of being completed within the expected time of 32 days.

These calculations can be extended further to say, determining the probability of completing a project within a span of two time schedules, for example

TS - 26 days at the lower level and 32 days at the higher level. See figure 3.20.

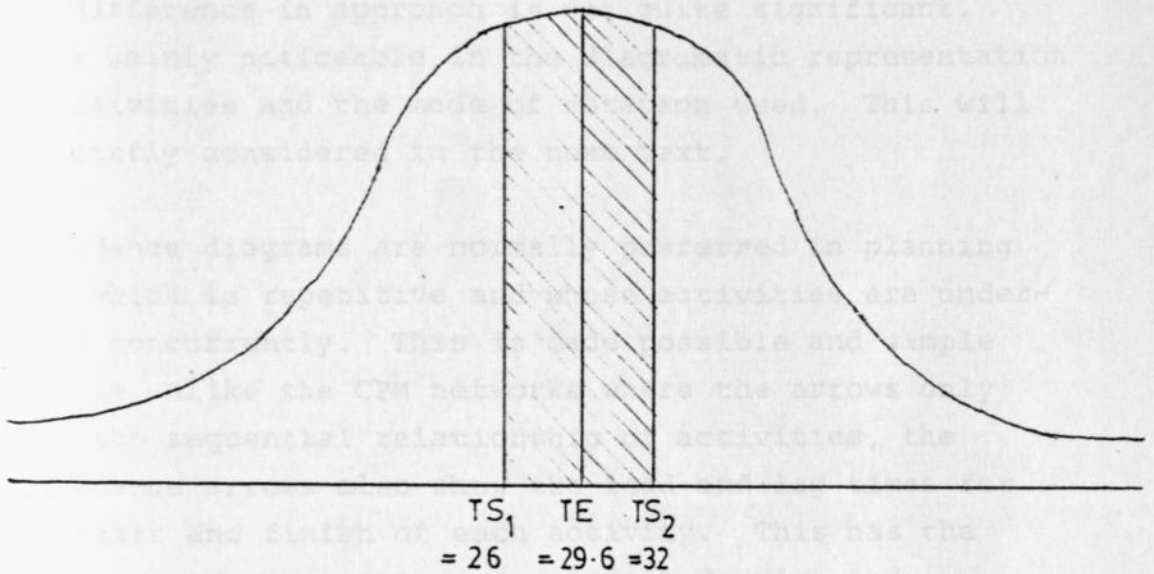


Figure 3.20. Normal distribution curve.

The calculations can be done as follows:

$$\begin{aligned}
 & \Pr (26 \leq T_s \leq 32) \\
 &= \Pr \left(\frac{26-29.6}{1.9} \leq Z \leq \frac{32-29.6}{1.9} \right) \\
 &= \Pr \left(\frac{-3.6}{1.9} \leq Z \leq \frac{2.4}{1.9} \right) \\
 &= \Pr (-1.895 \leq Z \leq 1.263) \\
 & \quad \Pr (Z \leq 1.263) = 0.8962 \\
 & \quad \Pr (Z \leq -1.895) = 0.0294 \\
 & \therefore \Pr (-1.896 \leq Z \leq 1.263) \\
 &= 0.8962 - 0.0294 \\
 &= 0.8668 \\
 & \approx 0.87 \text{ or } 87\%
 \end{aligned}$$

Therefore the probability of the project being completed within the two time schedule is 87 per cent.

The Precedence Networks

The technique was developed by I.B.M. in 1963 primarily to remedy the defects inherent in the CPM networks.²¹ The difference in approach is not quite significant. It is mainly noticeable in the diagrammatic representation of activities and the mode of notation used. This will be briefly considered in the next text.

Precedence diagrams are normally preferred in planning work which is repetitive and whose activities are undertaken concurrently. This is made possible and simple because unlike the CPM networks where the arrows only show the sequential relationship of activities, the precedence arrows also show the lead and lag times for the start and finish of each activity. This has the advantage of eliminating unnecessary dummies and simplifying the network.

The lead and lag factors are indicated by pairs of subscripts, the first representing the preceding activity and the second representing the following activity, as below:

F_{ij} = lag time for a finish-to-finish relationship, i.e. the succeeding activity finishes this amount of time after the completion of the preceding activity.

S_{ij} = Lead time for a start-to-start relationship. (The preceding activity starts this much earlier than the succeeding activity).

C_{ij} = Lag time for a finish-to-start relationship. (The succeeding activity starts this amount of time after the completion of the preceding activity).

Questions to guide in the development of logic can be asked as follows:-²²

- (i) for the preceding activities:
 - (a) which activities must be finished before this activity may begin? What is the time delay? (Finish to start).
 - (b) which activities must be started before this may begin? What is the lead time? (start to start).
 - (c) which activities must be finished before the activity may be completed. What is the time lag? (Finish to finish).
- (ii) for succeeding activities:
 - (a) which activities must begin after the finish of the activity? What is the time delay? (Finish to start).
 - (b) which activities must begin after the start of this activity? What is the lead time? (start to start).
 - (c) which activities must be completed after the finish of this activity? What is the time lag? (Finish to finish).
- (iii) for concurrent activities:
 - (a) which activities are carried out at the same time?

Notations and Computations in carrying out notations for precedence diagram, identification appears in the left end of each rectangle, followed by the start times - earliest and latest at the top and bottom respectively, the description in the centre, the duration next, and finally the finish times - earliest and latest at the bottom respectively.

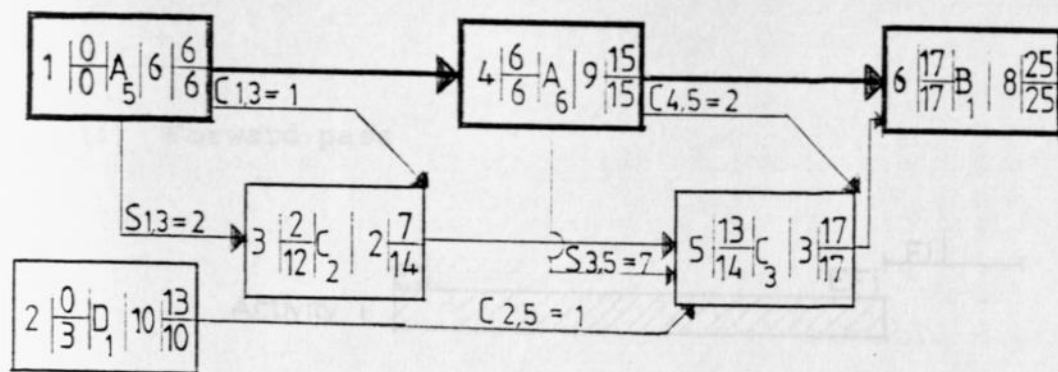


Figure 3.21 - Precedence diagram.

Computation of the activity times and the critical path are based on the forward and backward passes as in CPM. The activity being evaluated always has the j subscript in the forward pass, while its predecessors, the i subscript. In the backward pass, the predecessors and successors have j and k subscripts respectively.

The following equations show the necessary computations:

$$ES_j = ES_i + S_{ij} \text{ or } EF_i + C_{ij} - \text{whichever is greater.}$$

or $EF_j - D_j$ if the F_{ij} relationship exists.

$$EF_j = EF_i + F_{ij} \text{ or } ES_j + D_j - \text{whichever is greater.}$$

$$LF_j = LF_k - F_{jk} \text{ or } LS_k - C_{jk} - \text{whichever is smaller.}$$

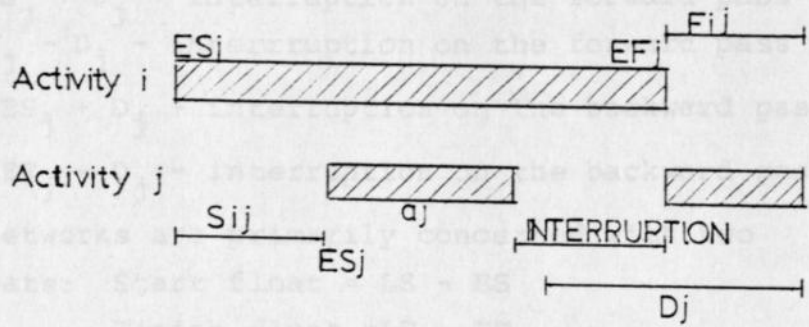
or $LS_j + D_j$ if only S_{jk} relationship exists.

$$LS_j = LS_k - F_{jk} \text{ or } LF_j - D_j - \text{whichever is smaller.}$$

Generally $EF - ES$ and $LF - LS$ do not necessarily equal the duration of the activity, implying an interruption.

This can occur in two ways: on the forward pass and on the backward pass. These concepts bring differences when CPM and precedence activity times are being compared.

(i) Forward pass

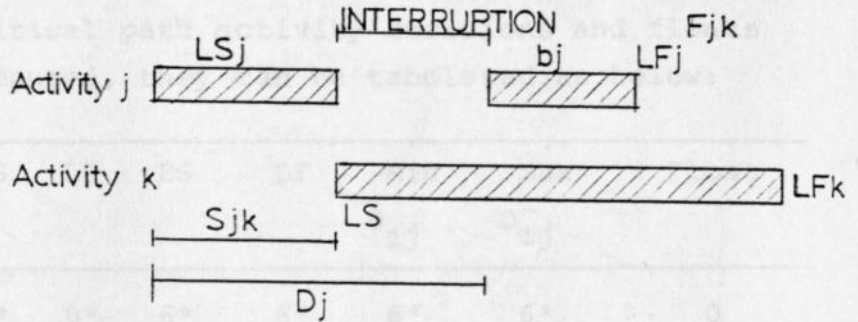


$$a_j = D_j - F_{ij}$$

$$\text{INTERRUPTION} \quad EF_i - ES_j - D_j$$

STARTED AT ES

(ii) backward pass



$$b_j = D_j - S_{jk}$$

$$\text{INTERRUPTION} \quad LF_j - LS_j - D_j$$

STARTED AT LS

Figure 3,22 - Interruption in activity duration⁸

The activity times for interrupted activities can be shown as follows:

$$EF_j - ES_j = D_j + \text{interruption on the forward pass}$$

$$LF_j - LS_j = D_j + \text{interruption on the backward pass}$$

$$EF_j = ES_j + D_j + \text{interruption on the forward pass}$$

$$ES_j = EF_j - D_j - \text{interruption on the forward pass}$$

$$LF_j = ES_j + D_j + \text{interruption on the backward pass}$$

$$LS_j = EF_j - D_j - \text{interruption on the backward pass}$$

Precedence networks are primarily concerned with two types of floats: Start float = $LS - ES$

$$\text{Finish float} = LF - EF$$

Like in CPM, all critical activities have no float i.e. $ES = LS$, also $EF = LF$. The critical path itself is indicated by marking the arrows as well as the activities it joins with double or heavy lines.

After the critical path activity durations and floats have been computed, they can be tabulated as below:

Activity	ES	LS	ES	LF	Min D_{ij}	Max D_{ij}	Float
1	0*	0*	6*	6*	6*	6*	0
2	0	3	10	13	10	13	3
3	2	12	7	14	2	12	10
4	6*	6*	15*	15*	9*	9*	0
5	13	14	17	17	3	4	1
6	17*	17*	25*	25*	8*	8*	0

* indicate values of activities that are on the critical path

Table 3. 5: Activity durations and floats.

Value of the Precedence Networks. It should be noted here that the use of precedence networks has three distinct advantages over the other forms of networks:

- it eliminates unnecessary use of dummies and thus simplifies the diagram. The input in terms of drawing and information is greatly reduced. This minimizes the chances of committing errors.
- standard coding can be utilized and this makes activity identification relatively easier. The coding system can be designed to identify the activity by aspect of the job, financial source and level, particular people or department involved, etc.
- the time lead and lag factors are also clearly shown in the precedence networks, making it easier for the planner to understand and model his project successfully. This however increases the involvement in activity time computations.²³

Graphical Evaluation Review Technique (GERT)

In the preceding discussions, four planning techniques, i.e. Bar charts, CPM, Precedence diagrams and PERT have already been reviewed. It has been noted that the first three techniques use only "one time estimate" and should be preferred for planning purposes on projects whose activity durations are deterministic. The fourth one on the other hand uses "three time estimates" and should be preferred on projects whose activity durations are probabilistic. One common feature in all these techniques is that all preceding activities must be completed before a node (an event) is finally reached or realised. This means that no succeeding activity can be depicted on the networks as commencing before

all the preceding activities entering the node (the j node) have been completed.

There are situations however where the realisation of a node is dependent upon the completion of not all, but one or more activities preceding this node and where both deterministic and probabilistic estimates of activity durations are necessary. In such cases, the use of the Graphical Evaluation Review Technique is preferable.

GERT is a relatively recent and more sophisticated approach to project planning and not many people, especially in the building construction industry, have made satisfactory acquaintance with it. As a matter of fact, it is only necessary on complex projects such as marine and airspace projects, where a number of variables are indeterministic.²⁴

The involvement of the Kenyan Government in such projects is to say the least, very limited. It is for this reason that the study does not consider it important to dwell in detail on the technique. If anything, the study only wishes to draw the attention of project planners to the existence of this technique, more or less for information purposes.

GERT is a technique that combines the disciplines of flow graph theory, moment generating functions, and PERT to obtain a solution to stochastic problems. It is claimed that its procedure makes it possible to analyse complex systems and problems in a less inductive manner than ever before.²⁵

The background for the development of GERT lies in the area of stochastic networks. A stochastic network has

the following properties:

- (i) each network consist of nodes that denote logical operations and transmittance.
- (ii) a transmittance has associated with it a probability that the activity represented by it in the network will be performed.
- (iii) other parameters describe activities that the transmittance represent.
- (iv) a realisation of a network is the realisation of a particular set of transmittances and nodes that describe the network for one experiment.
- (v) if time associated with a transmittance is a random variable, then a realisation also implies that a fixed time has been selected for each transmittance.

The properties listed above can best be understood when one looks at the GERT network model. The model completely differ from others discussed because it incorporates both deterministic and prababilistic nodes whose identification require special nodes. Another peculiarity lies in the use of loops which may start from any node and be incident to any previous one.

Nodes: Like in the other networks discussed, the nodes depict events - either the start or the end of an activity. The major difference however lies in the realisation of nodes. In the normal networks like CPM, PERT and PD, nodes are realised when all preceding activities are completed. This however is not so with the GERT technique. Here a node is realised when the prespecified number of releases associated with it are performed. The releases generally specify the number of times activities incident to the node must be performed before the node can be realised. For example, if the

number of releases is one, and there are five activities incident to the node, the node is realised when either the first, second, third, fourth or fifth activity is realised. If the number of releases is four and there are five activities incident to the node, the node is realised when any four out of five activities are realised.

Information required for each node is recorded as shown in figure 3.23 (i - iv). The semicircular shape represents the deterministic output as shown in Figure 3.23 (ii) and (iii). The probability for such output branches is 1.00. Information regarding incident branches is entered in the two segments on the input side. The upper segment shows the number of releases, that is the number of activities that should be done before this node can be completed. The lower segment shows the number of releases to repeat, i.e. the number of times the completion of such branches is required for any subsequent realisation of the node.

Figure 3.23 (iv - vi) show nodes with probabilistic outputs. This is illustrated on the diagrams by the probabilities of the activities D (P_d) and E(P_e) being shown as less than 1.00.

Two types of nodes have already been noted. Others can be noted as: the source node, the sink node, the mark node and the statistics node.

The source is found at the very beginning of a network and bears zero time duration. It does not have any branch incident to it.

The sink node on the other hand is the terminal node and does not have any branches (activities) emanating from it, and the network may be realised when one, any,

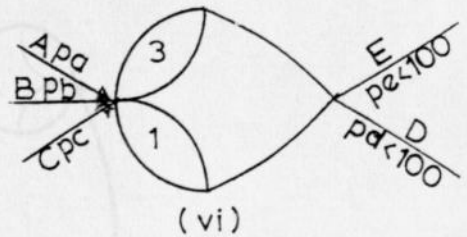
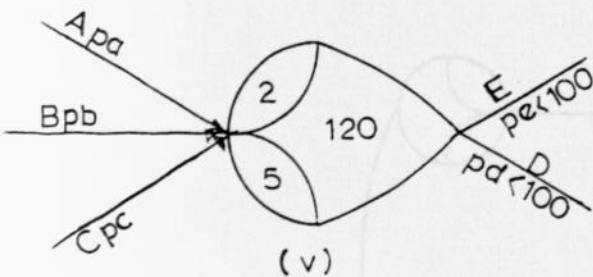
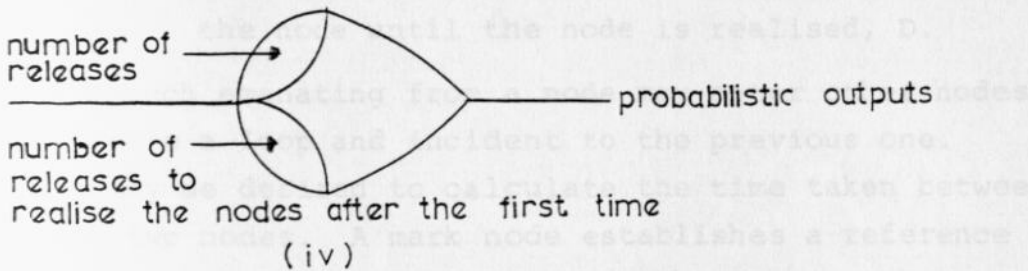
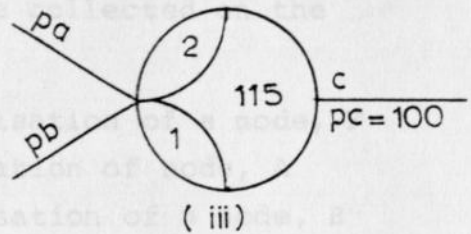
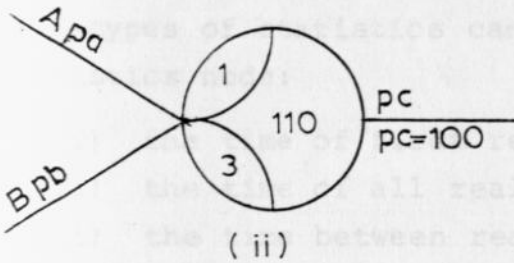
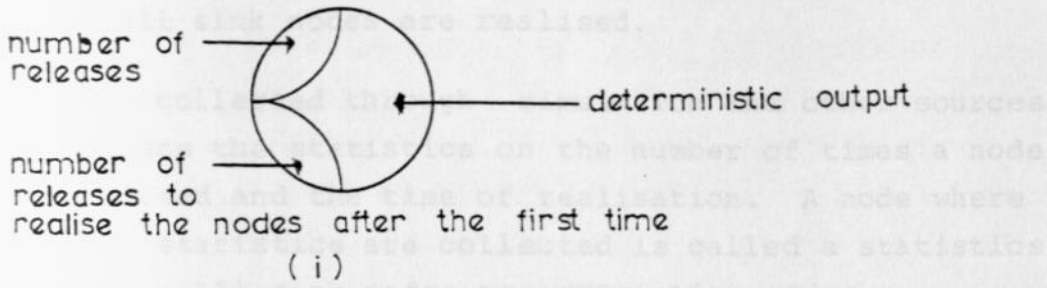


Figure 3.23. Deterministic and Probabilistic nodes.

(H.N. Ahuja, Construction Performance by networks, P.107)

or all sink nodes are realised.

Data collected through simulation and other sources include the statistics on the number of times a node is realised and the time of realisation. A node where such statistics are collected is called a statistics node. All sink nodes are statistics nodes.

Five types of statistics can be collected on the statistics node:

- (i) the time of first realisation of a node, F
- (ii) the time of all realisation of node, A
- (iii) the time between realisation of a node, B
- (iv) the time interval required to go between two nodes in the network, I
- (v) the time delay from first activity completion on the node until the node is realised, D.

A branch emanating from a node may enter other nodes or form a loop and incident to the previous one. It may be desired to calculate the time taken between the two nodes. A mark node establishes a reference time and permits the calculation of the time it takes to go from a mark node to a statistics node of the network.

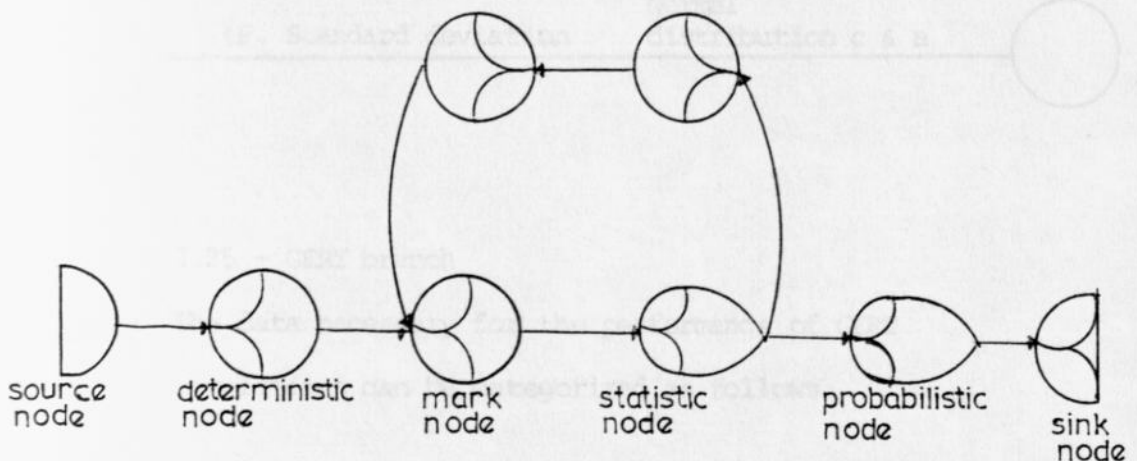


Figure 3.24 - Types of GERT nodes.

Branches: these are the equivalent of activities in ordinary networks. Each branch (activity) is associated with a probability that it will be completed or realised given that its start node is realised. Activity numbers are placed on activities to permit network modifications based on the realisation of the activity and to distinguish activities having the same start and end nodes. Network modifications involves the replacing of one node by another node to alter either temporarily or permanently the network logic.

Thus an activity (branch) in GERT networks is completely described as shown in figure 3.25.

- (i) Probability of realisation, P
- (ii) Parameter set for time, tp
- (iii) Distribution type, td
- (iv) Counter type, c
- (v) Activity number, a

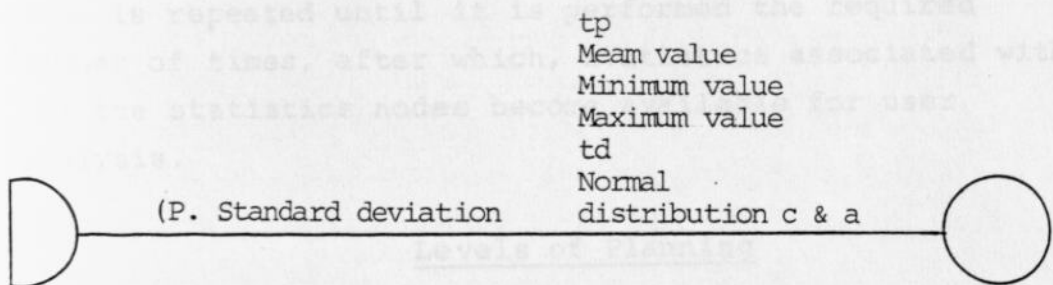


Figure 3.25 - GERT branch

Data: The data necessary for the performance of GERT simulations can be categorized as follows:

- (i) data relating to network: Project identification, number and type of nodes, identification of source sink, statistics and mark nodes, number of activities, number of times simulation is to be performed, random number seed, and network modification data.
- (ii) data relating to nodes: the number of releases required to realise a node for the first time and subsequently, output type, histogram characteristics and the type of statistical information to be collected.
- (iii) data relating to branches: parameters of time variables associated with activities, probability of realisation and distribution type.

Using the above listed data, GERT performs simulation of network by passing from event to event. This is done until appropriate sink nodes are realised. The simulation is repeated until it is performed the required number of times, after which, statistics associated with all the statistics nodes become available for user analysis.

Levels of Planning

So far, various planning techniques which can be utilised by a planner have been discussed. The choice of the appropriate one is the discretion of the planner or project manager; depending on the type of information he would like to display and also, on how familiar he is with the manipulation of each of the techniques.

The point which should be emphasized is that efficiency in planning can only be achieved if all pertinent

information is available to the planner or project manager. Normally most projects are started off with very little information, but more details are gathered as the project moves from one planning level to the next one. To facilitate this, it is important that the planner must define the different parts of the project. This helps in making clearer the project objectives and also breaking the total project effort into convenient sub-categories for purposes of network planning, assigning responsibilities, matching accounting systems to planning systems and for establishing a framework for reporting and control. This process is called establishing a work breakdown structure.

Work Breakdown Structure

A work breakdown structure is a framework for planning arrived at by breaking the overall project work to be done into convenient segments or levels. Simple projects could have only four; i.e. the project, the sub-projects, the work packages and the activities.²⁶

A sub-project is larger than both the work package and the activity. It is the first level of breakdown from the entire project in the total work breakdown structure. It is made of inter-related activities relatively independent from the next of the project and can be planned alone.

For each sub-project, a list of activities can be made and from this a network prepared. In preparing networks for sub-projects, it is important to note the key activities at the beginning and the end of each sub-project network suitable for interfacing purposes.

A work package is similar to a sub-project, but it is of a lower level. It need not be separate from the

rest of the project, although its interconnections should be distinct. Each work package is a cost centre in its own right; with a separate estimate, budget and expenditure account. Work packages are very helpful to the planner, especially when developing the project network. It is much easier to plan one work package at a time and piece the plans together into a project network than to develop a complete network without the work breakdown structure.

Networks for sub-projects and work packages are normally more detailed than the master network. They are usually referred to as sub-networks or fragnets - while the process of piecing them together is known as interfacing.

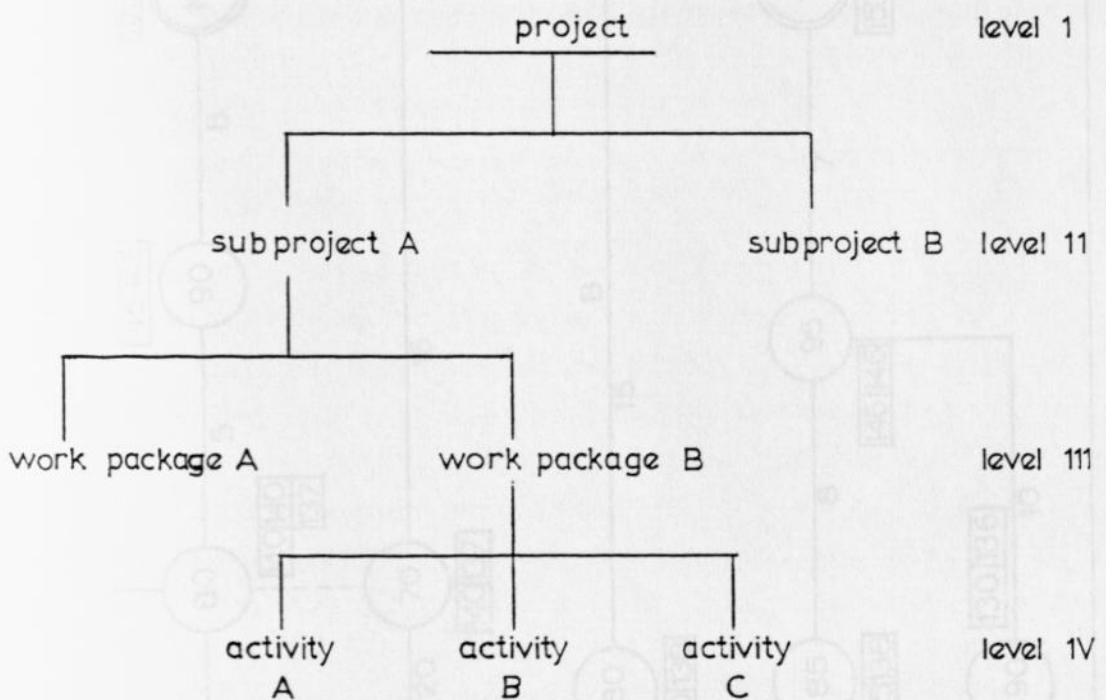


Figure 3.26 - Levels of Planning

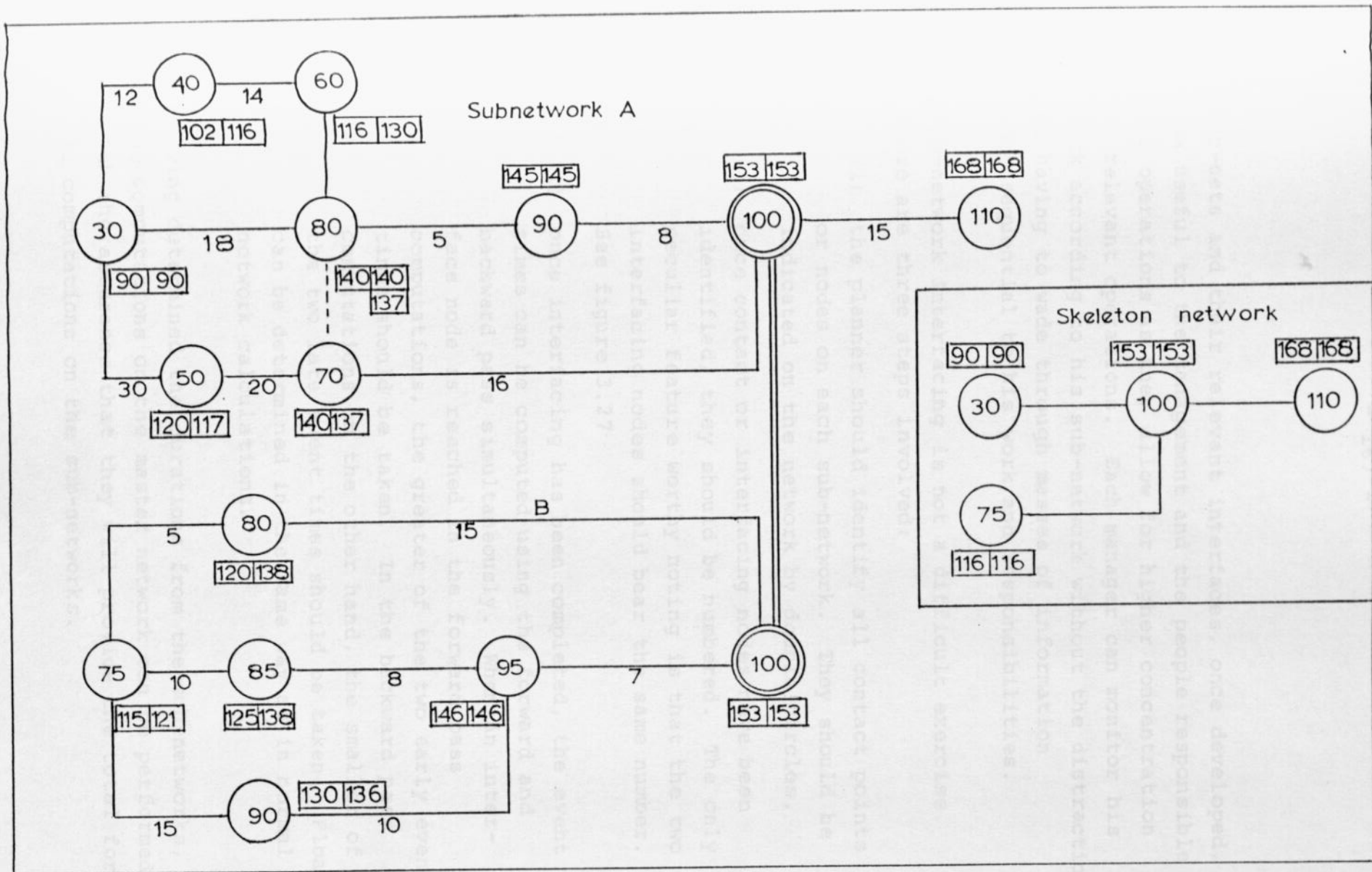


Figure 3.27 - Sub-networks and skelton network.

Sub-nets and their relevant interfaces, once developed, are useful to the management and the people responsible for operations as they allow for higher concentration on relevant operations. Each manager can monitor his work according to his sub-network without the distraction of having to wade through masses of information inconsequential to his work and responsibilities.

Sub-network interfacing is not a difficult exercise. There are three steps involved:

- (i) the planner should identify all contact points or nodes on each sub-network. They should be indicated on the network by double circles.
- (ii) once contact or interfacing nodes have been identified, they should be numbered. The only peculiar feature worthy noting is that the two interfacing nodes should bear the same number. See figure 3.27
- (iii) once interfacing has been completed, the event times can be computed using the forward and backward pass simultaneously. When an interface node is reached in the forward pass computations, the greater of the two early event times should be taken. In the backward pass computations on the other hand, the smaller of the two late event times should be taken. Floats can be determined in the same way as in normal network calculations.

Having determined the durations from the sub-networks, the computations on the master network can be performed with the assurance that they will provide the total for all computations on the sub-networks.

Computers for Planning

The process of identifying interface events and determining durations between the interfaces and important events is called Skeletonization, because the resulting master network is a skeleton of the detailed sub-networks.

It is for this reason that their use has been introduced in the construction industry.

Computer use for planning purposes is only one of the functions it can be put to in the construction industry. Planning is normally a tedious exercise involving many calculations to be carried out. Computers are as handy as they enable the planner to go through computations quickly and also have a chance to test alternative plans.

Computers however on their own have no capability to plan. This responsibility rests entirely on the planner. What the computer does is to facilitate easy planning by carrying out required calculations and displaying and printing the data output.

The procedure used in planning with computers is to a great extent similar to that one used in network systems, as follows:-

- (a) the planner first identifies the project activities and their respective time estimates.
- (b) He then works out a project network using either of the network techniques deemed appropriate. At this point, the most critical factor is to ensure logic.
- (c) the first and second steps are important and guide the planner to the third one, which is identification or development of a suitable programme to carry out the required calculations.

Computers for Planning

Computers generally form part of office equipment used by various organizations to store, calculate, display, sort and retrieve information pertaining to a given situation. Their advantage lies in the fact that they can carry out these operations rapidly and accurately, thus saving users laborious, time consuming work. It is for this reason that their use has been introduced into the construction industry.

Computer use for planning purposes is only one of the many functions it can be put to in the construction industry. Planning is normally a tedious exercise with many calculations to be carried out. Computers come in handy as they enable the planner to go through his computations quickly and also have a chance to evaluate alternative plans.

Computers however on their own have no capability to plan. This responsibility rests entirely on the planner. All that the computer does is to facilitate easy planning by carrying out required calculations and displaying or/and printing the data output.

The procedure used in planning with computers is to a large extent similar to that one used in network systems. It is as follows:-

- (i) the planner first identifies the project activities and their respective time estimates.
- (ii) he then works out a project network using either of the network techniques deemed appropriate. At this point, the most critical factor is to ensure logic.
- (iii) the first and second steps are important and guide the planner to the third one, which is identification or development of a suitable programme to carry out the required calculations

and output the desired data. Programmes can be developed by the planner, bearing in mind his needs. They can also be acquired from computer centers and utilized wholly or with some modifications. Whichever the case, it is important to note that the needs determine the programme. The needs usually are the type of input data the programme is designed to do, the format in which the data must be presented and the type of output reports that are required. For self made programmes, the planner takes care of this. But for acquired programmes, it is important to note the user (planner) reads the users manual very carefully to ascertain whether the programme is the relevant one or not.

- (iv) once these have been done, the input data on various activities is read into the computer through either cards, tapes or teletypes. It is then edited.
- (v) early start and finish times for each activity are calculated using the forward pass.
- (vi) late start and finish times for each activity are calculated using the backward pass.
- (vii) the float for each activity and the total project duration are then calculated. It should be noted that some programmes only use the backward pass to determine the activity times. In such cases the project duration is fixed and by working backwards, times for various activities are noted.
- (viii) the schedule is printed, more in the same fashion as in tables 3.1 and 3.2.

One area where the computers have advantage over the manual method of planning is in the presentation of information. Information can be presented in a variety of forms depending on the programme and the requirements of the planner. It can be presented as in figure 3.1 and 3.2, or alternatively with activity times printed on calendar basis. Another popular capability of many computer programmes is the printing out of bar charts schedules with individual activity showing early start and finish dates, durations, critical activities and float values. Also specific activities of current interest to the planner or user can be selected and the pertinent information required produced.

Summary

The chapter has reviewed various aspects of planning, with focus being placed on the need for planning, principles of planning and various techniques associated with it. Note has also been made of the capability of computers in planning.

The aspect which the study has however not dealt with is the recommendation of an ideal method of planning. This is difficult to do in such a study because the choice of technique is to a large extent a function of the project, its scope and complexity, the resources available, the type of control desired, and finally, the versatility of the project manager or whoever is responsible for planning, in the manipulation of the various project techniques. It would be unwise for example, to insist that CPM should be used when the project manager and his staff do not have good understanding of its mechanism. This could cause chaos and injure the project.

The study however insits on the use of appropriate techniques; techniques which provide for most planning features. Project managers with poor background in the sophisticated planning techniques are advised to update themselves accordingly, and not to hide in the sentiment that they should always use what they know best regardless of the inferiority associated with it.

Finally, there is one point which did not receive much emphasis during the discussions on planning. It is however an important one to note, especially at this stage. The point is that knowledge of modern sophisticated planning techniques is not a panacea to good planning. Good planning depend not only on the planner's thorough knowledge of the relevant planning techniques, but also on his experience and intuition. The good planner is one who develops an overview of his project in his mind right from the beginning and on this basis can choose the appropriate technique. The chosen technique should on the other hand expose to him the critical areas of the project so that he can provide for them early or ask the implementors to give them higher priority. This makes his plans more realistic and therefore subject to fewer ammendments. Ammendments normally upset the tempo of work and should be discouraged unless otherwise.

Footnotes

1. H.N. Ahuja, Construction Performance control by Networks, (New York: A wiley - Interscience Publications, 1977), P. 3
2. Ibid, PP. 3-6
3. R. Oxley and J. Poskitt, Management Techniques applied to the Construction Industry
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8. Ahuja, OP.cit. P. 8
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13. Ibid, P. 34

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16. Ibid, PP 47-68
17. Ibid, P. 68
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21. H.M.R. Burgess and Partners, The Manual use of Precedence Diagrams in Contract Documentation, (n.d.)
22. Ahuja, OP.Cit. P. 67
23. Abid, P. 78
24. Abid, P. 102
25. Abid, P. 105
26. Abid, PP. 129-130

CHAPTER 4

PROJECT CONTROL

Introduction

Control is one of the management functions necessary for the successful accomplishment of organizational objectives. It is intertwined with the function of planning in the following manner: planning defines the performance standards which are used as a basis in effecting the control elements of measurement and comparison. This makes it possible for any deviations from the plans to be noted and corrective measures taken. Corrective measures normally vary according to the deviations noted or anticipated. In serious cases, plans are entirely revised; while in lesser cases, minor modifications are made. The process can be repeated severally before the project is completed.

In this chapter, an indepth discussion is given to the process of control and how it can be profitably utilized on building projects. As a starting point the study considers why project control is necessary in a dynamic environment. It then touches on various features of project control such as monitoring, reporting, information analysis and corrective action. Finally the discussion is brought to conclusion by bringing out the need for adjustability on the part of the project managers.

Need for Project Control

The need for project control arises from the reality that every project is subject to factors; some internal, others external, which tend to interfere with its desired progress.

To ensure that the effects of these factors are minimized, project managers normally institute control procedures. Control procedures form a control system. An ideal control system should be designed and instituted right from the time of project inception.

Some of the factors which affect the progress of projects thus necessitating project control are discussed below as follows:-

(i) Poor Planning: Plans normally provide the basis upon which the process of control is effected. Production of faulty plans therefore makes the process of control meaningless. Over and above this, faulty plans are erroneous in logic and/or resource allocation, and when utilized, they tend to frustrate the effort put into the accomplishment of the project objectives. Faulty plans are a product of over-optimism or simply lack of proper planning skill on the part of the project manager. Sometimes, they are also good plans rendered faulty by a rapidly changing environment. Whichever case, the process of project control makes it possible for the anomaly to be noticed and rectified before considerable damage is suffered on the projects. The corrective action is normally in form of revised plans, which in essence are updated networks or bar charts.

(ii) Financial/Economic Factors: The two main ones are: escalations and fluctuation of prices of various project inputs, and poor cash flow.

Escalations and fluctuations of prices are caused by factors external to the projects.

When they occur, they normally upset the budgets of the projects, thus creating chaos in the implementation process. Some contractors and project managers safeguard themselves by quoting inflated estimates on various project items or insisting on contract agreements with provisions for upward revision of the estimated costs. On the face of it, this approach might appear prudent as the projects are guaranteed of adequate funds. But when one recalls Parkinson's law which states that "work expands to fill time available" and by analogy "costs expand to fill the budget available", he would be hesitant about adopting the approach. The best approach infact is to work with realistic figures, but keep a close watch on the performance of the economic environment. Information should regularly be gathered on the environment's performance and evaluated in the light of its future implications on the on-going projects. Through this approach, the project manager might realise that although his network initially indicated that, say activity 205 was critical and 210 subcritical, there might be a saving in money now if the latter is done first at the expense of the sooner. The analysis could further indicate that it would be wise to crash the project now in order to avoid bad economic times ahead.

Poor cash flow as an economic factor can badly inhibit the progress of projects. There is no exception as to whether this refers to the contractor or the developer. Both of them should ensure that their funds are available to meet project liabilities as required and no lapses are experienced during project implementation because of this factor.

They should note that where this does not happen, defaults on the contract agreement become possible, with adverse effects on the projects' progress. Project control where properly effected helps in averting this possibility. All that is required is for the project manager to regularly review the financial commitments of both the developer and the contractor and advise them on how they should organize themselves with a view of meeting these commitments without much strain on their financial resources. Where the project manager directly controls the funds, it is the same case: he should ensure that funds are released promptly and when cash shortages are envisaged, the management should be alerted in good time so that more funds are voted.

(iii) Resources: In construction projects, one of the objectives common to both the developers and the contractors is the minimization of the project costs through proper resource utilization. The major resources controlled are the manpower (labour), equipment and materials.

The first endeavour for the project management team is to come up with a technology which enables these resources to be intergrated and utilized in an optimal manner. This is done at the time when the projects are being planned and scheduled. Sometimes errors are made - due to either oversight or simply bias on the part of the project managers. Errors due to oversight occur when the project managers fail to take note of certain pertinent details such as the date of placing orders, recruitment and disposal of workers, hiring of equipment, etc.

Errors due to bias on the other hand, result due to the managers' ardent believe in either the utilization of labour intensive methods or capital intensive methods and failure on their part to look at each project separately and on the basis of its content design an appropriate method of implementation. In cases where errors of this type have been made, a good control system will make it possible for them to be quickly identified and thus rectified.

Over and above the errors discussed above, there are also certain cases where errors have not necessarily been committed at the planning stage, but during implementation. For example, orders for materials, equipment, etc., can be placed late, despite what is indicated on the schedules. The process of control again helps in sorting out and correcting such anomalies.

The most useful part of project control is not that it helps in the identification and correction of errors, but that when properly applied, it helps in pointing out well in advance possible errors.

(iv) Environmental Factors: These are several and include the inclemental weather, wars and civil conflicts, droughts, coup d'etas and economic recessions. These factors are external to the projects and can not be anticipated in good time by the project managers. But once they occur, reasonable steps should be taken to ensure that their effects have minimal consequences on the progress of the projects. Revision of plans and re-allocation of resources is advisable and should be done early enough.

(v) Other benefits: It has been noted that where project control exists, the projects are conducted in an orderly manner and everybody, right from the owners to the workers, become happy and proud of their achievements. P.O. Kharbanda subscribes to the same view when in his book "Project Cost Control in Action" he notes as follows:-

When we talk of 'benefits', we mean, in the first place, the monetary benefits: benefits that can be quantified. But in addition, the application of cost control techniques bring(s) fringe benefits, not quantifiable, such as (a) better communications and (b) better human relations. This will lead in turn to smoother project execution and both the morale and productivity (of workers) increase quite a lot:¹

So far the need for project control has been discussed, more or less in general terms. The reason for adopting this approach is that the factors raised will be discussed in greater detail later in this chapter when dealing with topics such as monitoring, reporting and corrective action.

Elements of Project Control

Before discussing project control in detail, it is important that the following points which essentially apply on every project situation regardless of the magnitude, be mentioned.

First and foremost, it should be noted that project control should start at the time the project is conceived. As has already been noted, control aims at the efficient use of resources such as capital outlay and time. The timing is however an important factor in the achievement of this.

For example, in a building project, a prudent project manager can save a lot of money and time by systematically analysing the various alternative designs and their respective plans of implementation. Thereafter he can choose the one which optimizes his objectives. This is referred to as Value Engineering (VE) but in essence is some form of project control instituted right at the conception of the project. Even without the concept of value engineering, it is a proven fact that the project, its scope and resource inputs, can best be controlled at the initial stages of implementation. When the project progresses, it does not only become more difficult to effect any meaningful changes, but also expensive to do so. Figure 4-1 illustrates this point very clearly.

Once a decision has been reached by the management to effectively control the implementation process of the project, the next step is to develop and instal a "control system". According to Andrew Parkin²

A control(led) system must have a standard (well defined objectives), a controller (which will seek to reach objectives) and control actions (which the controller may take)..... the objectives are the targets, the controller is the project manager and the control actions are principally the application and organization of the project resources, mainly people used in furthering the objectives.

If a control system is to reach its objective within specified time, the control actions must be able to draw sufficient resources to drive the system to its objective in time. If this system can be disturbed while the control action is being implemented, there must also be slack resources (slack time) available to overcome the disturbance.

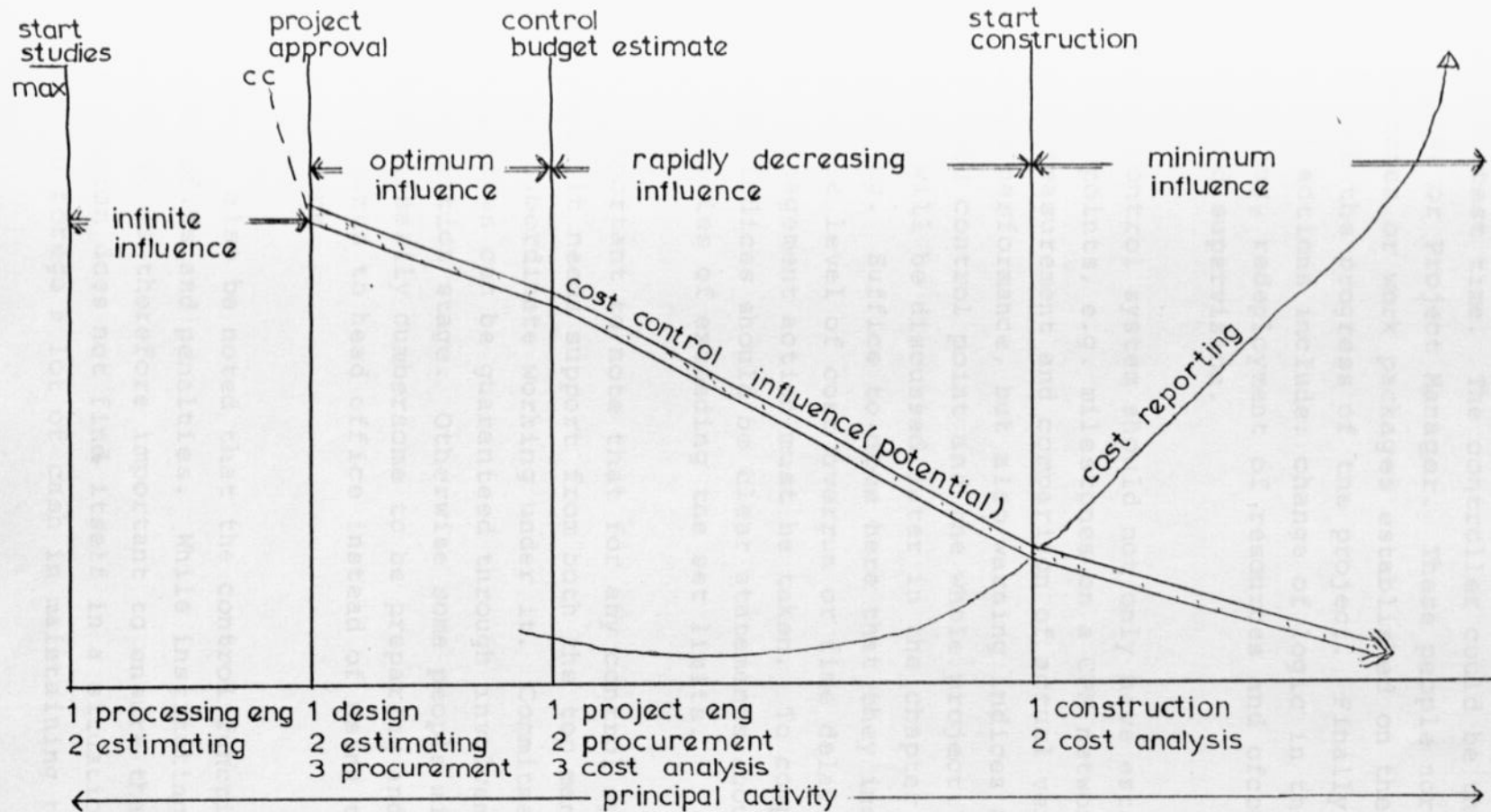


Figure 4 - 1. Cost Control Potential.

The ability to control costs diminishes rapidly over the life of the project, as the volume and number of cost control reports increases.

(Reproduced from a paper 'Owners CAN Control Costs, included in the 1969 Transactions of American Association of Cost Engineers, by Mr. G. Azud).

Source: O.P. Kharbanda, Project Cost Control in Action, P. 47.

In the building project the objectives of all the parties are naturally coming up with a building; functionally and aesthetically acceptable, at minimum cost and within the shortest time. The controller could be the Architect, Engineer or Project Manager. These people normally use milestones or work packages established on the network to appraise the progress of the project. Finally, the control actions include: change of logic in the plans, expediting, redeployment of resources and ofcourse, increased supervision.

A good control system should not only have established control points, e.g. milestones on a CPM network to enable measurement and comparison of actual versus planned performance, but also warning indices associated with each control point and the whole project. Warning indices will be discussed later in the chapter under monitoring. Suffice to note here that they indicate the acceptable level of cost overrun or time delay, above which management action must be taken. To compliment warning indices should be clear statements about the benefits and penalties of exceeding the set limits.

It is important to note that for any control system to succeed, it needs support from both the top management and the subordinate working under it. Commitment from subordinates can be guaranteed through involvement at the definition stage. Otherwise some people might find it unnecessarily cumbersome to be preparing and submitting field reports to head office instead of using that time on real work.

It should also be noted that the control function has both benefits and penalties. While instituting a control system, it is therefore important to ensure that an organization does not find itself in a situation where it has to forego a lot of cash in maintaining the system.

Also, the system should not become a stumbling block to progress as is the case in some highly bureauctized organizations. Instead it should pave way for faster action and harmony in the internal and external operations of the organization. It should be added here as a word of caution that "control the control system". Kast says the following on this:-

Considerable managerial skill is required to design a system which provides organizational control effectively and efficiently. Over-control may be both expensive (the time and effort involved) and dysfunctional. Picking the appropriate characteristic to monitor is extremely important because individual behaviour and organizational performance will be 'directed' accordingly.³

Last but not least in importance is the fact that once a suitable control system has been instituted in a given project situation, it should remain operational until the completion of the project. It's success should thereafter be appraised critically for the benefit of future projects. See figure 4-2 for a model of a typical control system

The process of project control in essence is complimentary to planning, and its mode and intensity depend to a large extent upon the defined objectives of the project; plans, schedules and resource estimates drawn to meet them, and generally on how they are intergrated with the external factors. Also to note is the fact that control is more susceptible to the influence of the organization's internal policies than planning. All these combine to relegate the process of control to a more or less inferior position - that of a reactor (planning is an actor).

The process of control, in descriptive terms, is very subjective. It is for example a matter of opinion to state whether or not, control was adequate on a certain project, to say whether it was significantly responsible for the success or failure of a project, and where required, to prescribe the correct dosage of control required.

It is for these reasons that one cannot help discussing the process of control in descriptive terms, and that much of the discussion dwells on the procedures as opposed to the techniques. This is quite a contrast to the case with planning.

As a starting point it is useful to note what Kast says:

The fundamental elements in any control system become the control process when linked sequentially in a circle. (Figure 4-3) show a generally model of the control cycle. Objectives are established, programmes planned, resources allocated, and work is performed.

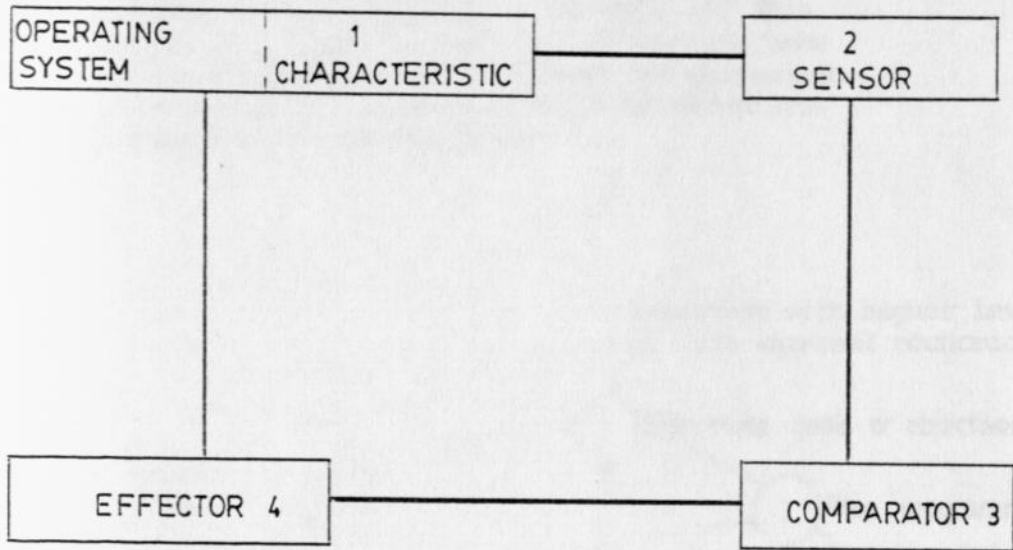


Figure 4-2: The basic elements of a control system:

- (1) a measurable and controllable characteristic for which standards are known;
- (2) a means (sensory device) of measuring the characteristic;
- (3) a means of comparing actual results to standards and evaluating differences;
- (4) a means of effecting changes in the system in order to adjust the pertinent characteristic.

(Kast and Rosenzweig, Organization and Management: A systems Approach, Page 470)

As actual performance is compared with the plan, feedback is generated to adjust workloads and the allocation of resources. This type of comparison relates primarily to the means used to accomplish goals and objectives. Another comparison is made between actual achievements and the programme originally planned. At this stage, information is fed back to the programme planning phase as well as forward for comparison leads to a reaffirmation of existing objectives or adjustments for the future.⁴

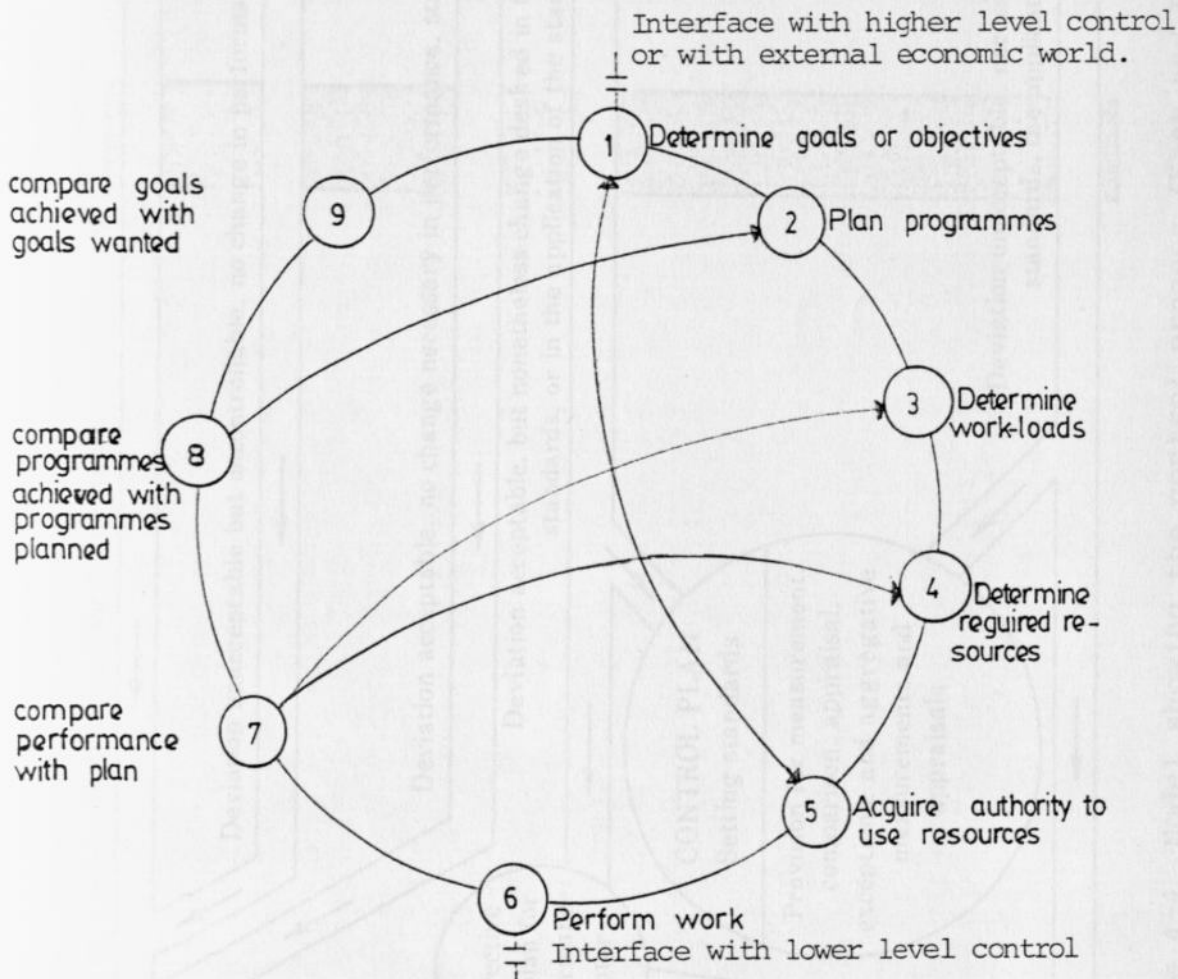


Figure 4-3 The process of control (Marvin E. Mundel, A conceptual framework for the management Sciences, McGraw-Hill Book Company, New York, 1967, P. 162)

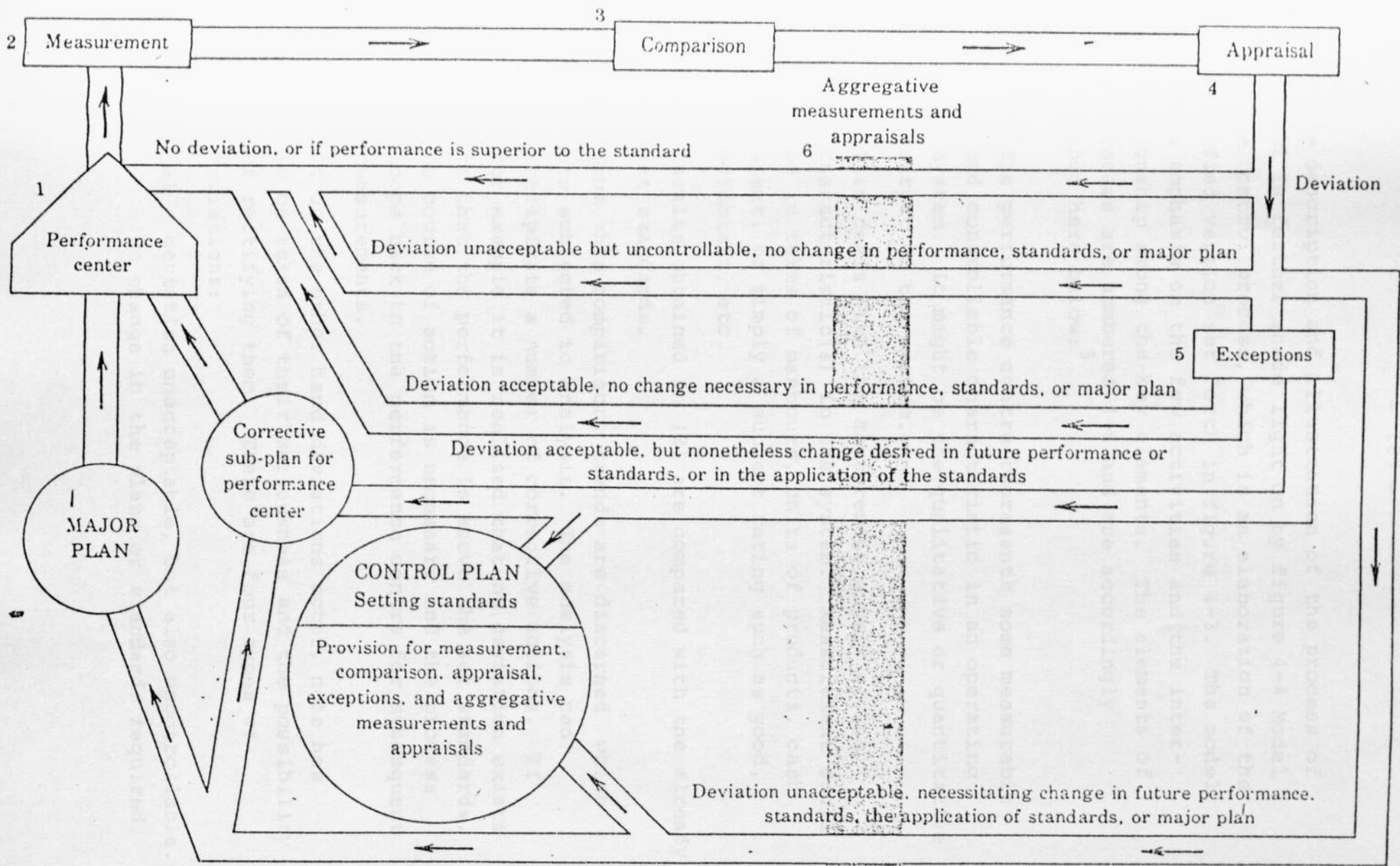


Figure 4-4 Model showing the control process (Kast and Rocenzwig)

Kast's description and illustration of the process of control is further shade light on by figure 4-4 Model of the control process, which is an elaboration of the simplified version set forth in figure 4-3. The model places emphasis on the few activities and the inter-relationship among the key elements. The elements of the process are numbered 1-6 and are accordingly described here below:⁵

- (1) The performance centre represents some measurable and controllable characteristic in an operating system. It might be the qualitative or quantitative output of the system.
- (2) This deals with the measurement aspect of the characteristic(s) in the system. Measurement could be in terms of manhours, units of products, cash spent, or simply a subject rating such as good, efficient, etc.
- (3) Results obtained in (2) are compared with the already set standards.
- (4) From this comparison, trends are discerned which are subjected to analysis. The analysis can precipitate a number of corrective actions. If for example it is realised that no deviation exists or that the performance is above the set standards, no course of action is necessary and the process loops back to the performance centre for subsequent measurements.
- (5) If on the other hand deviations occur, note has to be taken of their seriousness and the possibility of rectifying them. There are four types of deviations:
 - (a) deviation unacceptable, but also uncotrollable. No change in the plans or standards required.

- (b) deviation recognized, but of negligible magnitude and therefore requiring no change.
- (c) deviation acceptable for the present but indicating that some adjustment is required to keep the system 'in control' in future.
- (d) deviation clearly unwanted and therefore precipitating immediate corrective action.

Feedback for (a) and (b) flows into the performance centre, while for (c) and (d) flows into the subsystem for setting standards (control plan) as well as to the major plan and corrective subplan for the performance centre.

- (6) This cuts across all the appraisal alternatives and relates to some sort of aggregate or overall control process which relies on cumulative information to be used as a raw material for decision making. Certain aspects may have a rather high threshold before the control process evokes significant adjustments in the system.

From the foregoing description one can easily concretize the process of project control into three phases: monitoring, analysis and corrective action.

Monitoring

Monitoring can be done in a meaningful way when the following are available: clearly defined project objectives, plans (preferably in form of networks), schedules indicating various dates of activity commencement and completion, budgets (resources and how they have been allocated) and the control system designed and set. All these form the basis on which monitoring can be conducted.

Parkin defines monitoring as "getting information about the actual performance of the project so that accomplishments can be compared with plans".⁶ From this definition, which by all means is acceptable, some questions which are helpful in giving this discussion impetus emerge:

- (a) which status information in particular?
- (b) when should the information be received and in what form?
- (c) who should be responsible for the collection and submission of this information?
- (d) are there any problems inherent in information gathering and dissemination?

Before these questions are answered, one point of general importance should be brought out. The point is that information required, to a large extent, depends upon the mode of project organization, project stage of implementation and the environment in general. These three dictate the type of information required and what emphasis should be placed upon other related aspects such as interval or regularity of reporting.

- (a) Information about the performance of a project (or feedback) can be placed into three major categories: that pertaining to physical progress, to financial progress and generally towards the achievement of other project objectives such as aesthetics or workmanship and goodwill.
- (i) Information on the physical progress of the project is very important to both the contractor and the management in the sense that it enables them to review and reorder their future commitments. Its usefulness can however be limited if it is not submitted in quantitative values, and also, if at the time of receipt there are no established standards or targets to compare with.

Project targets are normally indicated on network diagrams or bar charts or CPM bar charts - whichever is in use, as milestones. Each milestone could comprise one or several activities; and each activity has a given commencement date and completion date. Non-critical activities have two alternative commencement and completion dates. Following the critical path, the duration of each milestone and the project at large can be determined. Scheduling enables this determined project duration to be presented on calendar time basis. See figure 4-5.

Normally, physical progress should cover project activities completed, started, and in progress. The period covered should be between the date of the last batch of information and to-date. Progress information can be presented in a tabular form or simply plotted on the bar chart or network diagram. Use of colours, where possible, make visualization and assimilation easier. Progress information can also be presented in percentage form - say, project is 80 percent complete. This is achieved by taking activities done, noting their proportion in terms of work content and expressing it as a percentage.

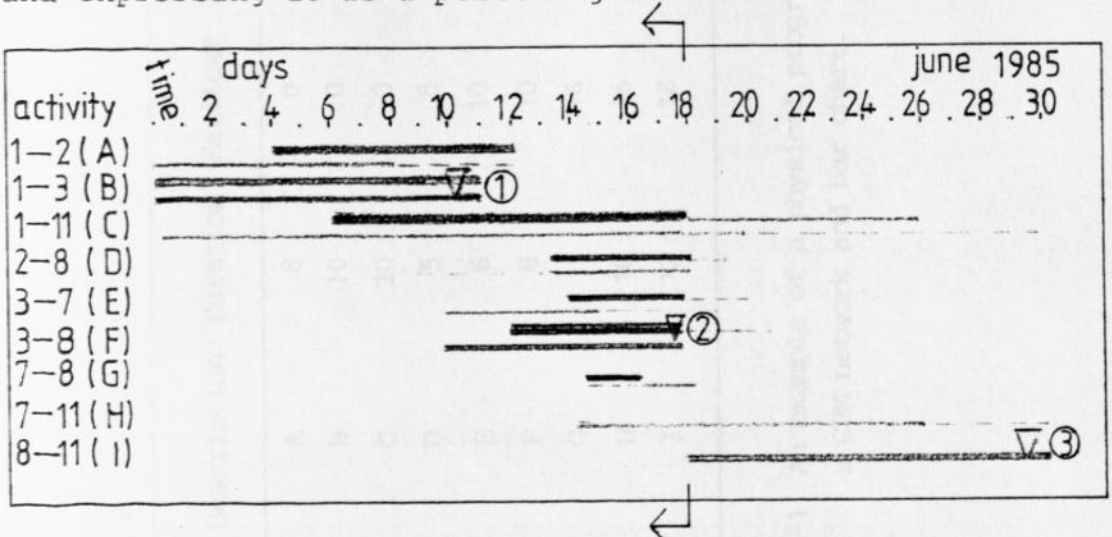


Figure 4-5 A CPM bar chart.

One single line indicate activity activity duration. Dotted periods indicate float. Thick single line such as for activity is 8-11 indicate that the activity is critical. The upper line on the other hand indicate progress.

PHYSICAL PROGRESS REPORT FOR THE MONTH OF JUNE											YEAR 1985
PROJECT NAME: BUNGOMA DISTRICT HOSPITAL				ITEM NO. WE 805			JOB NO. 0112H				
PROJECT DESCRIPTION: INSTALLATION OF MORTUARY EQUIPMENT, ETC											
Activity	Description	Duration	Earliest	Start		Finish		% Complete		Float	
				Latest	Earliest	Latest	Target	Actual	Original	Now	
1,2	A	8	0	5	8	13	100	100	5	N/A	
1,3	B	10	0	0	10	10	100	100	0	N/A	
1,11	C	20	0	10	20	30	65	60	10	9	
2,8	D	5	8	13	13	18	100	95	5	0	
3,7	E	6	10	16	16	17	100	60	4	4	
3,8	F	8	10	18	18	18	100	60	0	0-3	
7,8	G	1	16	17	17	18	100	100	1	N/A	
7,11	H	10	16	20	26	30	30	0	4	1	
8,11	I	12	18	18	30	30	0	0	0	0	

Table 4-1 An example of a physical progress report based on a CPM network and bar chart. See figure 4-5

- (ii) Feedback on financial performance of a project is very important as it helps both parties to know in advance whether possibilities of underexpenditure or overexpenditure exist, and which areas are responsible. Even in cases where none of these is likely to happen, knowledge of the project's financial progress is important as it helps the management optimize on their cash flow. An example of this is where there is a project with a huge provision of funds. The project management is at the beginning very ambitious and forecasts a monthly expenditure of £.100,000 for the project duration of 2 years. After the project has been in progress for 6 months, it is realised that the contractor does not have the capability of spending £.100,000 per month. He can only spend £.60,000 per month. In such a case, a quick thinking management can temporarily untie the funds and commit it on other economic ventures such as purchase of bonds or opening of a fixed deposit account with high rates of interest.

Like in physical progress reporting, financial reporting should also be done in quantitative values. The report should clearly state what has been certified as payments on various activities. This should be made alongside the initial provisions. In cases where variation orders of financial consequences have been made, they should be noted.

Again, it is important to have established checkpoints or milestones, which, read together with the budget, make comparisons between actual and planned much easier. See table 4-2 for a typical financial progress report.

FINANCIAL PROGRESS REPORT FOR THE MONTH OF JUNE YEAR: 1985									
PROJECT NAME: BUNGOMA DISTRICT HOSPITAL				ITEM NO.		JOB NO.			
PROJECT DESCRIPTION: INSTALLATION OF MORTUARY EQUIPMENT ETC									
Account No.	Activity	Description	% Complete	Original Estimate £	Revised Estimate	Spent to date £	Estimate to £ complete	Underrun £	Overrun £
0291	1,2	A	100	15,200	15,125	12,604	15,125	75	-
0292	1,3	B	100	65,000	65,080	54,233	65,080	-	80
0293	1,11	C	60	120,000	120,000	70,033	120,000	-	-
0294	2,8	D	95	14,800	44,990	12,491	14,990	-	190
0295	3,7	E	60	18,650	18,800	9,166	18,880	-	150
0296	3,8	F	60	21,150	20,750	13,000	20,750	400	-
0297	7,8	G	95	10,000	10,000	8,335	10,000	-	-
0298	7,11	H	0	15,000	16,700	-	16,700	-	1,700
0299	8,11	I	0	25,060	25,090	-	25,090	-	30

Table 4-2: An example of a financial progress report based on a CPM network and bar chart. See figure 4-5. Note that in the table, the amount spent is less than the certified value of work done. This is because 1th of this sum is held in form of retention sum - to be released at the final completion of the project.

- (iii) Receiving feedback on the physical and financial performance of a project is not enough. It is also helpful to receive information about the quality of workmanship going into the project. One might be happy that savings are being made, or that the project is ahead of schedule; when infact all these are being done at the expense of the desired quality of workmanship. Cases have been noted where contractors have quoted very low contract sums so as to win tenders. But once on site, they deliberately use inferior materials so that their profit margins increase. This creates unnecessary future expenses to the owner. It is therefore important that the Project manager should be on the watch out for this. The clerk of works or the Architect/Engineer responsible should closely monitor this aspect.

Quantification of this aspect is however very difficult. All the same, good reports about the materials, method of laying, etc. should still be submitted for scrutiny.

- (iv) Fianlly it should be added that it is not enough to monitor factors affecting directly the progress of the project. There are also other factors such as the political climate, the current economic activities, the weather, etc. which in their own way can affect the project positively or adversely. A project manager should keep himself abreast with the current trend of these factors.
- (b) So far the information considered relevant as part of feedback on a project have been discussed, although briefly. The next question is: when and how often should this information be received, and in what form?

Feedback on a project should begin immediately work commences and should continue until the completion day. How often feedback should be given depends on the type of project organization, the project content and to some extent the prevailing environmental conditions. But one point is clear, "the greater the frequency of feedback and response, the higher the probability of attaining the project objectives". Although this point is correct, it should be taken with caution: frequency of feedback entails costs. One should therefore be careful about the price and benefits involved.

Under the normal circumstances, the greater the size of the project, in terms of duration and/or resources, the more regular feedback is required. Parkin adds as follows:

The risk of variance can be considered to arise because of imperfections in information about what has to be done or what obstacles might arise. If the project manager had perfect information, he could in theory make a perfect plan. The perfection of knowledge improves as the project progresses - to be more exact, there is probably a negative exponential type of relationship between uncertainty and project progress, uncertainty being greatest at the outset. Thus the early activities in project development require more checkpoints than later ones, other things being equal.⁷

The form in which feedback should be received varies according to the interest and responsibility of the recipient. But as a general rule, the information should be more and more condensed as is presented up the ladder of the organisation's management. The supervisors for example might want to know the physical and financial progress on daily basis. So daily reports comprising mainly raw data should be prepared and submitted to them.

In most cases, there are ready made work sheets which can be filled with information pertaining to labour, plant usage, materials and weather conditions. Reports to the project manager on the other hand should span over a wider period and therefore appear in summary form. They should cover one week or two weeks depending on the accepted practice. Information to the top management, finally should be either in summary form or on exception basis. The summaries in this case should be more condensed, covering a period of between 1-3 months. They should highlight on areas of main interest to the management, such as the achievement of the project objectives.

The format to be used in information presentation or reporting varies according to the organization in question and its needs. Therefore one cannot be recommended in this study.

- (c) The responsibility for information collection lies with the field officers. Using work sheets, they can submit the required information to the supervisor or the project manager. If the information has to pass from the field officers to the supervisor, to the project manager and finally to the owner or top management, then the responsibility changes at every stage. The labourers and plant operators, for example, file the activities done and manhours used with the field officers; who in turn process this and submit it in summary form to the supervisor. The supervisor might wish to observe the situation for one week before he files his report to the project manager, etc.

- (d) Gathering information is not devoid of problems and other sorts of peculiarities. One problem which arises quite often is that field officers sometimes do not see the need to submit reports. They believe this aspect is useless and simply detracts them from their routine work. It is important that these people be made to see not only the usefulness of giving progress information, but also in good time. Delayed reports are of historical value only and cannot help the management in reaching critical decisions. The management can ensure that this is done by making the personnel on site understand the usefulness of the information. One possible way of doing this is to let them participate in the setting of check-points.

The other problem is that the field officers sometimes mix records by charging costs mistakenly or deliberately on wrong items of work. Ahuja writes the following:

Field personnel may charge costs to the wrong items of work or to those that are actually costing less than was estimated in order to doctor those items that are costing more. They may even charge the costs of one job to another in order to make a losing job look better. When exposed, their argument may be that they are not really dishonest, because in any event, all the costs are chargeable to that job or that company. This may mislead the estimators in their future estimates, resulting in total chaos.

He adds:

They do this without any detriment in mind, to keep their bosses happy. Thus they report greater than actual progress on activities, wishfully thinking that this progress will be achieved by the time the report is read.

It is important that the management should watch closely performance on site and regularly discuss this with the supervising staff. This can help them pick out anomalies of this nature.

The other problem inherent in progress reporting is the bulkiness of the data. Sometimes the information given is in raw form. If the project manager does not give it immediate attention and the next batch arrives, processing and assimilation becomes difficult. Use of computers in such cases is beneficial. Computers excel in this because they can code, sort, summarize and cross-reference information within a short time.

Analysis of Information

Information gathered is not useful if it is not correctly analysed. Analysis involves comparing the actual performance versus the planned one and taking note of the variance. The variance noted can further be scrutinized to indicate the trend being taken by the project. Information leading to the discerning of trends is very important. This is because trends normally answer the question: Which direction is the project heading to? And being able to answer this question is the first step in taking corrective action.

Analysis of project information can be facilitated in two ways (a) plotting the actual performance alongside the planned one on the network diagram or bar charts and visually noting any differences, and (b) through normal mathematical computations and deductions.

(a) Various diagrams can be used in the comparison and analysis of planned versus achieved progress. It is however not the intention of this study to discuss all of them since most of them can be found in ordinary statistics and operation research books.

For purposes of this study two illustrations are given; one covering physical progress and the other covering financial progress.

Physical progress can be plotted on the project network diagram alongside the original activity lines. In doing this, the use of separate coloured marking pens should be preferred as this improves visual assimilation. Activities which are completed are coloured, say in red. Those which are in progress are also coloured up to the extent where progress has reached. This done, a pause is taken, and a survey made of the relationship between the actual and the planned plotted lines. Variances, whether positive or negative, are easily noticeable and the project manager should draw conclusions as to whether they are desirable or not, and what is the likely future project performance if no corrective action is taken. This approach is regularly used and all that is required is a network diagram and its accompanying schedule of activities. This study does not however wish to recommend this approach. It wishes to recommend the use of CPM bar charts. See figure 4-5. This approach or technique is better because it permits activities to be plotted on a calendar time scale. Actual performance is plotted alongside the planned one, either below or above. In figure 4-5, the thick line above the thinner one indicates actual performance. Dates can easily be read and delays visibly noted. For example in the diagram, it is visible that activity 3-8 which is on the critical path is delayed by 2 days. From this information it can be noted that the project is likely to overrun by at least 2 days. On this basis, the project manager can institute some corrective action.

The other diagram that should be mentioned here is the S curve. This is used in the analysis of various project aspects such as manhours, plant hours, and cost.

Project Progress: Value of Works Analysis

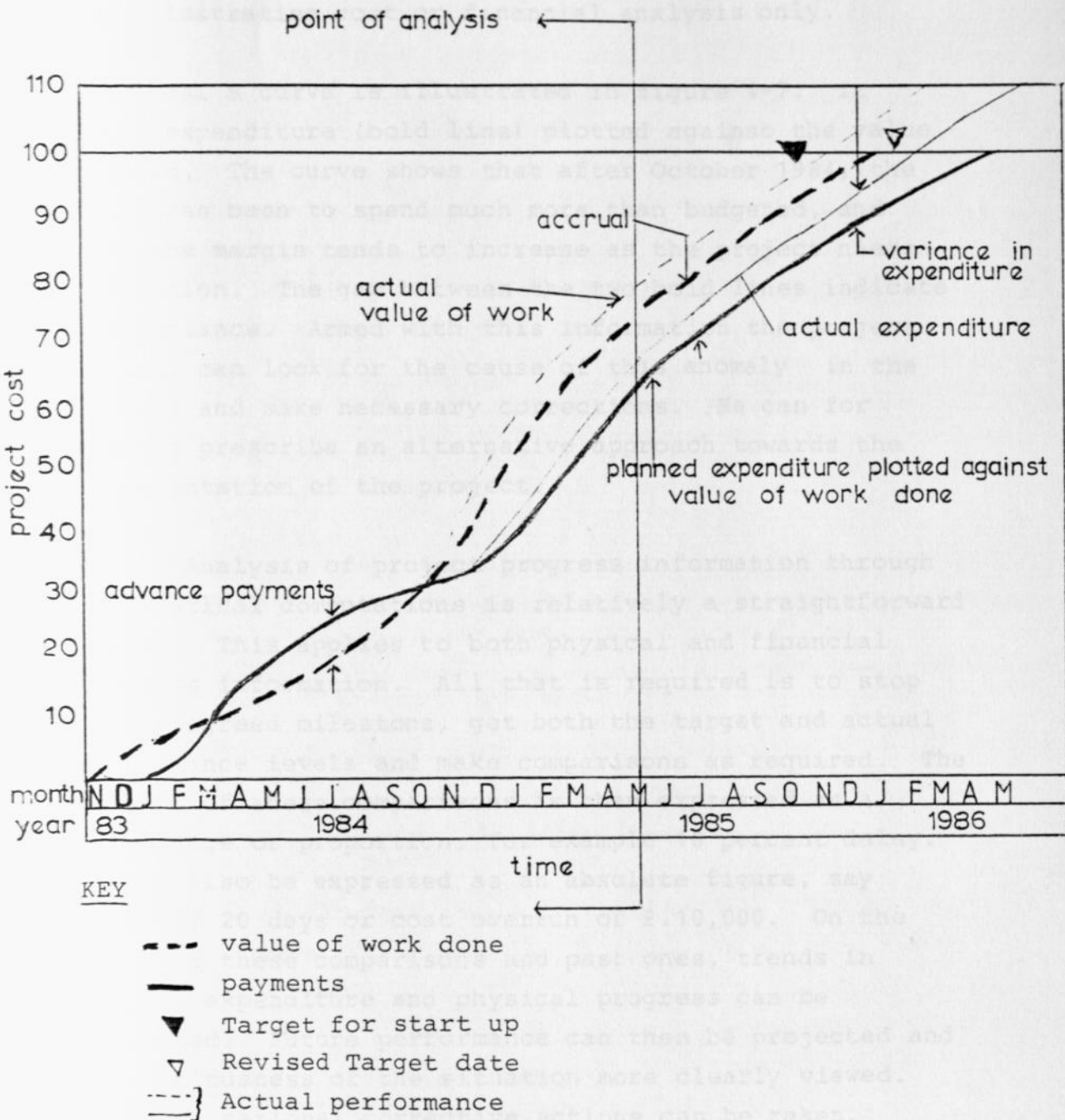


Figure 4-6: value of work done versus expenditure.

In early stages, down payments and progress payments made before equipment and materials arrive in the field may cause expenditure to run ahead of value of work done, but most of the time it will lag two months or more. (Adopted from Kharbanda, Stallworthy and Williams, Project cost control in action, Gower, Hampshire, 1980. P.108)

This discussion would however like to use the diagram for illustrating cost or financial analysis only.

A typical S curve is illustrated in figure 4-7. It shows expenditure (bold line) plotted against the value of work. The curve shows that after October 1984, the trend has been to spend much more than budgeted, and that the margin tends to increase as the project nears completion. The gap between the two bold lines indicate the variance. Armed with this information the project manager can look for the cause of this anomaly in the reports and make necessary corrections. He can for example prescribe an alternative approach towards the implementation of the project.

(b) Analysis of project progress information through mathematical computations is relatively a straightforward matter. This applies to both physical and financial progress information. All that is required is to stop at the agreed milestone, get both the target and actual performance levels and make comparisons as required. The product of these comparisons is then expressed as a percentage or proportion; for example 10 percent delay. It can also be expressed as an absolute figure, say delay of 20 days or cost overrun of £.10,000. On the basis of these comparisons and past ones, trends in project expenditure and physical progress can be discerned. Future performance can then be projected and the seriousness of the situation more clearly viewed. Finally, rational corrective actions can be taken.

Before discussions on this subject are brought to conclusion, it is important to take note of one more point: that sometimes a project might be behind schedule and yet underspent..

In such a situation, the owner might be getting value for his money even though the timing is out. In other cases the project might be overspent, but ahead of schedule. Like in the above case, the owner is likely to get value for his money. This type of reasoning create some state of confusion as to what is supposed to be an optimal position from both the physical and financial progress point of view. To sort out this, an indicator called the "status index" should be used. Parkin defines the status index as:

....an indicator of project progress which tries to take both of these factors (physical and financial) into account. It is useful as a broad concept, and possibly of practical value as a high-level indicator when budgetary control is exercised and projects are too large to permit frequent reworking of forecasts of completion time and cost. In essence the index measures: achievements relative to plan⁹
costs relative to budget

Parkin continues to explain the indexes as follows:

Index = 1 means achievements are in accordance with what was expected for the money spent.

Index > 1 means progress greater than value of money spent.

Index < 1 means that progress less than value of money spent.

Measuring "achievements relative to plan" and "costs relative to budget" is a tricky affair. It can however be contained if both positive and negative total float of the project are brought into play, in cases of achievements; and savings and losses, in cases of costs relative to the budget.

Achievement relative to plan $\frac{\text{duration to date}}{\text{duration to date less float}}$

The formula is based on an understanding that if the completion is early (duration to date is less than planned) relative achievements are greater than 1, i.e. achievements exceed those planned. If on the other hand completion is late (overall duration is greater than planned, so there is negative total float) relative achievements are less than 1.

Measuring actual costs relative to planned ones to date is expressed as follows:

Costs relative to budget =

$$= \frac{\text{Actual costs to date}}{\text{Actual costs to date plus budget savings.}}$$

This means that if completion is achieved at less cost than budgetted, relative costs are less than 1; if at more cost, more than 1.¹⁰

Fig. 4-17: Interpretation of Status Index Plots.

Index values between 0.9 and 1.1 should be considered to be within normal range, not requiring control action.

See Pashin, Systems Management, Edward Arnold (Publishers) (London 1967, p. 113).

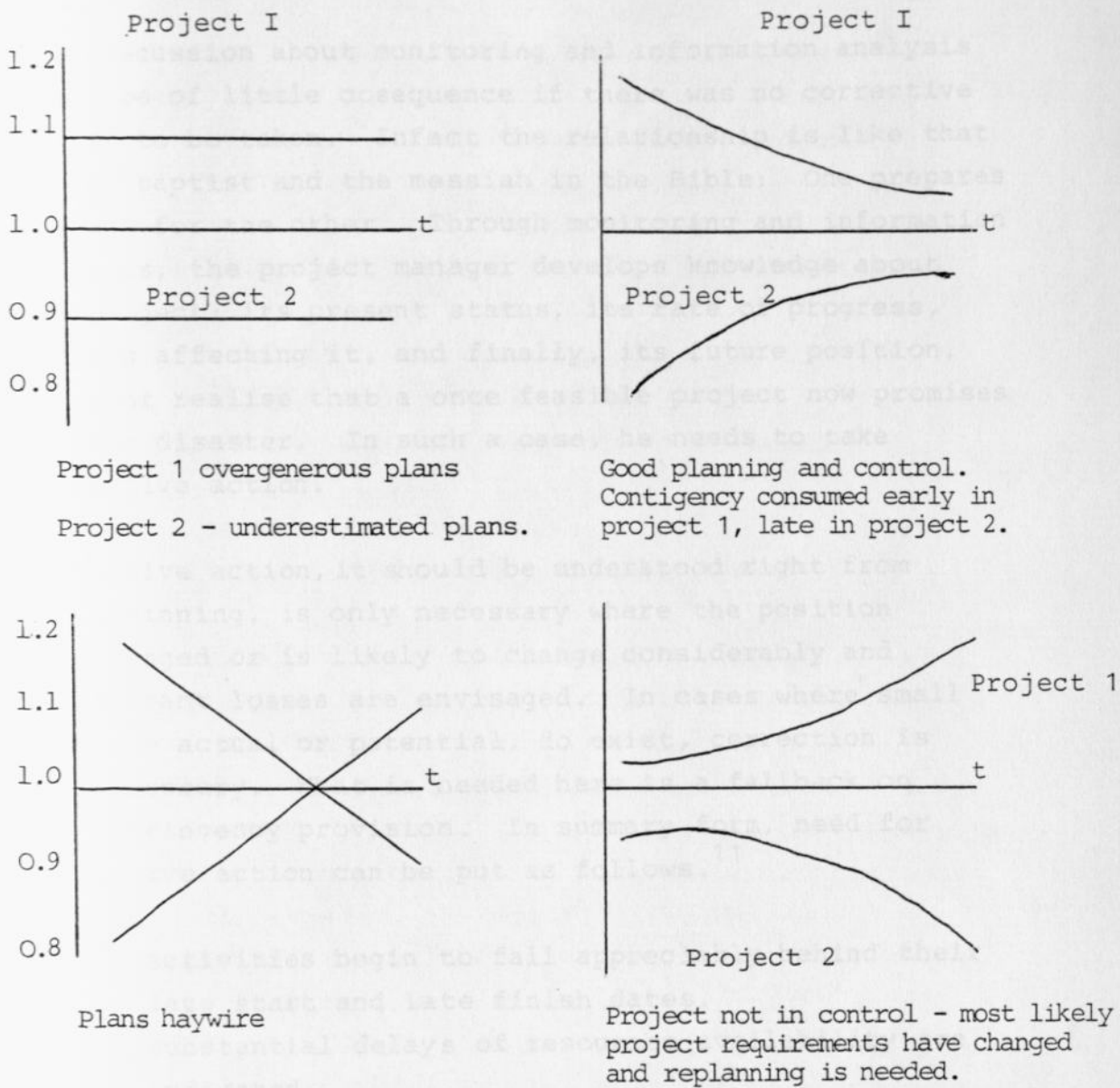


Figure 4 - 7: Interpretation of Status Index Plots.
Index values between 0.9 and 1.1 should be considered to be within normal range, not requiring control action.

(Andrew Parkin, Systems Management, Edward Arnold (Publishers) Ltd, London 1980, P. 112).

Corrective Action

The discussion about monitoring and information analysis would be of little consequence if there was no corrective action to be taken. Infact the relationship is like that of the baptist and the messiah in the Bible; One prepares the way for the other. Through monitoring and information analysis, the project manager develops knowledge about the project: its present status, its rate of progress, factors affecting it, and finally, its future position. He might realise that a once feasible project now promises to be a disaster. In such a case, he needs to take corrective action.

Corrective action, it should be understood right from the beginning, is only necessary where the position has changed or is likely to change considerably and significant losses are envisaged. In cases where small delays - actual or potential, do exist, correction is not necessary. What is needed here is a fallback on the contingency provision. In summary form, need for corrective action can be put as follows.¹¹

- (i) activities begin to fall appreciably behind their late start and late finish dates.
- (ii) substantial delays of resources availability are indicated.
- (iii) the time duration of future activities appear to have been materially underestimated.
- (iv) logic changes in work yet to be performed have become necessary.

The type of corrective action to be taken largely depends upon the type of the project and the nature and magnitude of the problems facing it. In a building project, there are 6 main alternatives of corrective actions available to the project manager. Apart from alternative (i) below, all other alternatives can be combined to produce better results. The alternatives are:-

- (i) cancellation or abandonment of the project
- (ii) reworking of the plan
- (iii) reorganization of personnel's priorities
- (iv) increase of input resources
- (v) increase of supervision
- (vi) revision of targets and objectives

(i) Cancellation or abandonment of a project is not a new phenomena in the building industry. It has been done before by both the owners (project management) and the contractors. This has happened mainly where it has been found that it was no longer viable to continue with the project. Some people have also abandoned projects for security reasons. Essentially this is not a corrective measure as such; it is more or less a solution to a helpless situation. Whichever the case, cancellation of projects should only be done when it is certainly clear that the expected benefits have been overcome by costs. While considering this, one should also remember to evaluate the element of goodwill and public image. For a developer, cancellation of a project might reflect financial instability, thus influencing business associates and creditors to be a bit wary about entering into transactions with him. For a contractor, the effect is more or less the same. Developers become reluctant to engage him on their projects.

Where it has been found that only a miracle is required to save the situation, cancellation should be done immediately. The staff and plant assigned to the project should be deployed elsewhere or laid off. Over and above this, although hardly done, the causes of the project cancellation should be meticulously recorded for future planning purposes.

(ii) Replanning is a corrective action possible at practically all stages of the project. Its possibility and value however reduces as the project advances. Need for replanning is based on an understanding that at the initial planning time, the person responsible was missing certain vital information, or that certain inputs to facilitate use of a particular technology were unavailable. With the passage of time and changes in other environmental factors however, new possibilities which permit for efficiency in project implementation have surfaced and can therefore be utilized. Aspects which are affected during the reworking of a project plan are mainly the logic involved in scheduling project activities and the technology to be used. When looking at the project logic, the interesting points are inter-dependence and concurrence. These have been discussed in chapter 3. Change of technology on the other hand has dual relationship with the project activities' logic. When certain activities should be done and after which ones, to some extent determine the use of plant and manpower on site. On the other hand the availability of plant and labour and their combination ratio influence the interdependence and concurrence of project activities.

H.N. Ahuja sums up this discussion very nicely as follows:-

The second recourse is to design a completely new network model from the current position to the project completion event, introducing new construction methods and/or equipment, together with other additional resources, to maintain the desired completion date.

For this model an estimate of required resources is made and the new total cost is determined. After feasibility analysis and optimization, if the plan is acceptable, the project is rescheduled and proceeds according to the new plan. If not, further alternative plans may be devised until finally the most economical solution is obtained.¹²

(iii) Reorganization of the personnel's priorities is tied up with the use of labour and plant. More often than not, projects are delayed because the personnel involved have got their priorities wrong. Architects and Engineers often spend much time on aspects which are not of much consequence to the project. For example, drawings can be held up because of external finishes when this could be added at a later date; Or the project Architect engaging himself in draughting before the design work is over, when this can be done by draughtsmen.

Reviewing such situations and ensuring that greater focus in terms of manpower and plant is given to critical activities is a very useful corrective action. In some cases it might involve having to shift the project engineer or architect concerned from head office to the site.

(iv) It is normally very difficult to effect any serious corrective action without touching resource inputs. In most of these cases the resources are reviewed upwards, not downwards. It is for this reason that this study would wish to discuss how resources can be optimally utilized on a given project. The resources in question are mainly three: time, labour and equipment (plant). Each of these resources has a cost implication which should never be lost sight of while carrying out the reallocation exercise.

The reallocation exercise is normally based on the fact that the project has performed poorly and a delay in completion is foreseen. This delay has cost implications and the expected monetary savings or revenue will be foregone unless remedial action is taken. All other things having been considered, it might be found that the alternative open is to increase input resources of various types and hopefully compress time to the originally scheduled one. This is referred to as "time expediting" and where networks are used, sometimes as "network compression". Others simply call it "crashing".

Time expediting or crashing starts with the determination of the acceptable time or duration as opposed to the one which the project will naturally take if uninterfered with. The sooner is called crash duration (DC) while the latter normal duration (DN). Associated with these durations are crash costs (CC) and normal costs (CN) respectively. See figure 4.8. The interaction of the four combine to give a cost slope which can be mathematically expressed as

$$\text{Cost slope} = \frac{\text{CC}-\text{CN}}{\text{DN}-\text{DC}}$$

If for example DN=50 days

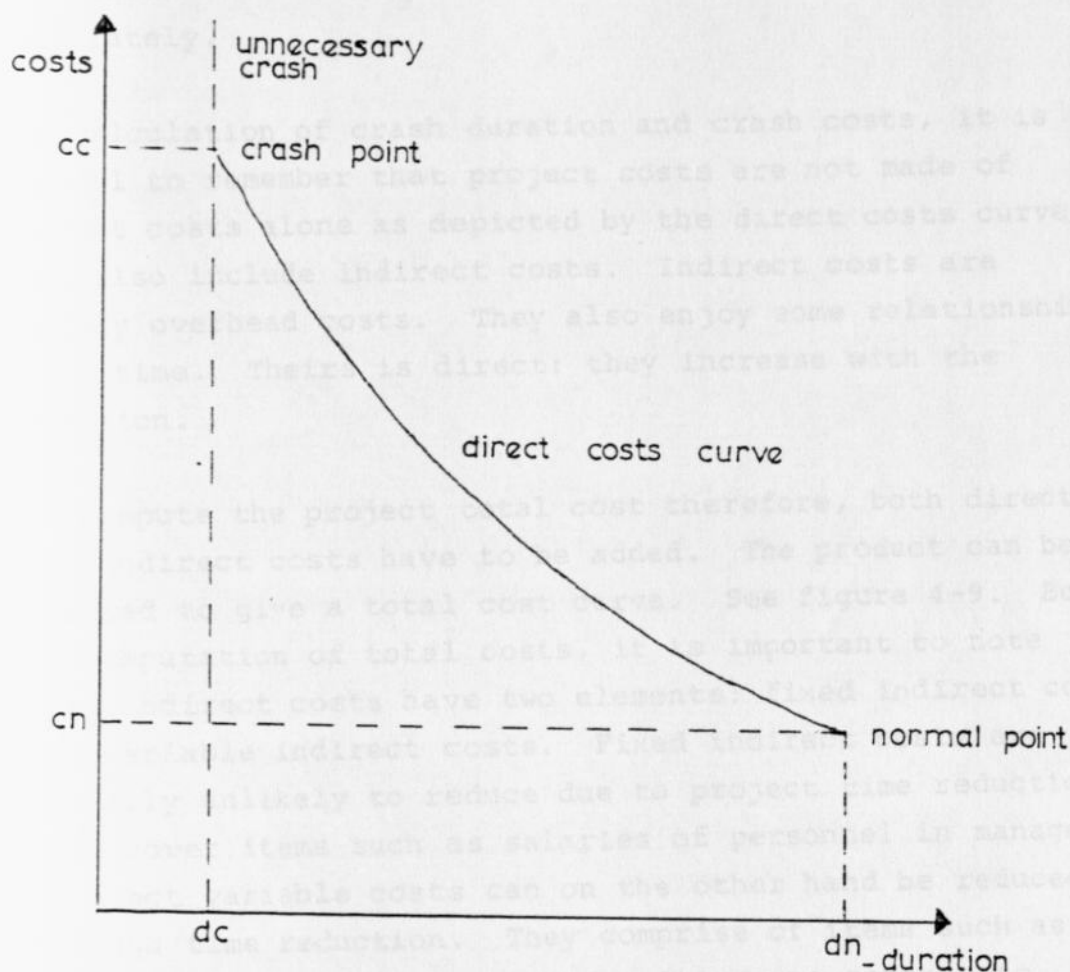
DC=30 days

normal duration CN=£20,000

Crash duration CC=£35,000

$$\text{Cost slope} = \frac{35,000-20,000}{50-30} = 750$$

This means that each day saved has a cost implication of £750. A prudent project manager should always endeavour to reduce this cost implication. Reduction in the costs has an effect of flattening the cost curve.



KEY

- DN - Normal duration
- DC - Crash duration
- CN - Normal cost
- CC - Crash costs

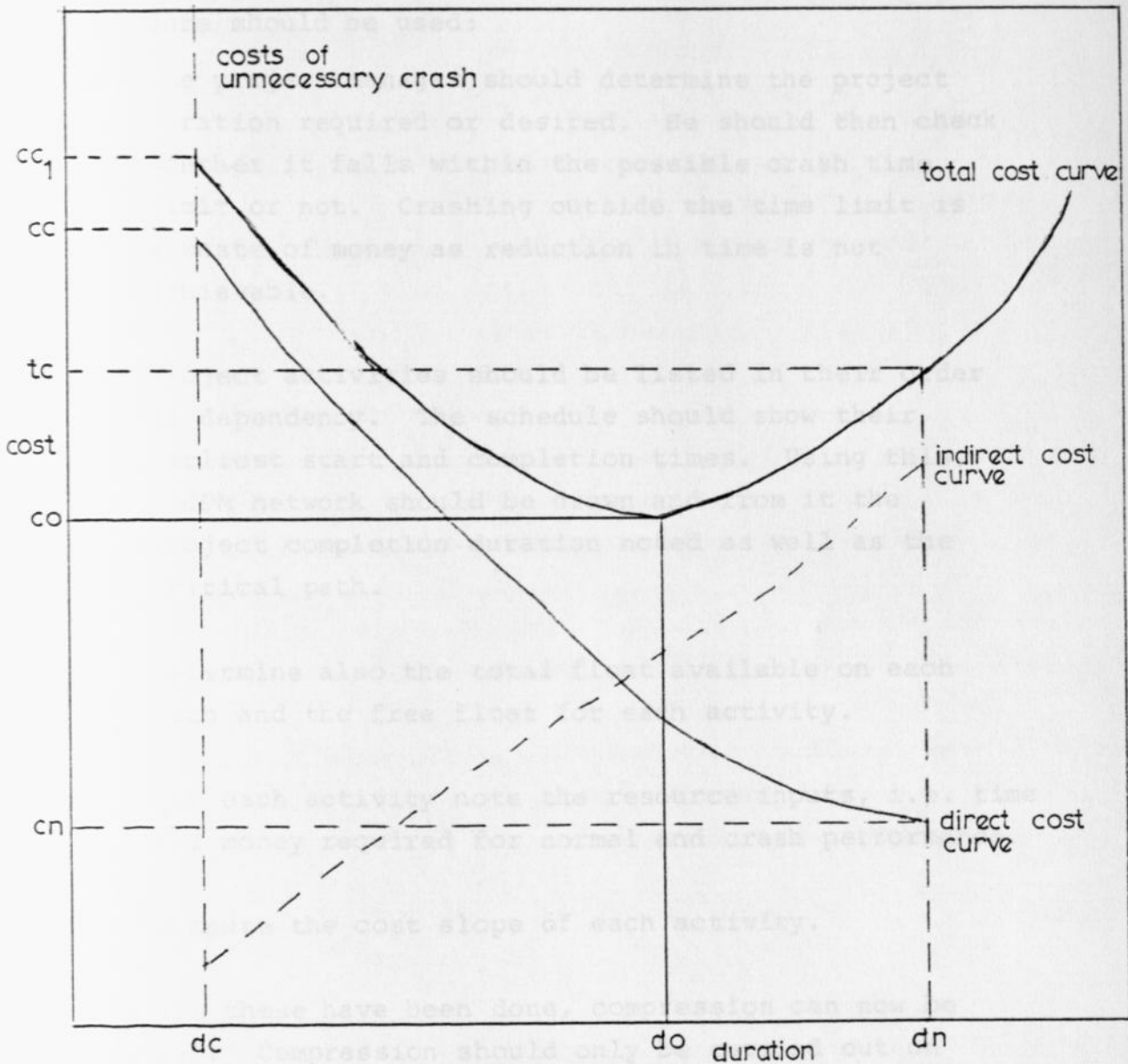
Figure 4-8 Graphical representation of normal duration versus crash duration.

The cost curve, although in theory is supposed to be linear, it normally assumes a parabolic shape. This means that the cost slope is not uniform but different at various points. To determine the various cost slopes, the curve can be broken into segments, each joining points of linear relationship. These segments can be analysed separately.

In calculation of crash duration and crash costs, it is useful to remember that project costs are not made of direct costs alone as depicted by the direct costs curve, but also include indirect costs. Indirect costs are mainly overhead costs. They also enjoy some relationship with time. Theirs is direct: they increase with the duration.

To compute the project total cost therefore, both direct and indirect costs have to be added. The product can be plotted to give a total cost curve. See figure 4-9. But in computation of total costs, it is important to note that indirect costs have two elements: fixed indirect costs and variable indirect costs. Fixed indirect costs are normally unlikely to reduce due to project time reduction. They cover items such as salaries of personnel in management. Indirect variable costs can on the other hand be reduced through time reduction. They comprise of items such as salaries for storemen, watchmen, insurance cover, etc.

When a project is being crashed, there is a time limit beyond which funds expended on crashing are wasted as they do not help in project duration reduction. Lying between crash time limit and normal time is a point where crashing can be done with maximum savings in costs. This is referred to as optimum duration (DO) and the cost as optimum cost (CO). DO and CO can be obtained on the total cost curve by joining the curve's point of lowest cost slope to the horizontal axis, representing duration; and the vertical axis, representing costs, respectively. This is shown in figure 4-9.



KEY:

CCI = Crash Cost + Indirect Costs at point DC

TC = Total Cost at point DN

CO = Point of Optimality

Figure 4 - 9. Total Cost Curve

In carrying out compression of a network the following procedure should be used:

- (a) the project manager should determine the project duration required or desired. He should then check whether it falls within the possible crash time limit or not. Crashing outside the time limit is a waste of money as reduction in time is not achievable. This continues until the required time is achieved, or where impossible, the crash limit is reached.
- (b) Project activities should be listed in their order of dependency. The schedule should show their earliest start and completion times. Using this, a CPM network should be drawn and from it the project completion duration noted as well as the critical path. The illustration shows a CPM network diagram, the original and the revised one.
- (c) determine also the total float available on each path and the free float for each activity. Some showing project activities with their associated float.
- (d) for each activity note the resource inputs, i.e. time and money required for normal and crash performance.
- (e) compute the cost slope of each activity.

Once all these have been done, compression can now be effected. Compression should only be carried out on activities on the critical path. It is waste of money to compress or crash activities with float time as this does not affect the project duration at all. While carrying out compression, remember to check total float and the free float available for each activity. It is possible for new critical paths to emerge after compression has been made. When this occurs and there is still need to continue with the compression, chosen activities on the critical paths should be compressed simultaneously.

All these borne in mind, the project manager or whoever is concerned, can mechanically compress the project duration. The activities with the lowest cost slopes are taken first. They are crashed to their crash limit. Then others are considered. This continues until the required period is achieved, or where impossible, the crash limit is reached.

An illustration of project duration compression is shown in table 4-3. It is about a project whose normal duration of 67 days, determined through critical path analysis, should be compressed to 53 days. The illustration shows the two CPM network diagrams, the original and the revised one (figure 4-10 and 4-11 respectively) and two schedules; one showing project activities and their resources, while the second showing project activities with their associated times, floats, costs, slope and proposed days for reduction. The schedules are labelled tables 4-3 and 4-4 respectively.

Figure 4 - 10 A CPM network indicating crashing. The critical path is 1, 2, 4, 5.

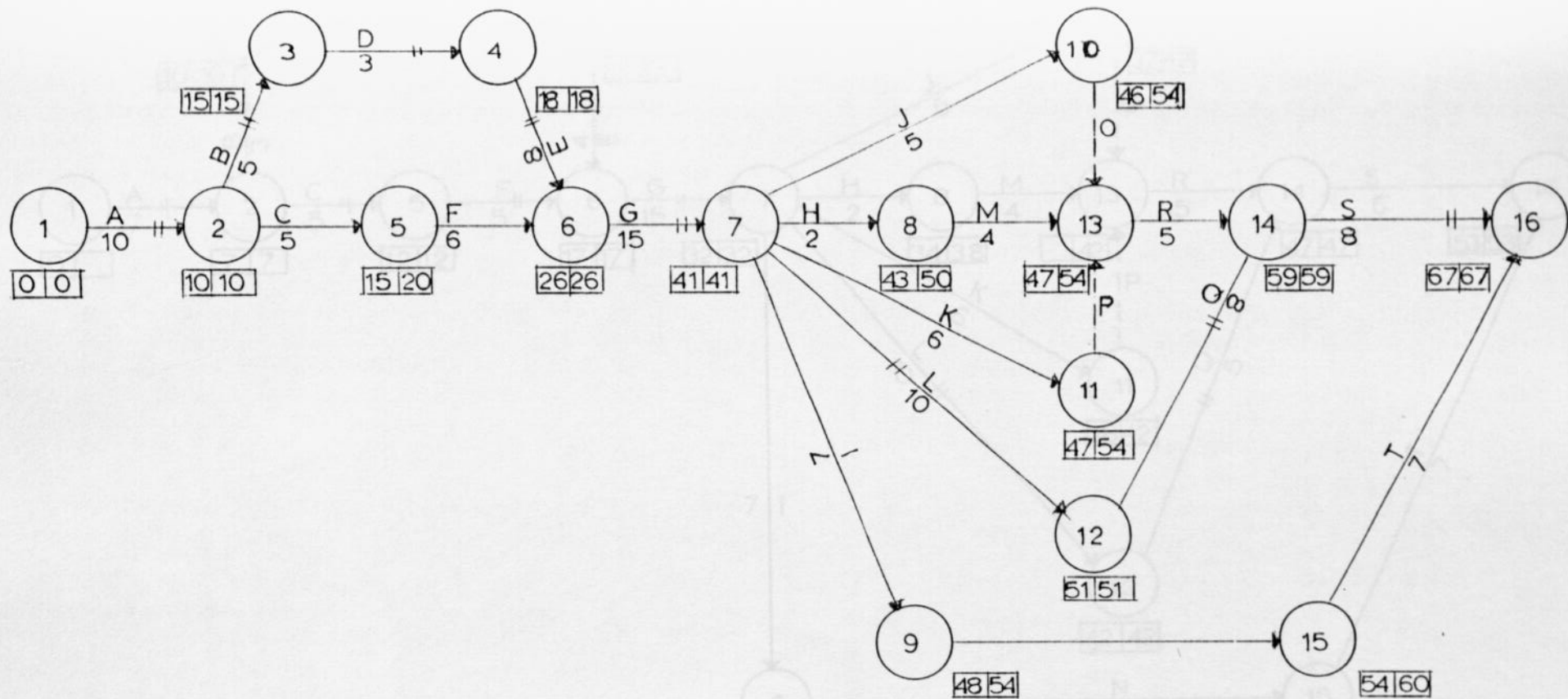


Figure 4 - 10 A CPM network indicating the project duration before crashing. The critical path is 1, 2, 3, 4, 6, 7, 13, 14, 15.

Figure 4 - 11 A CPM network after compression. The critical paths are: 1, 2, 3, 4, 6, 7, 14, 16 and 1, 2, 5, 6, 7, 13, 14, 16.

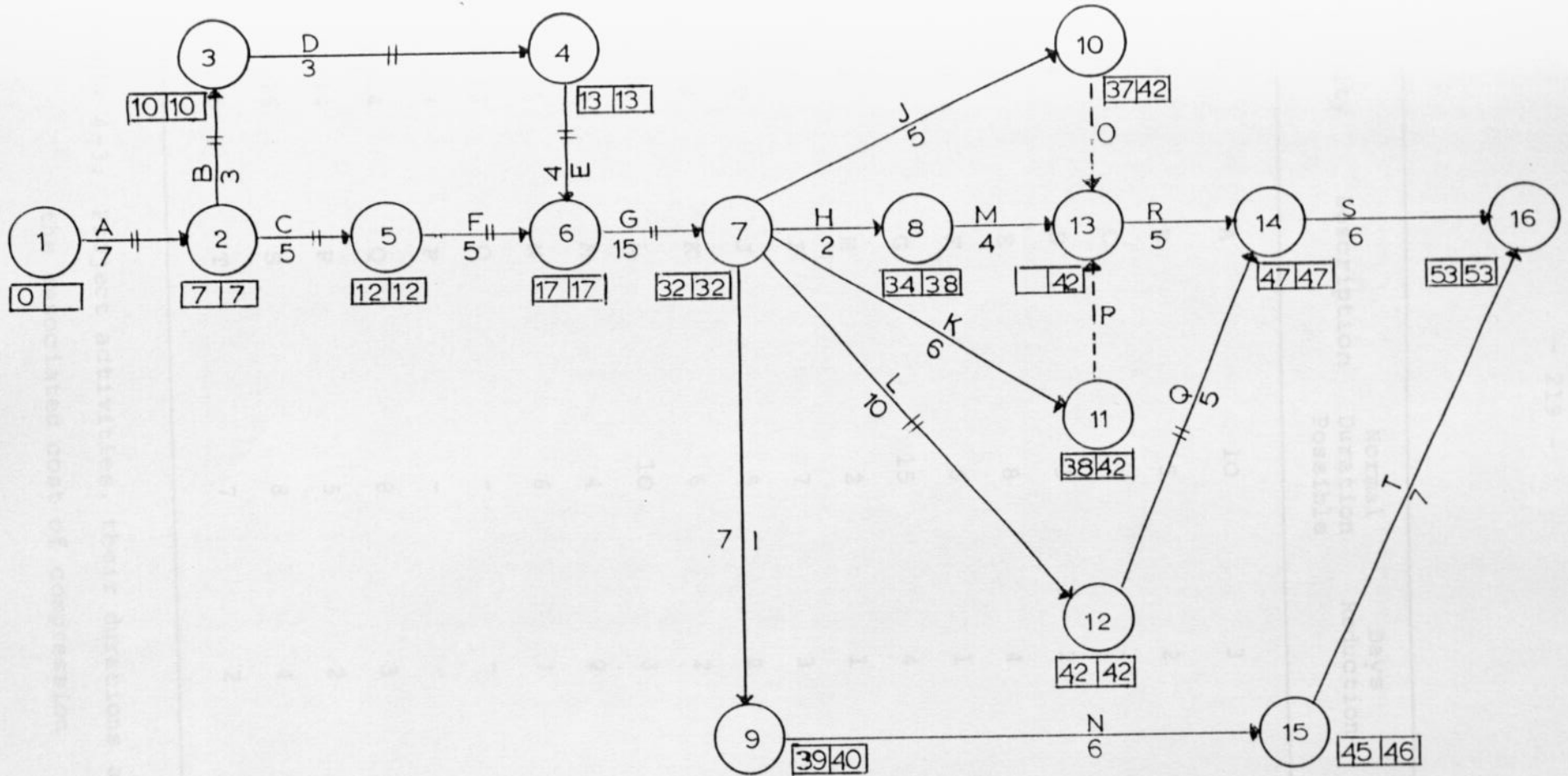


Figure 4 - 11 A CPM network after compression. The critical paths are: 1, 2, 3, 4, 6, 7, 14, 16 and 1, 2, 5, 6, 7, 13, 14, 16.

Activity	Description	Normal Duration Possible	Days Reduction	Cost £
1,2	A	10	3	120
2,3	B	5	2	20
2,5	C	5	1	200
3,4	D	3	2	170
4,6	E	8	4	300
5,6	F	6	1	180
6,7	G	15	4	2400
7,8	H	2	1	20
7,9	I	7	3	600
7,10	J	5	2	200
7,11	K	6	2	80
7,12	L	10	3	300
8,13	M	4	2	100
9,15	N	6	1	100
10,13	O	-	-	-
11,13	P	-	-	-
12,14	Q	8	3	150
13,14	R	5	2	150
14,16	S	8	4	800
15,16	T	7	2	150

Table 4-3: Project activities, their durations and the associated cost of compression

Activity	Dij	Start		Finish		Floats		Cost Slope	Compressed Dij
		ESi	LSij	ECi	LCij	TFi	FFij		
1,2*	10	0	0	7	7	0	0	40	7
2,3*	5	7	7	10	10	0	0	40	3
2,5	6	7	7	12	12	5	0	180	5
3,4*	3	9	9	12	12	0	0	85	1
4,6*	8	12	12	17	17	5	5	75	4
5,6	6	12	12	17	17	0	0	180	
6,7*	15	17	17	32	32	0	0	600	
7,8	2	32	36	34	38	7	0	20	
7,9	7	32	33	39	40	6	0	200	
7,10	5	32	37	37	42	8	0	100	
7,11	6	32	36	38	42	7	0	40	
7,12*	10	32	32	42	42	0	0	100	
8,13*	4	34	38	38	42	6	0	50	
9,15	6	39	40	45	46	6	0	100	
10,13	-	-	-	-	-	-	-	-	
11,13	-	-	-	-	-	-	-	-	
12,14*	8	42	42	47	47	0	0	50	5
13,14	7	38	42	43	47	7	7	75	
14,16*	8	47	47	53	53	0	0	200	
15,16	7	54	60	61	67	6	6	75	

Table 4-4: Project activities before and after compression

Compression on the network has been effected as follows:-

1st step

<u>Activity</u>	<u>By</u>	<u>To</u>	<u>Slope</u>	<u>Cost</u>	<u>Cumcost</u>	<u>duration</u>
1,2	3	7	40	120	120	64
2,3	2	3	40	80	200	62

(pause and check for TF and FF on path 1,2,5,6. There is a surplus float of 3 days)

12,14	3	3	5	50	150	59
4,6	4	4	75	300	650	55

(After crashing activity 4,6 by 4 days, path 2,5,6 has become critical. Infact it has a negative float of 1 day. To rectify the balance, one activity must be crashed by 1 day)

5,6	1	4	180	180	830	55
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2 more days are still required. Crashing activity 3,4 which has a cost slope of 85 by 2 days gives a cost of £170. In the process however, either activity 2,5 or 5,6 must be crashed since they will lie on a new critical path. The total implication will be £530. Further ahead the network it can be noticed that after crashing activity 12,14, path 7,9,15,16 has still a float of 2 days. It also can be noticed that activity 14,16 which has a crash limit of 4 days and lies on the critical path can be compressed at 200 per day. No other activity on adjacent paths need to be compressed. Since it has a cost implication of £400, as opposed to the previous one of £530, it should be preferred.

<u>Activity</u>	<u>By</u>	<u>To</u>	<u>Sope</u>	<u>Cost £</u>	<u>Cumcost £</u>	<u>Duration</u>
1,2	3	7	40	120	120	64
2,3	2	3	40	80	200	62
12,14	3	5	50	150	350	59
4,6	4	4	75	300	650	55
5,6	1	5	180	180	830	55
14,16	2	6	200	400	1230	53

Table 4-5: Summary of the compression

(v) Increase of supervision is one other corrective action normally taken when the project seem not to be meeting its target. This can be achieved through the stationing of a senior officer at the site to watch closely the implementation of activities, increasing the frequency of reporting, and also increasing the frequency of site visits.

(iv) Revision of targets and objectives is to some extent an admission of failure. It simply means that the targets have become impossible to achieve but not the objectives, and the project is not completely done. Some flexibility should therefore be brought in to make the project continue up to its logical end. For example, the time span should be increased, quality of workmanship moderated and possibly more money made available. The point to note is that where such a possibility exists, and it is considered to be the best one, it should be taken promptly. It should then be followed by strict control in form of closer supervision.

The Use of Meetings

It has been considered essential that this topic should be discussed at the end of this chapter simply because meetings have various functions which cut across all project control aspects discussed above. For example, properly organized meetings normally provide for the tabling of progress reports, for analysis of these reports and for the recommendation of the appropriate corrective action(s). This in essence is project control in its entirety.

The need for project meetings, their level of organization and regularity depends a lot on the complexity of the project and the intensity of the factors that have to be controlled. A multi-million shillings project would require more attention by both the implementors and the top management simply because it involves more components, resource inputs and time, and chances of things going wrong are higher. A small project on the other hand has very few risks and requires very little involvement, very few project meetings. Infact where meetings are held, they are more or less for briefing purposes.

It is not the intention of this study to discuss very much about project meetings and how they should be organized. Suffice to note that project meetings are useful and should be held regularly at all levels. Essentially, there are three levels at which project meetings can be held. The first level is at the site or drawing office, depending on the status of the project; and should involve the personnel dealing with the day to day activities of the project and their superiors. During this meeting, progress reports should be received on various activities. The meeting should also discuss what should be done, when and by which worker. Problems experienced in the past should be highlighted and those likely to occur taken note of. The regularity of these meetings should depend on the sizes of the tasks. If tasks are such that can be completed in one day, then these review cum assignment meetings should be held at the end of each day. If on the other hand the tasks are big, requiring a week or two, then meetings should be held when they are completed.

Meetings can also be held at a semi-management level. Such meetings, held after a fortnight or a month, should involve the project manager and his team on one side, and the contractor and possibly his sub-contractors on the other. Performance of the project should be reviewed in its totality. The purpose is to establish at that level whether project objectives are being fulfilled or not. Again, reports should be received, reviewed and where necessary, targets revised.

The third level meetings are not regular and are more or less convened when a problem requiring the sanctioning of the top management has occurred. Problems of this nature include sanctioning of variation orders, recruitment of additional staff and reallocation of funds. Participants in such meetings are mainly the project manager and the executive members of the organization. Various departments of the organization should be represented, more or less in a consultancy capacity.

Conclusion

In this chapter, the usefulness of project control, especially in respect to the management of building construction projects, has been discussed. Over and above this, the discussion has also touched in an elaborate manner on the methodology of project control, its essential elements and how they are intergrated to form a control system.

A useful observation that can be made is that project control is not an exact science - infact it is more of an art. This means that understanding the process of project control as discussed above is not enough.

Some personal element, call it intuition, experience, etc. is also required. It is infact this element which draws the line between good and bad managers. For example there are plenty of project managers all over the world with little training in scientific management, and yet very successful. There are others on the other hand who are adequately trained and yet present cases of what a project manager should not be. This study therefore places emphasis on both the development and use of appropriate management techniques and "the personal touch".

To complement the above, the project manager should try to thoroughly understand his project: know what is involved and the pitfalls lying ahead. He should most of all develop an alertness in detecting unexpected situations. This alertness should be argued by an ability to find solutions to the problems that have occurred and foresight to replan under the changed circumstances.

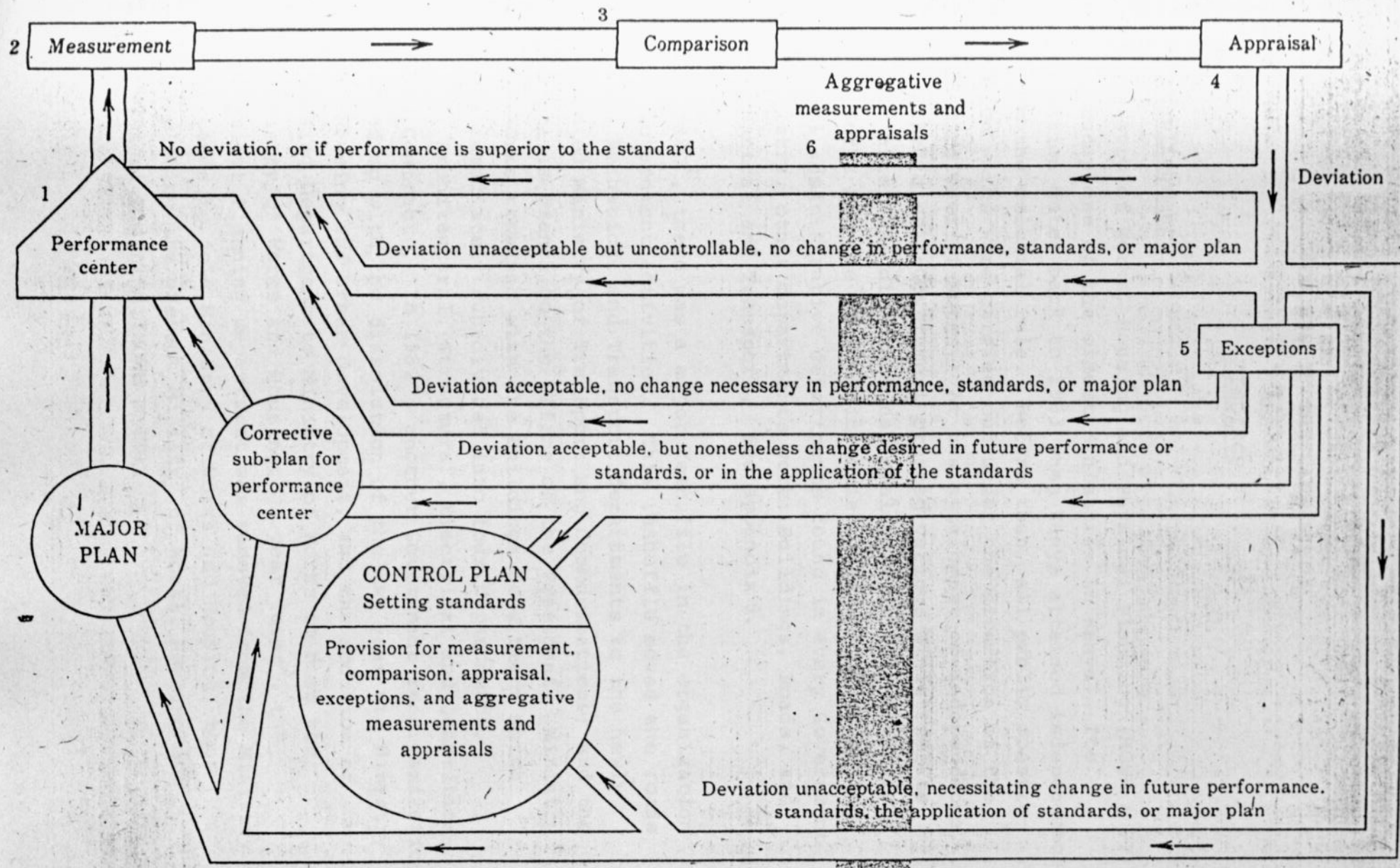
It is not enough for the project manager to have all these qualities and show them practically. He should also realise that project control is a concerted effort. He should therefore guide both his staff and the contractor on the application of some of these techniques. For example he should guide the contractor on the use of networks or CPM bar charts for purposes of project control. The contractor should also receive guidance in respect to resource utilization. To his own staff, he should give concise co-ordination procedures. They should know from whom to receive orders and to whom they should report.

Finally, project control should end with a recorded postmortem of how the project in question was implemented. The postmortem should note whether any warning signals about impending dangers were ignored and as a result the project objectives not fully realised. Where the warning signals were heeded, was the response fast? Was the environment stable? Note should also be taken of the likelihood of some of these factors recurring. All these help in improving the managers' experience and therefore making him better for the benefit of future projects.

To end this discussion, let Murphy's Maxim be quoted again: "if anything can go wrong, the chances are that it will". The project managers and all those involved in projects should try as hard as possible to ensure that the chances of things going wrong do not exist.

Footnotes

1. O.P. Kharbanda et al, Project Cost Control in Action, (London: Gower, 1980), P. 35.
2. Andrew Parkin, Systems Management, (London: Edward Arnold Publishers Ltd, 1980), P. 71.
3. Kast and Rosenzweig, Organization and Management - A Systems Approach, (International Student ed., New York. McGraw-Hill, 1970), P. 472.
4. Ibid., P.
5. Kast and Rosenzweig, Organization and Management A Systems Approach, (International Student ed, New York: McGraw-Hill 1970) PP.
6. Andrew Parkin, Systems Management, P. 109.
7. H.N. Ahuja, Construction Performance Control by Networks, (New York: A Wiley-Interscience Publication, 1976), PP. 441-446.
8. Ibid, P. 452.
9. Parkin, OP. Cit. 1
10. Ibid.
11. P.O. Kharbanda, Project Cost Control in Action, (London: Gower, 1980), P.
12. Ahuja, O-P. Cit. P. 456.



CHAPTER 5

RESULTS OF THE CASE STUDY

FINDINGS

Establishment

Ministry of Works, Housing and Physical Planning (MOWH & PP) is today one of the oldest Ministries in Kenya. Its creation dates back to 1963 when Kenya attained independence from the colonial rule. Before then, all public construction works were carried out under the direction of the Commissioner of Works. At the attainment of independence, the Kenya self-Government created various Ministries to look after the different national activities. Ministry of Works was one of the Ministries created. Besides the usual administrative departments found in every Government Ministry, other departments were: Buildings, Roads, and Mechanical and Transport. See appendix 9.

In 1980¹, there was a major reshuffle in the organization of Government activities. This reshuffle moved the roads and, Mechanical and Transport departments to the newly created Ministry of Transport and Communications; and the Supplies Branch to the Office of the President. Ministry of Works remained with the Buildings department which was immediately sub-divided into four departments, i.e. Architectural, Structural, Electrical and Quantities and Contracts. In 1982², another Government re-organization ended up with the dissolution of the two year old Ministry of Housing and Urban Development, and the addition of Housing Department to Ministry of Works to form the Ministry of Works and Housing. A year later³, the Physical Planning department was removed from the Ministry of Lands to join Ministry of Works and Housing, thus completing the present Ministry of Works, Housing and Physical Planning (MOWH & PP).

The MOWH & PP establishment also consists of two parastatal and two semi-parastatal organizations. The parastatal organizations are the National Housing Corporation and the National Construction Corporation. The semi-parastatal ones are the Housing Research Development Unit based at the University of Nairobi and the Kenya Building Centre.

Responsibilities

In the last 5 years, there have been 4 re-organizations of Government Ministries. Each of these has had a significant effect on the responsibilities and operations of the Ministries concerned. 3 of these re-organizations have directly touched on the functions of MOWH & PP. Before 1980, the Ministry was charged mainly with the responsibility of creating and maintaining infrastructural facilities. It also bore the extra responsibility of running the Government Supplies stores.⁴ The changes of 1980 reduced the Ministry's responsibilities significantly, leaving it with the construction and maintenance of buildings alone. In 1982, the responsibilities were increased when the Housing Department was added to the Ministry. The following year saw further enlargement when the Physical Planning department was added and the Supplies Branch returned from the Office of the President where it had been based for the last 3 years. The fourth re-organization of Ministries, effected in March, 1985 did not touch on the responsibilities of MOWH & PP.

The responsibilities of MOWH & PP are stated in the Presidential Circular No.1/83 of 3rd October, 1983. They are:

- (i) Public Works
- (ii) Buildings (construction)
- (iii) Maintenance of Buildings
- (iv) Government Housing
- (v) Electrical Services

- (vi) Inventory of Government property
- (vii) National Construction Corporation
- (viii) National Housing Policy
- (ix) Urban Development
- (x) National Housing Corporation
- (xi) Physical Planning
- (xii) Supplies Branch

Although MOWH & PP has 12 defined functions, most people still largely view it as mainly concerned with the construction and to a small extent, maintenance of public buildings. Examples of public buildings are: hospitals, schools, offices for various Ministries, police posts and stations, Army barracks, pool and institutional houses, etc. This function or responsibility is the one that has generated a lot of criticism for the Ministry from various quarters, thus necessitating this study.

The fact that the Government considers the construction of buildings a major priority in the national development process is already discussed in chapter 1. The major indicator of this is the amount of money voted annually for expenditure on building construction. See table 1.3, page 16. A comparison of the funds voted for building construction (as in table 1.3) with the Gross Provisions in the Development estimates indicates that on average 20 percent of the development funds goes into building. In comparison with other development activities undertaken by other Ministries, this is the biggest consumer.

Construction of buildings is not a single activity as it might appear from the definition of MOWH & PP responsibilities. It is a function made up of several major activities, most of them specialized and requiring professional knowledge of execution.

The activities are listed below in a condensed form. For a detailed breakdown, see appendix 10.

- (i) Receipt of briefs from the client Ministries
- (ii) Preparation and submission of the sketch drawings for their approval
- (iii) Estimation of the total costs for the client Ministries use in the preparation of the Forward Budgets. Forward budgets are used by the client Ministries to inform the Treasury of their future commitments and their monetary implications.
- (iv) Detailed design of buildings
- (v) Documentation, i.e. preparation of the working drawings, bills of quantities and specifications.
- (vi) Contracting of the projects
- (vii) Supervision of the contractors and certification of their payment
- (viii) Certification of the completed works and "handing over" to the owners (client Ministries).

Apart from these activities, the Ministry also undertakes activities directly required for smooth implementation of the projects. These include the preparation of the works programmes, planning through bar charts, monitoring of the projects' progress, preparation of the Project status reports, requisition of funds and revision of contract sums where necessary. The Ministry is also responsible for advising on construction standards for various facilities in the country.

Organization

The present Organizational Structure of MOWH & PP has been in use for only 5 years. It was introduced after the Government's re-organization of 1980. Prior to that, the Ministry utilized a structure that could be classified as matrix in form.

(i) The Present Structure: It is hierarchical in form; what is normally referred to by Management Scientists as Functional Organization structure. It became operational early 1980. Under this structure the Ministry is separated into 7 departments listed below:

- (i) Administration: composed of Personnel, accounts and supplies branches
- (ii) Architectural
- (iii) Quantities and Contracts
- (iv) Electrical (with mechanical)
- (v) Structural
- (vi) Physical Planning
- (vii) Housing

See appendix 11 for the diagrammatic representation of the Ministry's organizational structure.

The structuring of the departments is essentially based on Work specialization. Unlike other Government Ministries, MOWH & PP is charged with very specialized work requiring personnel of high professional training. Infact members of the administration department are the only ones with general training and can fit easily in other Ministries.

MOWH & PP like all Government Ministries is headed by a Minister and his two Assistants, who are all Presidential appointees. Below the Minister is the Permanent Secretary also a Presidential appointee, who is the executive officer of the Ministry and controls all its day to day administrative work. Reporting to him are the various departmental heads. Apart from the departments of Administration and Physical Planning, which are headed by the Deputy Secretary and the Director of Physical Planning respectively, all other departments are headed by Chiefs.

Below the departmental heads, the hierachical order is as follows: deputy chiefs, team or sectional leaders, professional staff members, sub-professional staff members and the supporting staff. The supporting staff are mainly the executive officers, clerks, secretaries/typists and the subordinate members, i.e. drivers, cleaners and office messengers.

The structure of the Ministry so far discussed reflects the position in the head office. The Ministry however has been decentralized beyond this level. It has offices in the provinces and districts. The Ministry's head in the provinces are known as Provincial Works Officers (PWOs). They are 8 in number and are based at the Government provincial headquarters i.e. Nairobi, Kakamega, Kisumu, Nakuru, Embu, Garissa, Nyeri and Mombasa. These officers deal with the day to day affairs of the Ministry at that level. Their offices are staffed with members of various professions, drawn from their respective departments in the head office. These officers take care of their departments' functions in the Provinces. They are however more intergrated and work as a team. Also reporting to the PWOs are the District Works Officers (DWOs). These officers are fast becoming important personalities in the Ministry's projects implementation programmes as a result of the Government's decentralization programme generally known as the District Focus. Although their offices do not have enough or all members of the various professions in MOWH & PP setup, it is the Ministry's desire that they should in the long run be fully staffed. The Districts are further divided into what is referred to as MOWH & PP depot offices. Heading depots are Building Superintendents. Their staff is an assortment of various tradesmen. The depots are mainly used for the storage of resources used in the maintenance projects and other small development projects utilizing departmental labour.

In respect to building construction, only 4 departments are directly involved. They are: Architectural, Structural, Electrical, Quantities and Contracts departments. The other departments' contribution is not quite significant, and therefore, does not warrant much attention.

The Architectural department is the biggest of the 4 departments mentioned above. It is headed by the Chief Architect and its staff consists of Architects, Building Surveyors, Land Surveyors, Draughtsmen and the general supporting staff. See table 5.4. The department is directly responsible for the implementation of building projects. The Architects collect the briefs, prepare sketch drawings, design, prepare working drawings, participate in the selection of the contractors and also the negotiation of funds with the Treasury. When the projects commence on sites, they become responsible for their supervision and general management. Because of their wider role in the implementation of projects, they are generally accepted by other professional members as team or project leaders. The project leader is generally referred to as the DR, i.e. Departmental Representative.

Below the Chief Architect are the Chief Superintending Architects. These are three in number and are designated Chief Superintending Architects: Development, Administration and Recurrent respectively. Below the Chief Superintending Architects are the Senior Superintending Architects. These are also three in number and control Superintending Architects - or what are generally known as Group Leaders. The department is divided into 10 groups named Group I to X. The first eight groups deal with architectural works i.e. designing, supervision of projects, etc. The last two i.e. the Forward Planning Group (FPG) and the Survey Section deal with non-architectural matters.

The FPG deal with the preparation of Works Programmes, monitoring of the projects' performance and the preparation of the Job Status Reports. The group is staffed with building surveyors and programmers, who are essentially Land Economists in training. The Survey Section is on the other hand staffed with Land Surveyors and deals with the surveying of sites and preparation of site plans.

The Quantities and Contracts department is next to the Architectural Department in terms of size and also output in the implementation of building projects. It is headed by the Chief Quantity Surveyor (CQS) who is a professionally qualified Building Economist. Immediately below him are Senior Superintending Quantity Surveyors. These are three in number and oversee the Superintending Quantity Surveyors. The Superintending Quantity Surveyors are given the responsibility of overseeing the various teams (8No) staffed with Quantity Surveyors, Assistant Quantity Surveyors and Quantity Surveying Assistants. Besides these, there are sections of the department such as the Contracts Offices which are staffed with a high proportion of clerical staff. Attached to the department are also the Computer Bills Unit and the Cost Planning Unit.

The department's responsibilities are mainly to prepare specifications and bills of quantities, tender projects, examine various bids made on tendered projects, prepare contract documents, measure and certify the values of works carried out and also close or finalise contracts accounts. In undertaking its responsibilities, the department has a very important task of ensuring that projects are undertaken at a very reasonable cost. Therefore, when projects are received and their briefs confirmed, the Quantity Surveyors come in to advise on the estimated costs of construction and where possible, the most cost effective methods of implementation. They also advise on the cost implications of variation orders and site instructions.

The Electrical department also plays a significant role in the implementation of projects. The department is more or less a merger of two professional engineering groups, i.e. Mechanical Engineers and Electrical Engineers. It is headed by the Chief Electrical Engineer supported by 2 Senior Superintending Engineers and 5 Superintending Engineers. Below them are the Engineers separately designated as Mechanical and Electrical Engineers respectively. Other members of the department are superintendents (Electrical and Mechanical), Inspectors, draughtsmen and the general supporting staff.

The department's contribution is to provide professional input in respect to the designing, procurement, installation and servicing of both electrical and mechanical equipment (services) in public buildings. It has 5 working teams taking care of projects of various votes. Besides these teams, the department also provides the Government's Chief Fire Officer who advises on standards and necessary fire precautionary measures to be undertaken in construction to minimize fire hazards.

Last but not least in importance is the Structural department. It is headed by the Chief Structural Engineer supported by 3 Senior Superintending Structural Engineers and 4 Superintending Engineers. Below them are Engineers, Assistant Engineers, draughtsmen and the general supporting staff. The department's internal organization structure is completely different from others examined in the sense that whereas other departments distinguish their teams by means of votes (Ministries) under which the projects fall, the latter effects its distinction through Geographical locations. Engineers are also allocated projects as they come!

The department is staffed with Civil Engineers whose main tasks are two: provide designs for the structural elements of the buildings, and also evaluate the drainage factor of the sites and provide suitable drainage system.

- (ii) The Previous Structure: Prior to the adoption of the present M.O.W.H & P.P. organization structure, the Ministry utilized a matrix organization structure. See appendix 9.

At the top was the Minister, followed by the Permanent Secretary, departmental heads, branch heads, sectional heads, professional staff members and finally the supporting staff. The Ministry was divided into 4 departments, i.e. Buildings, Roads, Mechanical and Transport, and Administration. There were 5 Provinces. These were not based on the Government Provincial Administrative boundaries but on zones envisaged by the Ministry to be easily accessible from certain centres.

The Buildings department was charged with the responsibilities of creating and maintaining buildings. Working towards the accomplishment of these objectives were the same professionals that are engaged in the same exercise today. The only difference is that all of them were answerable to the Chief Architect, who was the head of the Buildings Department. Below the Chief Architect were the Chief Quantity Surveyor, the Chief Electrical Engineer, the Chief Structural Engineer and the Chief Superintending Architect. These were in-charge of their respective professionals. The various professionals were drawn from their respective branches and intergrated into a building team. There were 6 such teams, i.e. Health I, Health II, Public Buildings (PB) I, Public Buildings II, Public Buildings III and Housing. Each of them was headed by a team leader who was an Architect by training. Appendix 12 shows the Buildings department's organization structure.

The Ministry's organization in the provinces was somewhat similar to the present one. The only difference being that the provinces then were headed by the Provincial Engineers (PE). The Provincial Engineers had a multi-disciplinary staff composed of Architects,

Quantity Surveyors, Engineers and Maintenance Surveyors. These officers were responsible for the implementation of building projects designated for execution at that level. The projects were normally small ones, not exceeding £. 150,000. Although the Ministry had depot offices, it did not have well developed district offices to undertake building project. A comparison of the two organizational forms is summarized in table 5.1

The Previous Organization Structure	The Present Organization Structure
1 department involved in building projects	4 departments involved in building projects
Organization structure similar to the Matrix Organizational Model. All professionals worked together as a team and were responsible to the head of the department- the Chief Architect	Organization structure similar to the Functional organizational Model. Professionals work separately and are answerable to their respective departmental heads - also of similar training background.
6 Multi-disciplinary building teams. Team members answerable to the Team Leader on their day to day activities, and to their respective Chiefs on all professional matters.	Each department has its own teams. The Architectural department has 10, the Quantities and Contracts..... ⁸ the Electrical .5... and the Structural .4... The teams have no properly defined horizontal relationship.

Table 5 - 1. Previous vs Present Organization Structure:
a Summary of the distinct features.

WorkLoad

The Ministry's workload discussed here is one pertaining to building construction projects. (see table 5.2).

During the survey, it was found that much of the workload, approximately 65 percent, is borne by the headquarters staff. The remainder is undertaken by the Provincial and District offices staff, and the consultants. (see table 5.3).

Year	Value of Works	Voted funds £	Number of Projects		
			On going	Design	Total
1976/77	99,286,155	19,398,000	247	362	609
1977/78	139,382,139	29,651,000	378	356	734
1978/79	204,159,532	40,148,000	451	643	1094
1979/80	249,989,558	46,111,146	492	725	1217
1980/81	348,840,383	59,174,000	605	969	1574
1981/82	390,683,701	64,577,111	643	1011	1654
1982/83	454,426,111	64,535,428	705	1477	2182
1983/84	464,235,537	46,217,815	739	1205	1944

KEY

1. The term "on-going" covered all projects on the AWP that are at Post-tender stages of implementation.
2. The term "Design" cover all projects on the AWP that are at pre-tender stages of implementation.

Table 5 - 2 - M.O.W.H. & P.P.'s Workload.

YEAR	HEADQUARTERS £	PROVINCES £	CONSULTANTS £	TOTAL VALUE £
1976/77	76,340,025	19,645,202	3,300,928	99,286,155
1977/78	940,282,295	35,054,421	10,199,423	139,382,139
1978/79	150,075,885	39,675,342	14,408,307	204,159,532
1979/80	140,619,464	87,539,761	21,830,303	249,989,558
1980/81	231,673,920	72,062,199	45,104,270	348,840,383
1981/82	216,530,693	109,271,598	64,881,410	390,683,701
1982/83	283,740,528	113,401,092	57,284,491	454,426,111

Table 5.3 - Value of work as per centres of implementation. (Source: Forward Planning Group, Ministry of Works, Housing and Physical Planning; Annual Works Programme Index - 1976 - 1984).

The value of the work undertaken by M.O.W.H. & P.P. is recorded in documents known as the Annual Works Programmes (AWP). The AWP is prepared on annual basis by the Forward Planning Group (F.P.G.) and lists all building projects being undertaken by M.O.W.H. & P.P. regardless of their status. The projects on the AWP are normally funded or approved for funding by the Treasury, and have sites already confirmed by the Commissioner of Lands. See appendix - 1 for an example of an AWP.

In estimating the Workload, the officials of the Ministry normally look at the number and value of the projects on the AWP. Although this method is easy and quick to use, the Ministry officials concede that it is quite superficial. In the first place, an enumeration of the number of projects on the AWP is inaccurate. This is because the projects are not uniform in size and scope. Secondly, the projects are undertaken under varying environmental conditions, which make each project unique in its own way. Consideration of the value on the other hand is not sufficient. This is because when the AWP is being prepared, i.e. at the beginning of every financial year⁶, various projects are at various stages of implementation. Some of the projects are at commencement stage and still require a lot of input before they get underway, others are on-going, while others are at practically complete stage and require only the preparation of the final accounts before they are completely done away with. It is therefore quite obvious that projects at these varying stages do not generate the same amount of workload over a given period, be it one year or a quarter of it.

Using the method discussed above, the workload for each year borne by the Ministry between financial years 1976/77 and 1983/84 was calculated and shown in table 5.2.

Table 5-2 indicates quite clearly that the workload undertaken by the Ministry has grown tremendously in the last 8 years. The growth between 1976 and 1984 can be noted as approximately three-fold, notwithstanding the effects of inflation.

There is also another method used in the Ministry, especially by the Architectural department in estimating workload. The method appears to be recent as there is evidence of its use in the last 3 financial years only. Its accuracy is also questionable since it is based on a number of assumptions as follows:-

- (i) the headquarters is the critical centre for projects implementation and its personnel have a direct involvement in all projects on the AWP be they projects commissioned to consultants or done in the provinces.
- (ii) The architectural department is the key department in terms of responsibility for the implementation of the building programmes. Other departments merely complement its efforts and can for all practical purposes be regarded as consultants.
- (iii) the work done in the provinces, by consultants in the private offices and by other M.O.W.H. & P.P. departments is by and large supervised by the architectural department. In calculating the workload for the architectural department a percentage of this workload should be reflected in its total workload.
- (iv) many of the projects undertaken by the Ministry are either repetitive in design content and utilize standard

designs or re-usable details. The estimation given for such projects is 70 percent of the total value of work on the AWP. 30 percent of the workload is assumed to be one-off. This assumption is in respect to design workload.

- (v) Since it is clear that not all projects on the Works Programmes are under design, some are on-going, a weighting factor is used which equates the workload for on-going projects to that of projects under design. It is assumed that where there are two projects; one on-going and the other under design, the total amount of time and effort which goes into the on-going project is equivalent to only 25 percent of what goes into the one under design.

Using the method described above, the Ministry determined the workloads for financial years 1981/82, 1982/83 and 1983/84 as £. 180,202,328, £. 194,513,044 and £. 207,692,100 respectively. See appendices 13, 14 and 15.

The values of the workload indicated above are for the Architectural department, but as already made clear in the assumptions, the architectural department is responsible for the entire Ministry's building programme and other departments do more or less what it gives (assigns) them to do. This is an aspect which has generated a lot of friction between the architectural department and the other 3 departments. The other departments keep questioning whether it is only the architectural department, or conversely the architect, that is capable of taking charge of the building programmes. They content that they have equal capability and should be let to handle

projects on their own, with as little supervision from the architectural department as possible. The structural department for example does not understand why it should be supervised when it is carrying out purely structural or drainage works. The electrical department on the other hand feels the same about the architectural department's involvement in works of electrical nature e.g. installation of equipment in hospitals and other institutions. The Architectural department on its part contents that the architect traditionally has been in-charge of the building team and the position should not be reversed now. If anything, the grumbling departments should be brought under its complete fold so that effective supervision and coordination can be ensured.

Staffing

Table 5-4 shows the M.O.W.H. & P.P. personnel directly involved in the implementation of building projects. The table lists in departmental order the various professionals engaged, their qualifications and areas of involvement.

An area noted as a major handicap in the implementation of projects is the adequacy of staff. The Chief Architect in a paper entitled "Constraints on Implementation of Government Projects Through Ministry of Works, Housing and Physical Planning", presented at the Kenya Institute of Administration (K.I.A.) in November 1984, noted that the professional staff situation has improved very little over the past 15 years. In contrast, the government building programme has been expanding very rapidly. This has resulted into the need to commission very many consultants to assist in the implementation of the building programme.

Table 5-4: M.O.W.H. & P.P. Staff undertaking building projects

Departments	Staff	Qualifications	Responsibilities
Architectural	Architects	B. Arch. + Professional exams	Designing and supervision of projects Training of fresh architects
	Asst. Architects	B. Arch.	Designing and supervision of projects - but under the supervision of architects
	Architectural Ass.	Diploma or other related training at the Polytechnics	Draughting
	Building Programmers	B.A. Land Economics	Forward Planning & Programming of Projects
Quantities & Contracts	Quantity Surveyors	B.A. Building Economics + professional exams	Production of bills of quantities and contract administration
	Asst. Q. Surveyors	B.A. Building Economics	Production of bills of quantities but under supervision of Q.S.
	Q.S. Assts.	Training at the Polytechnics	Help in the production of bills of quantities and cross-checking of tenders
Electrical	Engjneers	B.Sc. Engineering (Elec. & Mechn) Professional exams	Electrical and Mechanical designs. Training of fresh engineers
	Asst. Engineers	B.Sc. Engineering (Elec. or Mechn) Professional exams	Electrical and Mechanical designs. Work under supervision
Structural	Engineers	B. Sc. Civil Engineering	Structural & drainage designs
	Asst. Engineers	B. Sc. Civil Engineering	Structural & drainage designs. Work under supervision
	Engineering Assts.	Diploma or other related training at Polytechnic	Draughting

About the sources of the problem, he observed that they are two. The first one is the inability of the local University (University of Nairobi) to produce sufficient professionals to meet the needs of the Government, the Private Sector and Other East African Countries. The second is the Government's poor remuneration package which is in attractive, and often scorned by young professionals. These factors make it difficult for the Ministry to recruit and retain more and better professionals. These views were also echoed by other members of the Ministry interviewed. They seriously felt that the money spent annually on consultancy fees could be used to improve the salary structures of the professional staff in the Ministry. This would not only make it possible for the Ministry to recruit more staff, but also to keep them highly motivated, thus increasing productivity.

The Chief Architect summed up the staff position in the Ministry by stating that for the Ministry to cope up with its current (1983/84) design workload, it would require not less than 150 architects and twice as many architectural assistants.

In trying to verify the shortcomings of M.O.W.H. & P.P. staff revealed by the Chief Architect and other Senior staff members of the Ministry, the study came up with findings which are tabulated in table 5-5. The details in the table show M.O.W.H. & P.P. staff between financial years 1976/77 and 1983/84 in 3 categories. The first category is shown in the first sub-column of each financial year and is in respect to the existing staff. The number of the existing staff is based on the Personnel records. The second category is in respect to the establishments, i.e. posts for the various professionals approved by the Directorate of Personnel Management (DPM)

Department	Professional Staff	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84
Architectural		EX ES R	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R
	Architects	39 48 56	36 48 79	43 52 116	49 52 141	58 54 198	69 56 219	78 66 243	84 66 264
	Arch. Asst.	53 71 37	53 75 53	55 124 77	57 123 98	51 158 132	54 163 146	51 167 162	51 162 176
	B Programmers	4 4 25	4 4 27	2 4 27	6 4 33	6 4 33	6 6 33	6 6 33	5 6 33
	L. Surveyors	- - 4	2 - 6	2 - 6	1 - 8	2 - 8	3 - 12	6 - 12	8 - 12
	L. S. Assts.	3 5 6	4 15 16	9 17 27	12 21 34	11 26 44	15 29 50	17 29 50	17 29 54
Quantities & Contracts	Q. Surveyors	26 33 22	24 38 32	30 50 46	36 50 56	40 48 99	41 52 91	19 52 97	62 53 108
	Q.S. Assts.	29 45 25	30 52 36	31 57 49	33 57 51	40 57 63	43 57 91	46 57 101	51 52 110
Structural	Engineers	13 11 19	15 11 18	17 16 24	16 16 28	22 30 38	29 32 42	36 32 45	34 32 49
	Draughtsmen	8 21 -	7 21 13	25 34 12	29 34 14	37 51 19	48 56 21	52 56 20	55 56 22
	Inspectors	1 1 -	1 1 -	2 2 -	2 2 -	2 2 -	2 2 -	2 2 -	2 2 -
	Arch. Assts.	2 2 -	2 2 4	3 3 4	3 3 4	3 3 4	2 3 4	3 3 4	3 3 4
Electrical	Engineers	14 23 14	19 23 18	21 34 24	27 34 28	28 46 38	31 46 42	37 46 45	42 46 49
	Superintendents	20 21 -	19 21 -	21 20 -	21 20 -	26 26 -	30 30 -	30 30 -	34 30 -
	Inspectors	168 202 -	168 202 -	163 170 -	156 170 -	159 176 -	159 176 -	167 176 -	163 244 -
	Draughtsmen	16 21 7	17 21 9	12 21 12	12 21 14	17 23 19	21 23 21	21 23 40	21 21 44

KEY: EX - Existing staff

Department	Professional Staff	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84
Architectural	Architects	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R	EX ES R
		39 48 56	36 48 79	43 52 116	49 52 141	58 54 198	69 56 219	78 66 243	84 66 264
		53 71 37	53 75 53	55 124 77	57 123 98	51 158 132	54 163 146	51 167 162	51 162 176
		4 4 25	4 4 27	2 4 27	6 4 33	6 4 33	6 6 33	6 6 33	5 6 33
	L. Surveyors	- - 4	2 - 6	2 - 6	1 - 8	2 - 8	3 - 12	6 - 12	8 - 12
	L. S. Assts.	3 5 6	4 15 16	9 17 27	12 21 34	11 26 44	15 29 50	17 29 50	17 29 54
Quantities & Contracts	Q. Surveyors	26 33 22	24 38 32	30 50 46	36 50 56	40 48 99	41 52 91	19 52 97	62 53 108
	Q.S. Assts.	29 45 25	30 52 36	31 57 49	33 57 51	40 57 63	43 57 91	46 57 101	51 52 110
Structural	Engineers	13 11 19	15 11 18	17 16 24	16 16 28	22 30 38	29 32 42	36 32 45	34 32 49
	Draughtsmen	8 21 -	7 21 13	25 34 12	29 34 14	37 51 19	48 56 21	52 56 20	55 56 22
	Inspectors	1 1 -	1 1 -	2 2 -	2 2 -	2 2 -	2 2 -	2 2 -	2 2 -
	Arch. Assts.	2 2 -	2 2 4	3 3 4	3 3 4	3 3 4	2 3 4	3 3 4	3 3 4
Electrical	Engineers	14 23 14	19 23 18	21 34 24	27 34 28	28 46 38	31 46 42	37 46 45	42 46 49
	Superintendents	20 21 -	19 21 -	21 20 -	21 20 -	26 26 -	30 30 -	30 30 -	34 30 -
	Inspectors	168 202 -	168 202 -	163 170 -	156 170 -	159 176 -	159 176 -	167 176 -	163 244 -
	Draughtsmen	16 21 7	17 21 9	12 21 12	12 21 14	17 23 19	21 23 21	21 23 40	21 21 44

KEY:

EX - Existing staff

ES - Established posts

R - Required posts or staff

(-) data not available

Table 5-5 Professional Staff in M.O.W.H. & P.P. 1976/77 - 1983/84 financial years

and shown in the Recurrent Estimates. The third category, which is the most critical one, shows the staff required to effectively undertake the building programme. The second and third categories are indicated in the second and third sub-columns respectively.

Determination of the staff required is more or less an issue of approximation since the ministry has not yet developed a precise method of doing so. The method noted below has been used by the ministry in the last 3 financial years and the study found it more rational. It is also the method recommended in the "Handbook of Architectural Practice and Management"⁷. An important input in the calculations is the workload. Once the (design) workload is determined as discussed in the section dealing with workload, the calculations follow as below.⁸

1. Total workload, Say £.211,383,460
2. Assume 70% of £.211,383,460 is repetitive
 $\text{Department therefore rep} = \text{£.} 147,898,422$
 $\text{Quantity S. 30\% of £.211,383,460 is one-off}$
 $\text{assigned by Quantity Surv} = \text{£.} 63,385,038$
3. Of the repetitive work $\frac{1}{3}$ should be treated as new design, i.e. one-off = £. 49,299,474
4. Hence amount of work requiring design is
 $\text{£. } 63,385,038 + \text{£. } 49,299,474 = \text{£. } 112,684,512$
5. Total fee income = $\frac{13}{100} \times 112,684,512$
 $= \text{£. } 14,648,985$
6. Total fee earning from architects
 $= \frac{6}{13} \times 14,648,985$
 $= \text{£. } 6,761,070$

7. Assume salaries earned by architects is 35% = 2,366,374
8. Team costs: Assume architects work in teams as follows AR + 2AAR+2ARA

$$£ 7,00 + £.10,000 + £.10,000$$

$$= £.27,000$$
9. No. of teams to be employed if team costs £.27,000 and £,2,366,374 is available for salaries. Hence 88 teams: 88 Architects
: 176 Assistant Architects
: 176 Architectural Assistants
10. Teams composed of architects, quantity surveyors, electrical engineers and structural engineers should work in this ration
Design = Arch: Qs: Elec. Engn. Struct. Engn.
Team 6 : 2½ : 1 : 1
Thus 110 quantity surveyors, 44 electrical engineers and 44 structural engineers would be required.
11. Assume further that each engineer in both the Electrical and Structural departments requires a draughtsman to work with him. Each department therefore requires 44 draughtsmen.
12. Quantity Surveyors are also supposed to be assisted by Quantity Surveying Assistants. This puts the number of quantity surveying assistants to 110.

While determining the staff requirements for each department, it proved difficult to determine the numbers of superintendents and inspectors required. This is because the ministry has never bothered to develop any method of assessing the need of these sub-professionals.

1981/82	2,150,000	2,150,000
1982/83	2,250,000	2,250,000
1983/84	2,500,000	2,200,000

Table 5-6: Consultancy Fees: Provisions in the Estimates.

Source: Forward Planning Group, M.C.W.B. & P.P.

The study found it difficult on its part to do so because these personnel are also involved in the execution of maintenance projects and other minor works, and using the design workload did not appear rational. For this reason, dashes, have been put in the boxes where their figures were supposed to appear.

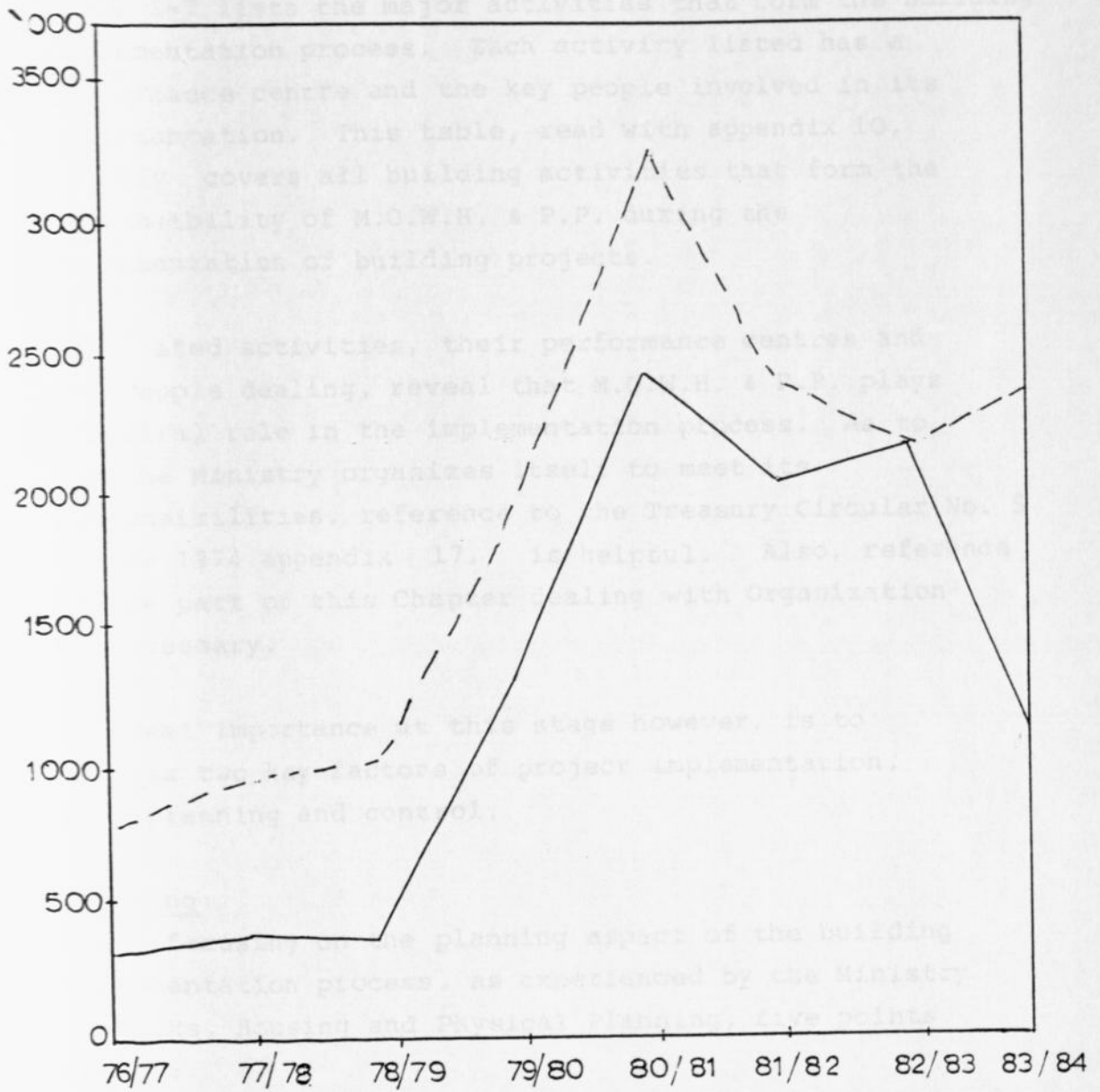
The table - 5.5 indicates that for practically every year the staff required to successfully undertake the building programme has been far in excess of the existing one and the establishments. The study therefore found it necessary to investigate how the ministry manages to carry out its work with this significant shortage of personnel.

It was found that the Treasury provides funds to the ministry's Vote (D 13) under an item called Consultancy Fees; to enable it commission projects which can not be done in-house to private consultants. To verify whether the money provided has been adequate to cover for the shortfall of staff, one needs to look at table 5-6. The table shows how much money has been requested each year by the ministry, and how much of it is granted by the Treasury.

Year	Funds requested £	Funds granted £
1976/77	750,200	389,150
1977/78	980,150	400,000
1978/79	1,138,450	400,000
1979/80	2,078,652	1,373,010
1980/81	3,310,000	2,500,000
1981/82	2,250,000	2,100,000
1982/83	2,250,000	2,250,000
1983.84	2,500,000	1,200,000

Table 5-6 Consultancy Fees: Provisions in the Estimates.

Source: Forward Planning Group, M.O.W.H. & P.P.



KEY

- Funds granted
- - - Funds requested

Figure 5-1. Consultancy Fees. The graph shows the variance between funds required and that granted by the Treasury. The projects are not quite consistent with the use of modern planning techniques.

Project Implementation

Table 5-7 lists the major activities that form the building implementation process. Each activity listed has a performance centre and the key people involved in its implementation. This table, read with appendix 10, roughly covers all building activities that form the responsibility of M.O.W.H. & P.P. during the implementation of building projects.

The listed activities, their performance centres and the people dealing, reveal that M.O.W.H. & P.P. plays a central role in the implementation process. As to how the Ministry organizes itself to meet its responsibilities, reference to the Treasury Circular No. 5 of May 1974 appendix 17, is helpful. Also, reference to the part of this Chapter dealing with Organization is necessary.

Of great importance at this stage however, is to discuss two key factors of project implementation, i.e. planning and control.

Planning

When focusing on the planning aspect of the building implementation process, as experienced by the Ministry of Works, Housing and Physical Planning, five points emerge;

- (i) Currently the Ministry has no properly structured planning methods to use.
- (ii) It has a history of planning.
- (iii) Over the years need for serious planning has been noted.
- (iv) There is generally despair, pessimism, about planning.
- (v) The professionals dealing with projects are not quite conversant with the use of modern planning techniques.

Table 5-7A - Building Activities

Stages	Main Activities	Performance Centres	People Dealing	Remarks
Inception	Identification of projects	Client Ministries	Projects Liaison Officers	Projects should meet genuine needs
	Confirmation of sites	Ministry of Lands and Settlement	Commissioner of Lands	Issues letter of allocation
	Approval of projects	Treasury	Budgetary Officers	Approved projects are normally printed in the Development Estimates with a token funding of £.10 ⁷
	Preparation and sub-mission of the briefs	Client Ministries	Projects Liaison Officers	Brief should be submitted on the project submission sheets. (PSS), 12 monthss prior to the date of construction on sites ⁸ .
Preliminary Planning	Receipt of PSS, itemization and entry onto the Annual Works Programme (AWP)	Forward Planning Group (FPG) of M.O.W.H. & P.P.	Building Programmers	Verification of the funding and site availability is done before the projects are entered onto the AWP. Where either of the two does not exist, the projects are rejected and PSS sent back
	PSS sent to the architects and Q.S.	Architectural/Quantities & Contracts depts. of MOWH & PP	Architects, Quantity Surveyors	Architects are supposed to form project teams. Briefs are developed. The Q.S. prepare and sent to the client Ministries the Estimated Total Costs (ETC). FPG receives a copy of the ETCs.

Table 5 - 7B - Building Activities

Stages	Main Activities	Performance Centres	People Dealing	Remarks
Preliminary planning	Production of site plans	Survey Section of M.O.W.H. & P.P.	Land Surveyors	Also record other existing facilities
	Production of sketches	Architectural department	Architects	Sketches should be approved by the Chief Architect before being presented to the client Ministries
	Approval of sketches	Client Ministries	Projects Liaison officers	Usually projects liaison officers work with their colleagues who are the users.
Detailed Planning	Designing	M.O.W.H. & P.P.	Architectural/ Structural, Electrical and Mech. Engineers	The architect is the Departmental representative (DR) and makes a programme for all the other professionals
	Preparation of the working drawings	M.O.W.H. & P.P.	Architects/ Structural, Electrical & Mech. Engineers	Each professional prepares his working drawings
	Approval of the working drawings	M.O.W.H. & P.P.	Chief Architect	Other departmental heads check their respective drawings to ensure that they meet the required standards
	Preparation of B.Qs and Specifications	M.O.W.H. & P.P. Quantities and Contracts depts.	Quantity Surveyors	

Table 5-7C - Building Activities

Stages	Main Activities	Performance Centres	People Dealing	Remarks
Contracting	Preparation of Tender lists	M.O.W.H. & P.P.	Architects/ Quantity Surveyors	This is an intricate exercise. The contractors listed will depend on their status or category. Big construction firms are enlisted for big projects. Recent performance of the contractors is also considered.
	Tendering	M.O.W.H. & P.P. Quantities and Contracts dept.	Quantity Surveyors & Contracts Officer	Contractors on the tender lists normally pick the B.Qs and price the items indicated. The type of contract in question is lump sum.
	Tenders returned & opened	M.O.W.H. & P.P. Quantities & Contracts dept.	Quantity Surveyors and Contracts Officers	The tender period is 14 days. The lowest tenderer is supposed to be awarded the contract unless otherwise.
	Letter of acceptance sent to the Client Ministries	M.O.W.H. & P.P. Quantities and contracts dept.	Chief Quantity Surveyor/ Permanent Secretary	Letter signed by Permanent Secretary
	Treasury's approval sought	Client Ministries	Project Liaison Officers	Approval given by the Treasury's Liaison Officers after ensuring that there are sufficient funds
	Letter of acceptance signed and returned to M.O.W.H. & P.P.	Client Ministries	Permanent Secretaries	

Table 5 - 7D - Building Activities

Stages	Main Activities	Performance Centres	People Dealing	Remarks
Contracting	Letter of acceptance sent to the contractor	M.O.W.H. & P.P.	Chief Quantity Surveyor	Acceptance should be given to the contractor within 60 days after the opening of tenders. This period is known as the validity period.
	Contract documents signed	M.O.W.H. & P.P.	Contractor	Contract documents ¹¹ for all projects over £.5,000 are handled in Head Office.
Construction	Handing over of sites, drawings and other contract documents	Sites MOWH & PP	Project Architects and contractor	
	Mobilization and commencement of construction	Sites	Contractor	Sometimes contractors are given advance money to enable them mobilize and commence construction
	Supervision of works	Sites	Project Architect engineers	The regularity of this will depend on the complexity of the project and also the competence of the contractor.
	Valuation of works done & preparation of payment certificates	Sites/MOWH & PP	Quantity Surveyors	Payment certificates prepared are counter-signed by the Architects and presented to the client Ministries for payment.
	Issue of Variation Orders (VOs)	Sites	Architect (DR)	Where V.Os have cost implications the client Ministries and the Treasury are consulted

Table 5-7E - Building Activities

Stages	Main Activities	Performance Centres	People Dealing	Remarks
Sub-Constructing	Tendering of P.C. Items	M.O.W.H. & P.P.	Architects, engineers and Quantity Surveyors	Nomination of Sub-contractors is done by the respective departments in conjunction with the Quantities and Contracts department. For example work of electrical nature is dealt with by the electrical department.
Completion	Preparation of certificates of practical completion	M.O.W.H. & P.P.	Architects	This is done after a thorough inspection of the completed projects. Defects are recorded for the contractors rectification.
	Release of First Moiety	Client Ministries	Project Liaison Officers and Accounts departments	The DR normally calculates the amount of retention to be released based on the Most-Up-to-date contract figure adjusted as per all known Variation Orders. The First Moiety is one half of the total retention sum.
	Handing Over	Sites	Project Architect Project Liaison Officer	This can be partial or complete
	Correction of defects	Sites	Contractor	All defects noted within the defects Liability period which is normally 6 months
	Preparation of Final Accounts & release of second	M.O.W.H. & P.P. Client Ministries	Architects/ Quantity Surveyor and project Liaison Officers.	When the contractor has made good any defects arising during the maintenance period, a Certificate of Making Good Defects is prepared. On this basis the final accounts are prepared.

Table 5-7E - Building Activities

Stages	Main Activities	Performance Centres	People Dealing	Remarks
Sub-Constructing	Tendering of P.C. Items	M.O.W.H. & P.P.	Architects, engineers and Quantity Surveyors	Nomination of Sub-contractors is done by the respective departments in conjunction with the Quantities and Contracts department. For example work of electrical nature is dealt with by the electrical department.
Completion	Preparation of certificates of practical completion	M.O.W.H. & P.P.	Architects	This is done after a thorough inspection of the completed projects. Defects are recorded for the contractors rectification.
	Release of First Moiety	Client Ministries	Project Liaison Officers and Accounts departments	The DR normally calculates the amount of retention to be released based on the Most-Up-to-date contract figure adjusted as per all known Variation Orders. The First Moiety is one half of the total retention sum.
	Handing Over	Sites	Project Architect Project Liaison Officer	This can be partial or complete
	Correction of defects	Sites	Contractor	All defects noted within the defects Liability period which is normally 6 months
	Preparation of Final Accounts & release of second	M.O.W.H. & P.P. Client Ministries	Architects/ Quantity Surveyor and project Liaison Officers.	When the contractor has made good any defects arising during the maintenance period, a Certificate of Making Good Defects is prepared. On this basis the final accounts are prepared.

As an elaboration to the first point, it is useful to record here what type and amount of planning is done. First, there is the "3 Year Forward Budget" which is done concurrently with the preparation of the Annual Estimates. During this exercise, the amount of money required by each building programme is noted and submitted to the Treasury. These are mere estimates of the money to be spent the following year and during subsequent ones. An examination of these estimates showed that very few of them had logical relationship with those of previous years. Very often, priorities seem to have changed quite dramatically.

Another form of planning exercise existing in the ministry is what is called "preparation of the Annual Works Programmes". Annual Works Programmes are prepared at the beginning of every financial year and list all projects submitted to M.O.W.H. & P.P. for implementation. They indicate for each project the current physical and financial status, the person in-charge, etc. See appendix 1. In real terms, the Annual Works Programmes are not plans, but rather basis on which implementation plans can be made. For example, it is envisaged that when the Architect, Quantity Surveyor, etc, get the Annual Works Programmes, they should come up with various plans for various projects. For pre-contract project, they should produce a working schedule indicating how they are going to conduct themselves through the design, documentation and tendering stages. For Post-contract projects plans and schedules based on the contractors' performance should similarly be produced. This is not the case in M.O.W.H. & P.P. Annual Works Programmes produced are circulated and simply stored away, only to be referred to when uncertainties about projects' funding, availability of sites, etc, arise. In the past, the Annual Works Programmes were used for the preparation of Bar Charts and the Financial review reports. Financial

review reports simply indicate how the voted funds would be used during the financial year and whether they are adequate or not. Both Bar Charts and Financial review reports are no longer produced. No specific reasons are given.

One would also expect that the contract periods allocated to projects are scientifically determined. This is far from the truth. Contract periods are based on the "table of contract value versus contract period" found in the Building Organization and Operations Mannual (BOOM). See appendix 17. The table lists against approximate contract value, approximate contract period. While these figures might have been realistic in 1974, given the high inflation Kenya has gone through in the last 10 years, it is evident that they are not now. Most officers are aware of this anomaly and determine their contract periods basing on their personal estimates of the contractor's capability. Some even allocate contract periods unwittingly, simply to satisfy or mollify the fears of the Client Ministry Officials. In most cases, contract periods have been conjured in fractions of a minute. As a result there are so many extensions of the contract completion period.

The case is however different where projects commissioned to consultants are concerned. The consultants are required through their terms of engagement to submit elaborate working plans either in form of bar charts or networks.

There is however enough evidence to indicate that the ministry at one time was serious about planning. Elaborate plans in form of bar charts and precedence diagrams are available to indicate that in the seventies, the Ministry was serious about an orderly way of doing things. This period also coincides with the period when the Forward Planning Group was formed, the Building Organization and Operations Mannual was published, and many

other literal works such as the Drawing Manual, the Precedence Manual, the Work-planning Handbook and even the Treasury Circular No. 5 of 1974 were published. Into eighties, it appears the enthusiasm to plan gradually died. (See appendices 18 and 19 for an example of the planning methods used).

There are several reasons advanced by the M.O.W.H. & P.P. Officers as to why the enthusiasm to spent more time on elaborate planning has died. One, the professionals are generally overloaded with projects. In the 83/84 financial year for example. There were 1940 projects being dealt with by 84 Architects. About 10 of these Architects were involved in administration. In essence, there were 74 Architects available to design and supervise projects. This means that each Architect was dealing with not less than 50 projects. As one Senior Architect put it, "if you want to put these projects on bar charts or networks, you will spent the first half of the year doing that. After completion, you will find that it is time to update them. You will therefore have no time for design or supervision of the projects. So it is better to do what can be done."

The second reason is that the organizational structure of M.O.W.H. & P.P. to a considerable extent defeats attempts to effect planning. Various professionals answer to their department heads on all aspects of their work. A structural engineer can therefore choose to ignore a plan prepared by an Architect should he find it inconvenient. The same can happen with the quantity surveyor or land surveyor. In all cases, the insubordinate officers can get away. This problem exists in the ministry and accounts for abortive design meetings and also site meetings. It is also responsible for late submission of working drawings. The phenomena has discouraged Architects from making plans as they realise that these could turn into a source of frustration.

Interference from outside, especially from politicians has been noted as another source of frustration. It is argued that there is no point making elaborate plans when it is likely that a politician will emerge from no where and put pressure that the priorities be changed. In some cases officers in the Client Ministries themselves demand for changes either in priority or simply come up with new briefs altogether when the projects are at advanced stages. This does not augur well for serious planning.

Finally, it is cited that the too frequent internal transfers make it difficult for professionals to settle and organize their work. For example, between 1980 and 1984, there were 8 reshuffles in the Architectural department. People are unwilling to draw future plans when they envisage change.

These problems have generated an air of pessimism about planning. The sad point is that the "Old Guards" do not find it necessary to train the young professionals in the skills of planning. Through the face to face interviews, it became apparent that very few professionals in the Ministry knew the mechanics of planning. The bar charts were familiar and easily conceivable, but the networks appeared quite new to most of them. Most of them who suffered in this ignorance gave various reasons to rationalize why the techniques were not necessary.

Control

Project Control activities carried out in M.O.W.H. & P.P. are mainly three, i.e. collection of information and updating of the Job Status Cards and the Contract payment Cards, site meetings, and the production of the Job Status Reports. Each of these activities is briefly discussed below.

For each project entered onto the Annual Works Programme, there is a card opened and filed in one of the card boxes for its respective ministry. See appendix 17. The Job Status Card has a corresponding Job Progress Sheet (see appendix 6. The Job Progress Sheet is used for the collection of raw data on the performance of the project. This is transferred onto the card. The Job Status card has two columns; one for physical information and the other for financial information. This enables both sets of information to be recorded separately and yet alongside each other for comparison purposes. Sources of information are mainly Site Weekly Reports, Site Monthly Meetings and other ad hoc reports.

The information recorded on the Job Status card is seriously analysed at the end of every quarter of the financial year. On the basis of these analysis, Job Status reports are prepared. Job Status reports mainly summarize for the client Ministries and the Treasury, the progress experienced on various projects. They also project future trends, especially those related to expenditure of the voted funds. This type of information is meant to help the client ministries and the Treasury to re-examine their future financial commitments.

The Job Status Cards, the Job Progress Sheets and the Job Status Reports are all produced in the Forward Planning Group. Unfortunately the group is badly understaffed and its total staff of 9 members find it difficult to keep track of the progress of over 1900 projects. The same staff is responsible for the production of the Annual Works Programmes. Due to overloading the group does not meet its expectations. For example, the cards are poorly updated, while the reports and working programmes come out late, thus making them of historical value only.

Officers in the Forward Planning Group also complain that some of their problems are caused by the uncooperative professionals who look at them as spies or supervisors of some sort. Some professionals conceive the role of the group as to spy on them and report to higher authorities. Others feel that the group generates unnecessary harassment when it reminds them of their chaotic work.

Contract payment cards can be regarded as other sets of control documents. The cards are opened in respect of each on-going project and contain details pertaining to the contract payments, Variation Orders and Sub-contracts let. The details on the contract cards are supposed to be used for contract financial appraisal. In the past they were supposed to be matched with the contents of "table of cumulative expenditure versus contract value (appendix 10)". This is not seriously practical now. This is because the table has not been revised since it was drawn 10 years ago.

Site Meetings are used to discuss all issues relating to the projects' progress. The Departmental Representative (DR), usually the Architect, convenes the meetings on monthly basis. Participants in these meetings include; all members of the project's design team, the representatives of the client ministries involved, the contractors, and where necessary sub-contractors. Critical corrective decisions are normally taken in these meetings and minutes produced form a source information, especially to members of the Forward Planning Group and the top Management. The unfortunate thing about site meetings is that some of them do not materialize due to the conflicting schedules of various professionals, or sometimes, simply lack of transport. Some professionals guilty of delays or other anomalies prefer being represented in the meetings, of course by their juniors. This minimizes the effectiveness of the meetings as the representatives are not in a position to comment on their relevant aspects of the

project authoritatively. They normally ask for time to consult and report in the next meeting - which is frustrating and time wasting to others.

In the foregoing discussions, the planning and Control functions as applied in the Ministry of Works, Housing and Physical Planning have been explored. One fact which emerges out of this survey is that both functions are done in a very sketchy way. This being the case, the question which next arises and to which the findings below are addressed to is whether the phenomenon of sketchy (poor) planning and control has any bearing at all on the performance of projects. In other words:

- (i) are projects really delayed?
- (ii) if yes, by what magnitudes?
- (iii) at what stages (performance centres) are delays notable?
- (iv) who are majorly responsible for the delays?
- (v) are there consequences?

Providing answers to these questions paves way for clear understanding of the role of planning and control in the implementation of M.O.W.H. & P.P. projects.

- (i) The question of whether projects are delayed or not is one which is easiest to answer. In the face to face interviews carried out, the question received an affirmative answer from 100 percent of all the people interviewed. Other sources of information examined, i.e., projects' documents such as the job status reports, the projects' files, the contract cards, also confirmed the existence of delays. The projects' files particularly made very interesting revelations. It was noted that alot of time and effort was spent on correspondence - trading accusations and counter-accussions for causing

delays. It appeared all parties were conscious of the phenomenon and did not want to be held responsible for it. They therefore, spent a lot of time making provisions to cover themselves, shifting the blame to others. The end result of this being production of large volumes of correspondence.

- (ii) Information depicting the magnitude of delays experienced on building projects is shown in tables 5-8 to 5-12. The same information is illustrated graphically in figures 5-2 to 5-5. Before discussing this information, note should however be taken of how the Ministry determines the durations (times) to be spent on various project activities. Through the survey, it was realised that the Ministry has no objective (quantitative) method of arriving at the required times for various activities. The practice is to estimate how much time would be required for implementing a particular project (not activity). As noted before while carrying out these estimates reference is made to the table of contract values versus contract period. This table has not been up-dated for over 10 years and is therefore an inaccurate source of reference. There is also a weighting factor which is supposed to make corrections in respect to the geographical regions under which various projects fall. Through the interviews it became apparent that very few officers utilized, or rather knew of this.

Whichever method used, it is the contention of this study that it is unlikely to fulfil the need of determining accurately the required implementation time for the

projects in question. Infact the use of contract values should be discouraged completely. This is because it is based on an underlying assumption that project contents are similar so long as the contract values (cost) are approximate to each other. This is false, especially when one notes that some projects have high contents of mechanical and electrical components which take very little time to instal, and yet cost comparatively high sums of money.

Apart from the two methods mentioned above, there are other methods used in determining the times to be utilized on projects. At pre-contract stage (design stage) it is generally believed that 12 months is an adequate period. So all projects are supposed to be designed and documented within 12 months after their submission to the Ministry.

This is regardless of whether the projects utilized standard designs or not. Infact this is a requirement contained in Treasury Circular No. 5 of 7th May 1974.

Allocation of times for projects under construction is based on several factors. Two methods have already been discussed. The third method utilized is one of having to allocate time basing on the rating of the contractor undertaking the project. If the contractor has a record of inefficiency, then some provision is made for the late finish of the project. The same applies to the rescheduling of the contract completion periods. A rough estimate is made of the outstanding works. This is related to the contractor's capabilities - and then an extension of several weeks is granted.

The main point of bringing out the fact that M.O.W.H. & P.P. has no scientific method of determining the times required for implementing various projects is not only to cast doubts on their planning and control methods, but also on the accuracy of their records which indicate that approximately 90 percent of their projects are delayed. What is being said here is that it is possible that the projects are noted to be behind schedule simply because one was unrealistic (mean) in his allocation of the implementation times. Conversely those noted to have been completed in time might have received generous time allocations.

Notwithstanding the foregoing arguments, the study continues to table and discuss delays as experienced on building projects undertaken by M.O.W.H. & P.P.

	Pre-Contract			Post-Contract		
	Proj.	Provs.	Consolid.	Proj.	Provs.	Consolid.
1960	1	1	1	1	1	1
1961	28	32	11	17	21	10
1962	41	55	11	71	83	31
1963	75	113	11	16	21	11
1964	80	122	18	75	107	15
1965	124	176	76	109	147	72

The main point of bringing out the fact that M.O.W.H. & P.P. has no scientific method of determining the times required for implementing various projects is not only to cast doubts on their planning and control methods, but also on the accuracy of their records which indicate that approximately 90 percent of their projects are delayed. What is being said here is that it is possible that the projects are noted to be behind schedule simply because one was unrealistic (mean) in his allocation of the implementation times. Conversely those noted to have been completed in time might have received generous time allocations.

Notwithstanding the foregoing arguments, the study continues to table and discuss delays as experienced on building projects undertaken by M.O.W.H. & P.P.

	Pre-Contract			Post-Contract		
	No.	Provs.	Completed	No.	Provs.	Completed
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9
10	10	10	10	10	10	10
11	11	11	11	11	11	11
12	12	12	12	12	12	12
13	13	13	13	13	13	13
14	14	14	14	14	14	14
15	15	15	15	15	15	15
16	16	16	16	16	16	16
17	17	17	17	17	17	17
18	18	18	18	18	18	18
19	19	19	19	19	19	19
20	20	20	20	20	20	20
21	21	21	21	21	21	21
22	22	22	22	22	22	22
23	23	23	23	23	23	23
24	24	24	24	24	24	24
25	25	25	25	25	25	25
26	26	26	26	26	26	26
27	27	27	27	27	27	27
28	28	28	28	28	28	28
29	29	29	29	29	29	29
30	30	30	30	30	30	30
31	31	31	31	31	31	31
32	32	32	32	32	32	32
33	33	33	33	33	33	33
34	34	34	34	34	34	34
35	35	35	35	35	35	35
36	36	36	36	36	36	36
37	37	37	37	37	37	37
38	38	38	38	38	38	38
39	39	39	39	39	39	39
40	40	40	40	40	40	40
41	41	41	41	41	41	41
42	42	42	42	42	42	42
43	43	43	43	43	43	43
44	44	44	44	44	44	44
45	45	45	45	45	45	45
46	46	46	46	46	46	46
47	47	47	47	47	47	47
48	48	48	48	48	48	48
49	49	49	49	49	49	49
50	50	50	50	50	50	50
51	51	51	51	51	51	51
52	52	52	52	52	52	52
53	53	53	53	53	53	53
54	54	54	54	54	54	54
55	55	55	55	55	55	55
56	56	56	56	56	56	56
57	57	57	57	57	57	57
58	58	58	58	58	58	58
59	59	59	59	59	59	59
60	60	60	60	60	60	60
61	61	61	61	61	61	61
62	62	62	62	62	62	62
63	63	63	63	63	63	63
64	64	64	64	64	64	64
65	65	65	65	65	65	65
66	66	66	66	66	66	66
67	67	67	67	67	67	67
68	68	68	68	68	68	68
69	69	69	69	69	69	69
70	70	70	70	70	70	70
71	71	71	71	71	71	71
72	72	72	72	72	72	72
73	73	73	73	73	73	73
74	74	74	74	74	74	74
75	75	75	75	75	75	75
76	76	76	76	76	76	76
77	77	77	77	77	77	77
78	78	78	78	78	78	78
79	79	79	79	79	79	79
80	80	80	80	80	80	80
81	81	81	81	81	81	81
82	82	82	82	82	82	82
83	83	83	83	83	83	83
84	84	84	84	84	84	84
85	85	85	85	85	85	85
86	86	86	86	86	86	86
87	87	87	87	87	87	87
88	88	88	88	88	88	88
89	89	89	89	89	89	89
90	90	90	90	90	90	90
91	91	91	91	91	91	91
92	92	92	92	92	92	92
93	93	93	93	93	93	93
94	94	94	94	94	94	94
95	95	95	95	95	95	95
96	96	96	96	96	96	96
97	97	97	97	97	97	97
98	98	98	98	98	98	98
99	99	99	99	99	99	99
100	100	100	100	100	100	100

Source: Data from Cards, M.O.W.H. & P.P.

Tables 5-8 to 5-12 present data pertaining to the implementation of building projects with emphasis placed upon average rates of delay at various performance centres.

Table 5-8 shows 5 distinct categories of projects. The categories are based on the estimated total costs and contract values of projects. This categorization to an extent reflects the Ministry of Works, Housing and Physical Plannings's Categorization of Contractors. This mode of presentation and the information contained in the table will come in handy when observations are being made about the performance of projects. For each category of projects, an indication is made in percentage terms, the total number performed at various centres, i.e. Headquarters, Provincial Offices and Private Offices (consultants) during the two major implementation phases, i.e. Pre-contract and Post-Contract. The data tabulated is a summary based on an analysis of the information contained in 5791 Job Status Cards, sampled using the stratified random sampling method.

Value of Projects £.'000	<u>Pre-Contract</u>			<u>Post-Contract</u>		
	HQs	Provs.	Consults.	HQs.	Provs.	Consul.
	%	%	%	%	%	%
0-10	28	72	-	17	93	-
10-50	44	56	-	71	29	-
50-250	76	13	11	69	24	7
250-750	80	2	18	75	10	15
750	24	-	76	28	-	72

Table 5-8: Percentage of projects performed at various centres.
(Source: Job Status Cards, M.O.W.H. & P.P.).

WEEKS CLASS INTERVAL	P R E - C O N T R A C T						P O S T - C O N T R A C T					
	HQS		PROV.		CONS.		HQS		PROV.		CONS.	
	f	%	f	%	f	%	f	%	f	%	f	%
Schedule	5	2.5	10	11	9	28	3	1.5	-	-	12	38
0 - 10	51	6	24	26.6	11	34.4	29	14.5	1	1	8	25
10 - 20	31	15	39	40	6	19	58	29	7	7.8	5	16
20 - 30	47	23	11	12	3	9	73	36	11	12	4	12
30 - 40	53	26	4	4.5	1	3	22	11	16	18	1	3
40 - 50	28	14	2	2	2	6	7	3.5	28	31	1	3
50 - 60	14	7	-	-	-	-	2	1	22	24	1	3
60 - 70	5	3	-	-	-	-	1	.5	2	2	-	-
70 - 80	2	1	-	-	-	-	2	1	1	1	-	-
80 - 90	3	2	-	-	-	-	3	1.5	1	1	-	-
90 -100	1	1	-	-	-	-	0	0	-	-	-	-
> 100	1	1	-	-	-	-	1	.5	2	2	-	-
TOTAL	201	100	90	100	32	100	201	100	90	100	32	100
GRAND TOTAL					579						579	

Table 5 - 9: Frequency of delays experienced on projects at pre-contract and post-contract stages of projects implementation in Ministry of Works, Housing and Physical Planning, 1975-1980

Source: Job Status Cards, M.O.W.H. & P.P.

WEEKS CLASS INTERVAL	PRE - CONTRACT						POST - CONTRACT					
	HQS		PROV.		CONS		HQS		PROV.		CONS	
	f	%	f	%	f	%	f	%	f	%	f	%
On Schedule	11	7.6	26	28	11	58	2	1.4	2	2	4	21
0 - 10	18	12.4	27	29	5	26	25	17	4	4.4	4	21
10 - 20	19	20	14	15	2	11	34	23	7	7.6	3	16
20 - 30	35	24	11	12	1	5	26	18	16	17	6	31
30 - 40	21	14.5	6	7	-	-	22	15	21	23	2	11
40 - 50	18	12.4	7	8	-	-	10	7	24	26	-	-
50 - 60	6	4	1	1	-	-	11	7.6	11	12	-	-
60 - 70	3	2	-	-	-	-	7	5	4	4	-	-
70 - 80	2	14	-	-	-	-	4	3	2	2	-	-
80 - 90	1	0.7	-	-	-	-	2	1.5	1	1	-	-
90 -100	-	-	-	-	-	-	-	-	-	-	-	-
> 100	-	-	-	-	-	-	1	0.7	-	-	-	-
TOTAL	144	100	92	100	19	100	144	100	92	100	19	100

Table 5-10: Frequency of delays experienced on projects at pre-contract and post-contract stages of projects implementation in Ministry of Works, Housing and Physical Planning - 1981 - 1985

Source: Job Status Cards, M.O.W.H. & P.P.

WEEKS CLASS INTERVALS	P R E - C O N T R A C T						P O S T - C O N T R A C T					
	H Q S		P R O V.		C O N S.		H Q S		P R O V.		C O N S.	
	LE	%	LE	%	LE	%	LE	%	LE	%	LE	%
Schedule	5	2.5	10	11	9	28	3	1.5	-	-	12	37
0 - 10	16	8	34	38	20	62	32	16	1	1	20	63
10 - 20	47	23.5	73	81	26	79	90	45	8	9	25	78
20 - 30	94	47	84	93	29	81	163	81.5	19	21	29	91
30 - 40	147	73	88	97	30	94	185	92.5	35	39	30	94
40 - 50	175	87.5	90	100	32	100	192	96	63	70	31	97
50 - 60	189	94.5	90	100	32	100	194	97	85	94	32	100
60 - 70	194	97	90	100	32	100	195	97.5	87	96	32	100
70 - 80	196	98	90	100	32	100	197	99.5	88	97	32	100
80 - 90	199	99.5	90	100	32	100	200	100	89	99	32	100
90 - 100	200	100	90	100	32	100	200	100	89	99	32	100
> 100	201	100	90	100	32	100	201	100	90	100	32	100

Table 5 - 11: Cumulative frequency table showing delays at pre-contract and post-contract stages of projects implementation in Ministry of Works, Housing and Physical Planning, 1975 - 80

Source: Job Status Cards, M.O.W. H. & P.P.

WEEKS CLASS	PRE - CONTRACT						POST - CONTRACT					
	HQS		PROV.		CONS.		HQS		PROV.		CONS.	
	LE	%	LE	%	LE	%	LE	%	LE	%	LE	%
On Schedule	11	7.6	26	28	11	58	2	1.4	2	2	4	21
0 - 10	29	20	53	57.8	16	84	27	19	6	7	8	42
10 - 20	58	40	67	73	18	95	61	42	13	14	11	58
20 - 30	93	64	78	85	19	100	87	60	29	32	17	89
30 - 40	114	78.6	84	91.6	19	100	109	75	50	54	19	100
40 - 50	132	91	91	99	19	100	119	82	74	81	19	100
50 - 60	136	94	92	100	19	100	130	90	85	93	19	100
60 - 70	141	97	92	100	19	100	137	95	89	97	19	100
70 - 80	143	98.7	92	100	19	100	141	97	91	99	19	100
80 - 90	144	100	92	100	19	100	143	99	92	100	19	100
90 - 100	144	100	92	100	19	100	143	99	92	100	19	100
>- 100	144	100	92	100	19	100	144	100	92	100	19	100

Table 5 - 12: Cumulative frequency table showing delays experienced on projects at pre-contract and post-contract stages of implementation, 1981 - 1985

Source: Job Status Cards, M.O.W.H. & P.P.

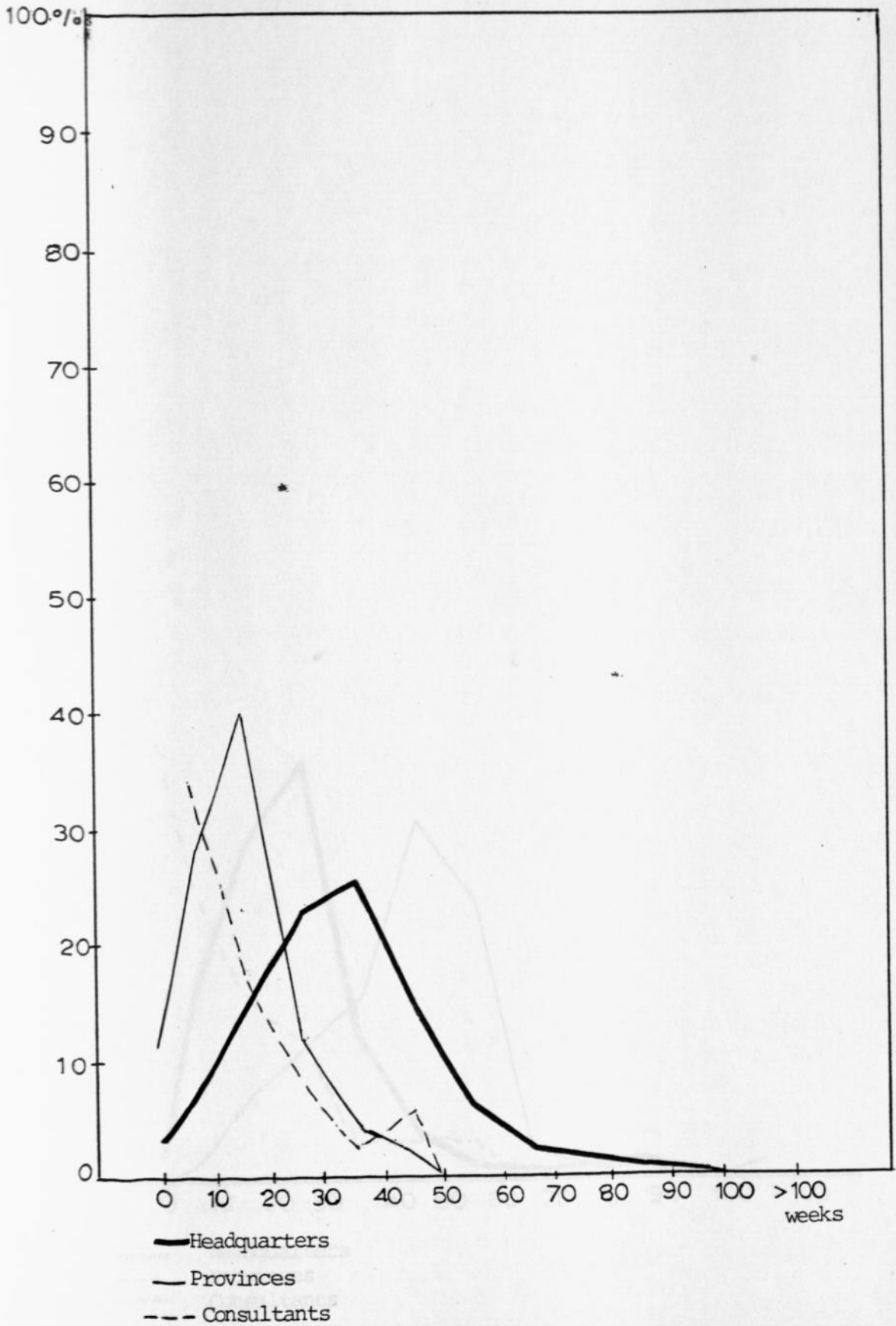


Figure 5.2 Graphical representation of delays experienced at pre-contract stage between 1975 - 1980.

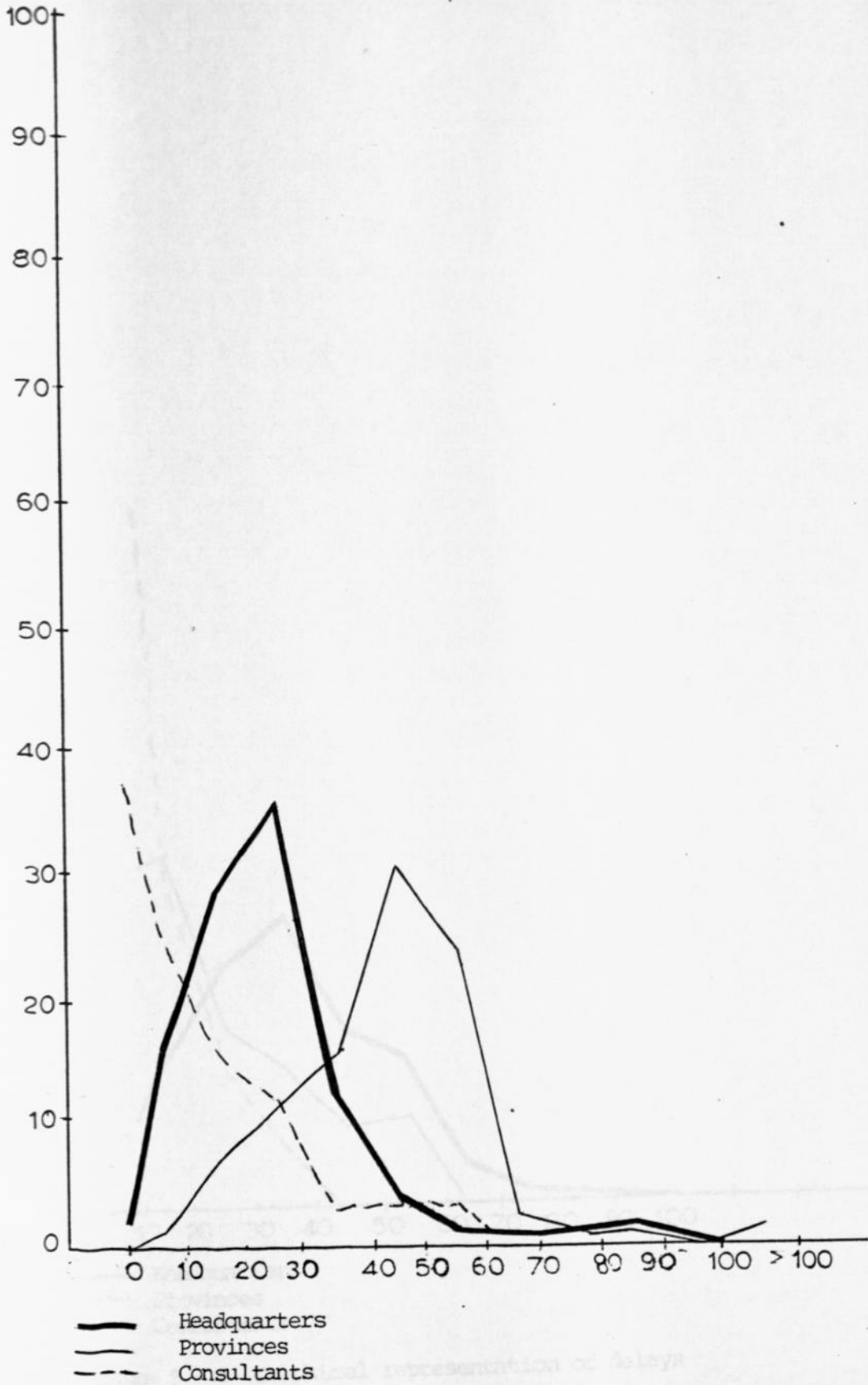


Figure 5 - 3 Frequency of delays at post-contract stage of implementation, 1975-1980

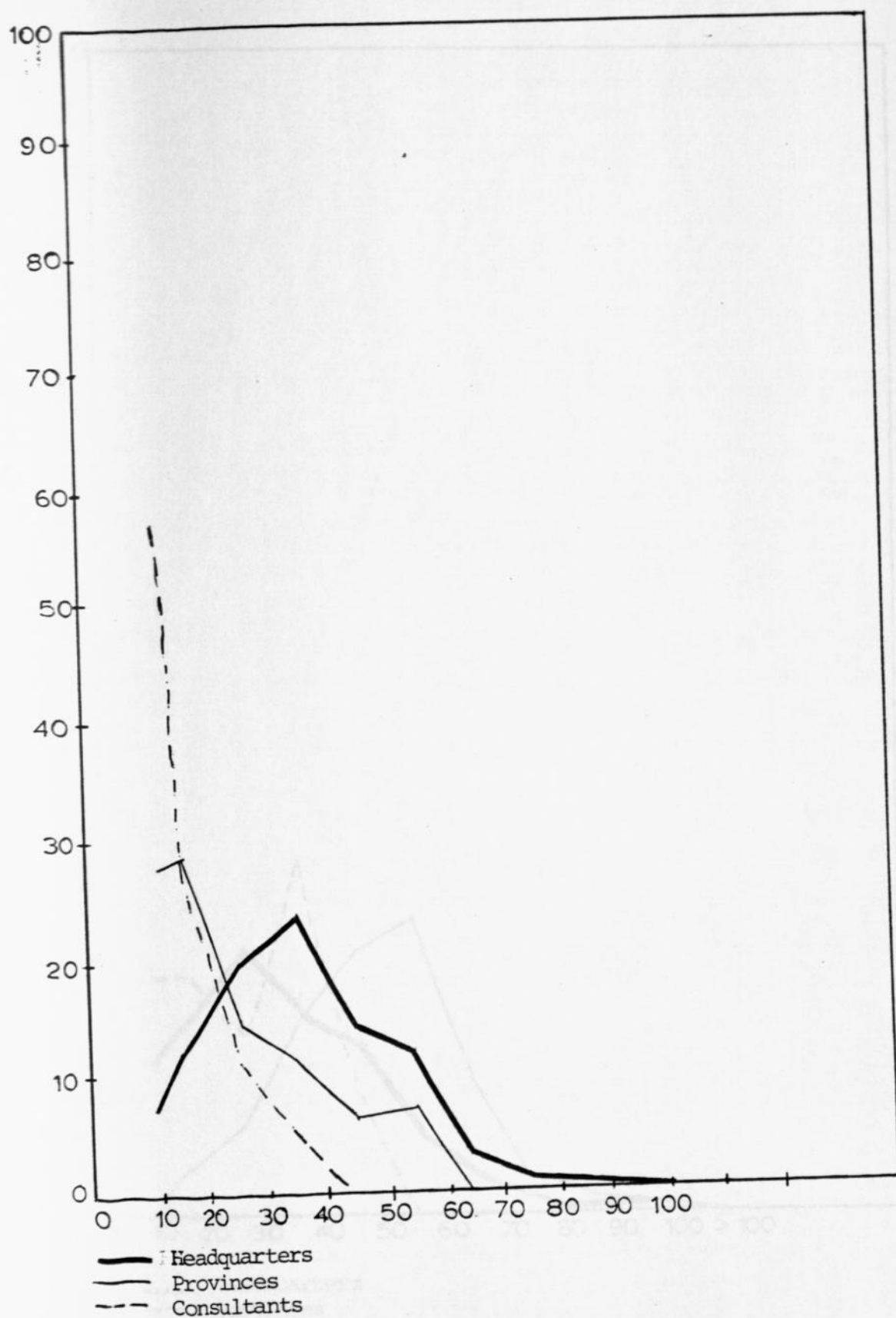


Figure 5 - 4 Graphical representation of delays
experienced at pre-contract state of
implementation, 1981 - 1985

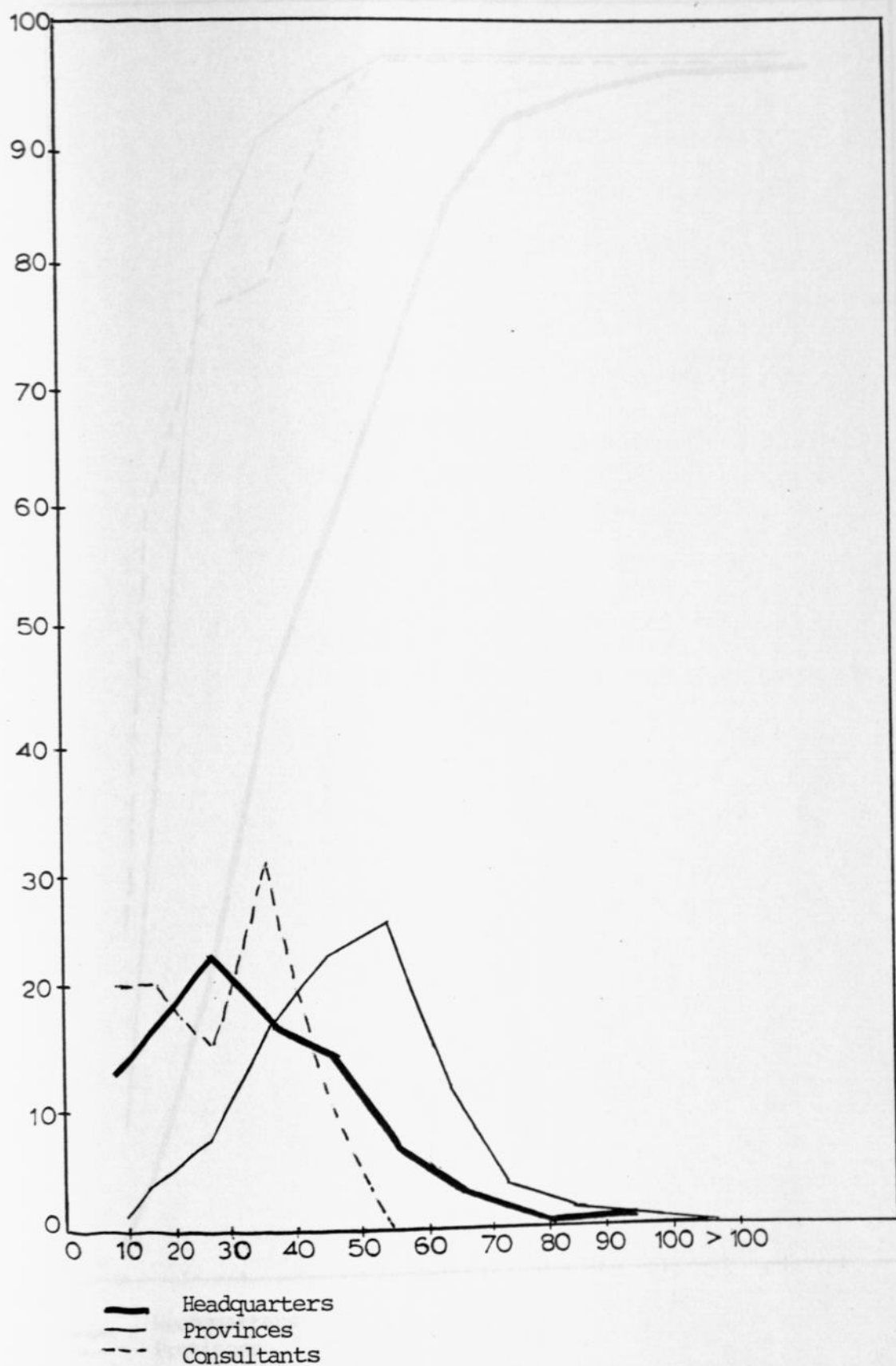


Figure 5.5: Graphical representation of frequency of delays at post-contract period, 1981 - 1985

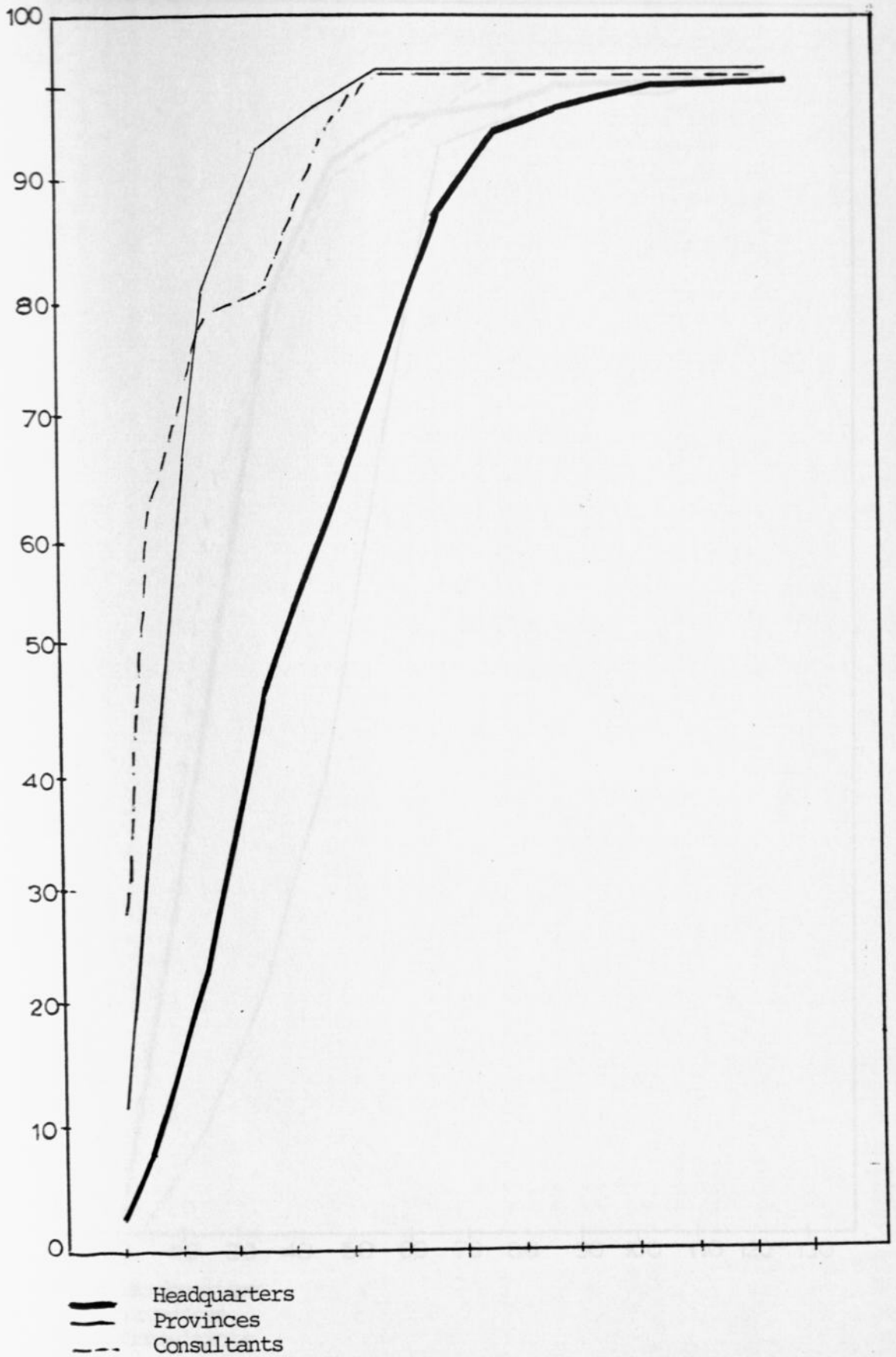


Figure 5 - 6 Graphical representation of cumulative frequency of delays at pre-contract period 1975 - 1980

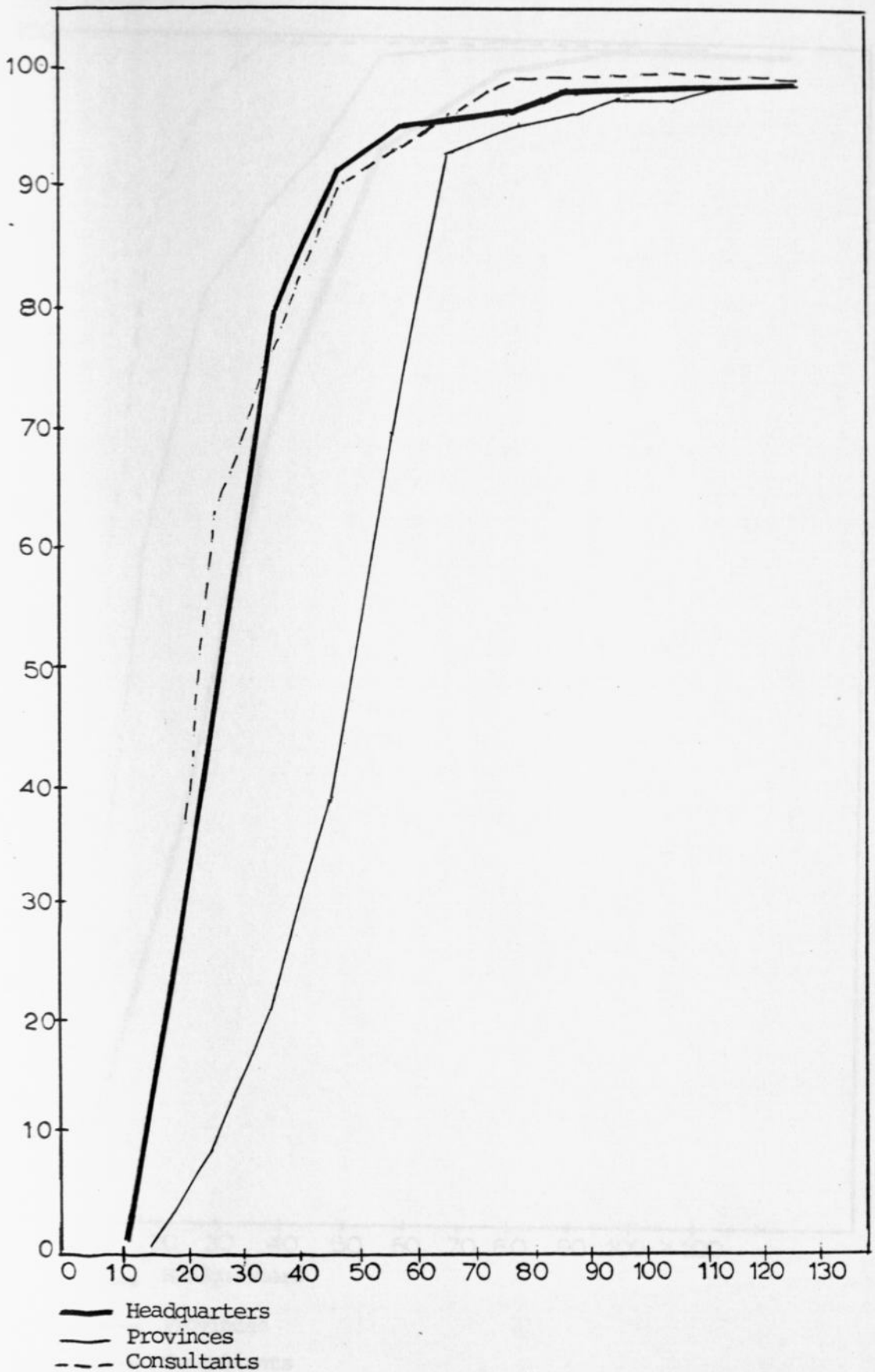


Figure 5 - 7 Graphical representation of cumulative frequency of delays at Post-Contract period 1975 - 1980

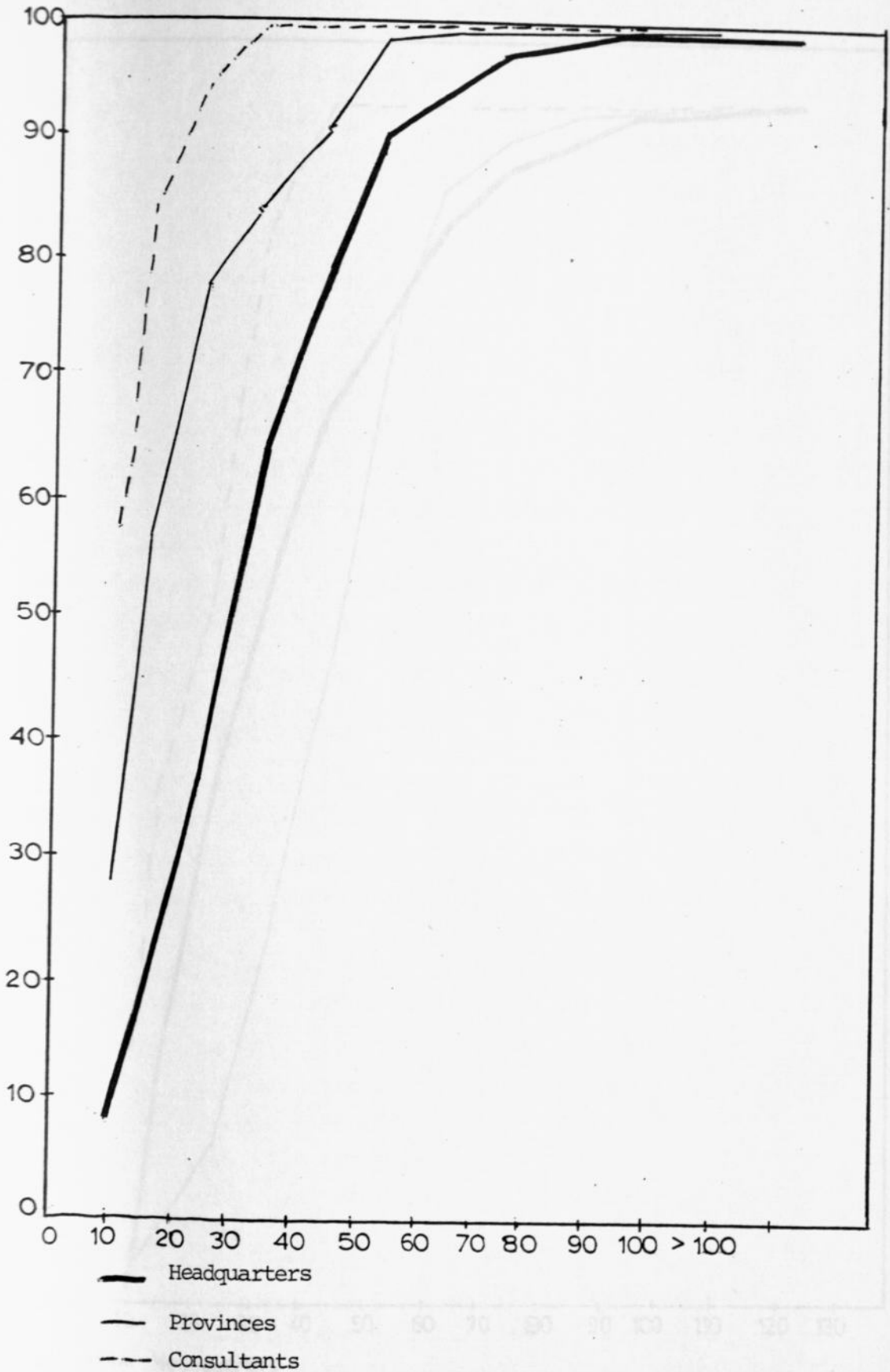


Figure 5.8: Graphical representation of cumulative frequency of delays at pre-contract stage, 1981 - 1985

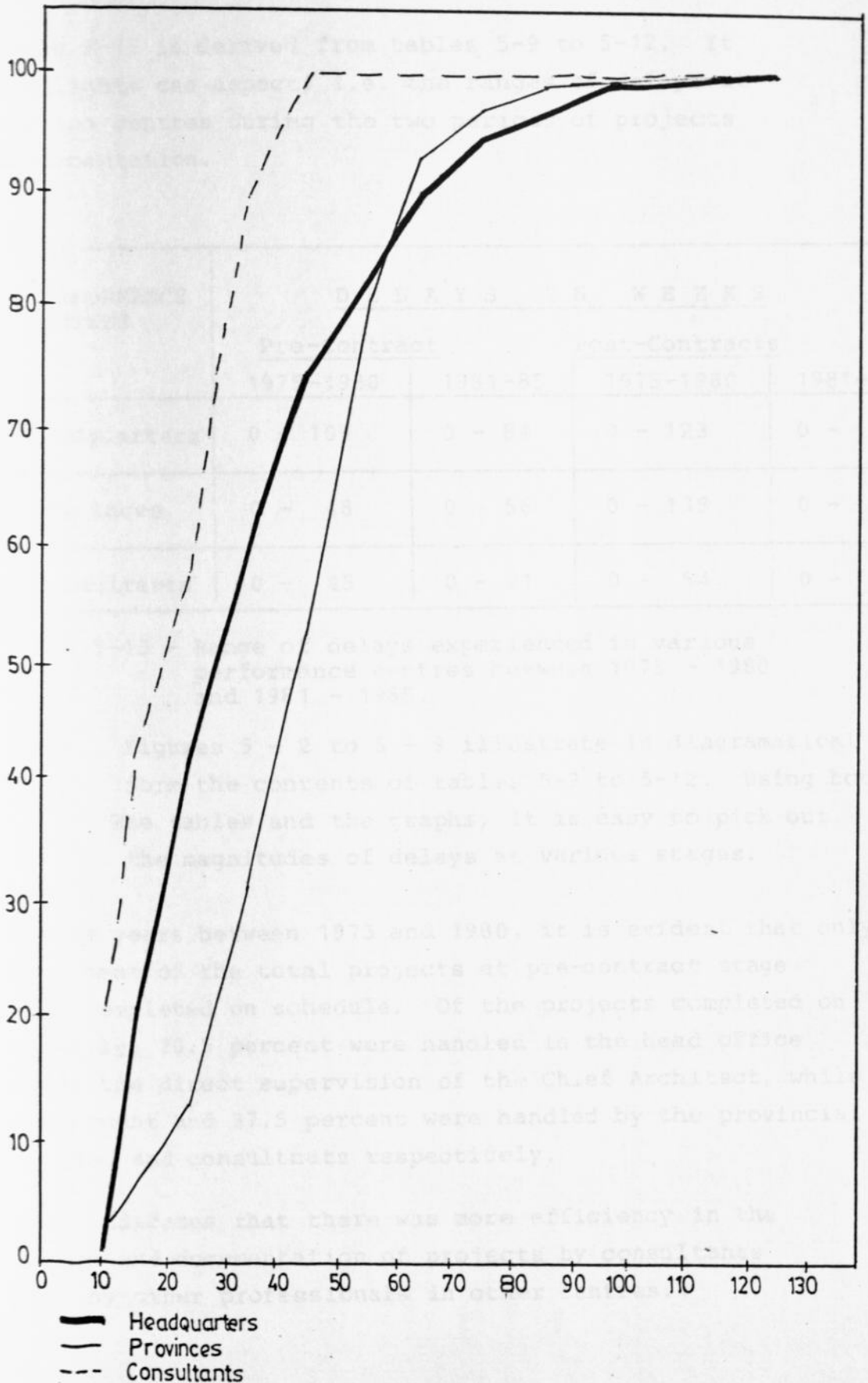


Figure 5.9: Graphical representation of cumulative frequency of delays at post-contract period, 1981 - 1985

Table 9-13 is derived from tables 5-9 to 5-12. It highlights one aspect, i.e. the ranges of delays at various centres during the two periods of projects implementation.

PERFORMANCE CENTRES	D E L A Y S I N W E E K S			
	Pre-Contract		Post-Contracts	
	1975-1980	1981-85	1975-1980	1981-85
Headquarters	0 - 107	0 - 84	0 - 123	0 - 103
Provinces	0 - 48	0 - 56	0 - 135	0 - 89
Consultants	0 - 45	0 - 21	0 - 54	0 - 35

Table 5-13 - Range of delays experienced in various performance centres between 1975 - 1980 and 1981 - 1985.

- (iii) Figures 5 - 2 to 5 - 9 illustrate in diagramatical form the contents of tables 5-9 to 5-12. Using both The tables and the graphs, it is easy to pick out the magnitudes of delays at various stages.

In the years between 1975 and 1980, it is evident that only 4 percent of the total projects at pre-contract stage were completed on schedule. Of the projects completed on schedule, 20.5 percent were handled in the head office under the direct supervision of the Chief Architect, while 41 percent and 37.5 percent were handled by the provincial offices and consultnats respectively.

This indicates that there was more efficiency in the design and documentation of projects by consultants than by other professionals in other centres.

A further look at the delays at various centres indicate that most head office projects experienced delays in the range of 10-50 weeks, with the highest peak at 30-40 class interval. Of the delays experienced on projects handled in the provinces, the peak occurred at 10-20; while for those handled by consultants, it occurred at 0-10. This information therefore indicates that during that period, head office (headquarters) was more inefficient in so far as the design and documentation of the projects was concerned.

The position however changed considerably during the post-contract (construction) period. The same table indicates that head office projects were delayed for periods ranging between 10-100 weeks, with the mode (peak) appearing at 20-30 class interval. Infact only 8 percent of the projects under construction were delayed for a period exceeding 40 weeks. This performance is considerably better than the one in the provinces. In the provinces the mode appears at 40-50 weeks. The table shows that approximately 62 percent of the projects were delayed for more than 40 weeks. In view of the fact that projects handled in the provinces were small (see table 5-8) the delay was serious. It meant that the delay as a proportion to the allocated construction period is great, in certain cases over 100 percent. Projects handled by consultants suffered very little delay and the mode appears at the right place, on schedule. A further analysis indicates that only 6 percent of the Consultants projects were delayed by periods exceeding 40 weeks.

Projects implemented between 1981 and 1985 do not exhibit significant changes, except that the position seems to

have improved a little bit. For example, it is notable that 18 percent of the projects at pre-contract stage were completed on schedule. This is by far better than the 4 percent recorded for projects implemented between 1975 - 1980. At post-contract stage, 3 percent of the projects were completed on schedule. Again this is better than the 2.6 percent recorded in 1975 - 80.

About the position of modes, it is observed that for head office projects, it falls within the 20 - 30 class interval. This is during pre-contract period. For projects done in provinces, the mode is recorded at 0-10 class interval, while for projects done by consultants the mode appear at 0, i.e. on schedule. From this information, it is again observable that consultants were more efficient in the implementation projects than Government employees.

Performance of projects at post-contract stage during the implementation period 1981 - 1985 again contrasts with the one recorded for pre-contract stages. It is noted that head office projects performed considerably better than provincial ones - although on the whole, consultants still came out best. The mode for headquarters projects is recorded at 10 - 20 class interval. Only 16 percent of the total projects are recorded to be delayed for periods exceeding 40 weeks. Projects done in the provinces have their mode at 40 - 50 class interval and 45 percent of the projects suffered delays exceeding 40 weeks. Consultants' projects have their mode at 20 - 30 class interval and no project suffered delays exceeding 40 weeks.

- (iv) The magnitude of delays experienced on projects at various stages of implementation have been noted.

The delays have been registered against the performance centres. This does not however say much when it comes to the question of who is the Chief Culprit for the cause of delays. This is because several people representing various institutions are involved in the implementation of the building projects. According to the information received through questionnaires, interviews and analysis of project documents, it is quite evident that the blame for delaying projects should be shared. Infact, the critical point here is, who should receive the biggest share? A look at every party's responsibility and what happens during its undertaking of these responsibilities can help in resolving the question.

- (a) Client Ministries: These are the owners of the projects. Their first responsibility is to identify projects which meet a genuine need existing within their organizations. Thereafter, they are supposed to obtain suitable land (sites). These should be confirmed in writing by the commissioner of Lands. The next step is to approach the Treasury for approval of the projects and subsequent funding.

All these should be done before the client Ministries submit the projects to Ministry of Works, Housing and Physical Planning for implementation. The records however indicate that the procedures are never followed as stated. In several cases (see appendix 20), client Ministries submit projects to M.O.W.H. & P.P. without fulfilling all necessary requirements. Projects are simply conceived and submitted without the acquisition of sites or funding from the Treasury. To get the projects accepted by M.O.W.H. & P.P., the client Ministries normally make false promises such as: the site is being confirmed or, this project will be funded from

external sources, etc. In some cases, they leave it upon M.O.W.H. & P.P. Officers to obtain sites and arrange for funding on their behalf. This overburdens M.O.W.H. & P.P. and slows its progress in the implementation of other projects. Although the Ministry has stated as a policy that it will never accept projects without sites and funds, several projects without these requirements are still found on the works programmes.

According to the officers in M.O.W.H. & P.P., the most painful area however is the submission of briefs. Most Liaison Officers in the client Ministries, it is alleged, have very little knowledge about the facilities they require; their sizes, functional uses, etc. While submitting projects, therefore, they give very general, practically useless information such as: Office block required or hostel required, etc. Such information does not help and the professionals have to keep guessing at what the client Ministries require. The situation sometimes becomes pathetic when the officers who provide the initial briefs are transferred and the new officers have different views about what is required. In such cases, new briefs are submitted and design work has to start all over again. Where construction has started, variation orders have to be made simply to accommodate these new ideas.

Ministries are also accused of failing to obtain funds in good time, thus holding up the progress of projects. In certain cases, projects are submitted to M.O.W.H. & P.P. with promises that the Treasury is going to provide funds in the following financial year. After the projects have been designed and fully documented, sometimes tendered,

it is then learnt that construction can not commence because of lack of funds. This slows down the progress of the projects. In other cases, the projects are funded, but the funds are not adequate. In such cases the commencement of the projects has to be deliberately delayed, or where the projects are on-going, the contractors are encouraged to go slowly. The point here is that if the projects are commenced early or the contractors move fast, there will not be enough money to sustain the payments throughout the financial year.

Another area where the client ministries are accused of is the late signing of letters of acceptance. Normally, before the contractor moves to site, he has to have a letter of acceptance, signed by the Permanent Secretary of the Ministry under which the project falls. This has to be done within the validity period, which is normally 60 days. In most cases letters of acceptance are held for more than 60 days resulting in the withdrawal of the contractors. The reasons for this are two: partly ignorance of the procedures and partly personal interests.

- (b) Ministry of Lands: This Ministry has been accused of failing to confirm sites in good time. Letters written to the Commissioner of Lands to confirm sites normally take a long time (4-12 months) before they receive response. The same Ministry is responsible for compulsory acquisition of land for Government use and also for land surveys. In some cases, contractors have been chased away from sites because the owners had not been compensated.

- (c) The Treasury: is responsible for the funding of all Government projects. Records indicate that it has never been consistent in its priorities - especially when it comes to the question of which projects should be funded. During the survey, it was learnt that the Treasury officers had no objective method of allocating funds to the projects. Sometimes funds were allocated depending on who went to their offices to bid for them. If a junior officer went to the Treasury with his figures immaculately arrived at, it would not be surprising if he returned with only half of what he requested for. On the other hand, if the Permanent Secretary went, it is obvious that he will get back with a full package. One officer stated that the method he used was to exaggerate all his figures by say 40 percent. After the reductions effected by the Treasury officials, he would still return with a neat package.

Inconsistency in funding has also appeared in other forms. Good examples of these are where the Treasury prefers to provide funds to a new project at the expense of an on-going one. Also, where it makes funds available in the middle of the financial year. In both cases, this study learnt, there is always the element of personal interest or pressure from certain surces. Politicians are famous for putting pressure on Government Servants to give priority to projects in their home areas (constituencies)

- (d) M.O.W.H. & P.P.: In all controversies surrounding the implementation of projects, Ministry of Works, Housing and Physical Planning has always featured prominently. The role played by the Ministry in the implementation process has already been discussed.

Its documents have also been examined and it is quite clear that it is to a considerable extent responsible for the delays suffered by projects.

All other parties involved in project implementation including contractors, sub-contractors and builders merchants content that the Ministry is the Chief culprit. The contractors for example complain that quite often, the Ministry contracts them on projects without all drawings, funds or even confirmed sites. The builders merchants on the other hand complain that they can never have enough stocks of materials because the Ministry never informs them of the amount of construction works underway. Again, the Ministry never helps them when it comes to the question of the acquisition of import licences from the Central Bank of Kenya.

Ministry of Works officials agree that they are to blame for the delays experienced on projects, but not in all cases. At pre-contract stage (design stage) they argue, delays occur partly because of lack of adequate qualified staff to design and document projects, and partly because of other problems such as (1) poor briefs from the client ministries (2) lack of sites, (3) non-confirmation of funds and (4) regular changes in priorities. Their problem stems from lack of staff and there is very little that can be done on short term basis. The solution to this problem, which has been put forward and rejected, is to have the Government building programme reduced. The Ministry's officials also argue that some delays have been imposed on them. For example, there are times when projects can not be tendered simply because of lack of stationery.

On the other hand, contractors have had to wait for working drawings for weeks, not because the drawings are not ready, but because there is no printing paper. Not the Ministry's fault but that of Central Tender Board.

On delays experienced by projects at post-contract (construction) stage, Ministry of Works officials argue that the biggest culprits are the contractors - especially the so called African Contractors. Most of these contractors are only in construction business for one motive, to make money as quickly as possible regardless of whether their obligations are met or not. It is not therefore surprising that some abandon their projects in the middle when they discover that there is no money to make. The problem of the African Contractors is attributed to four major factors.

- (1) Lack of proper training to enable them survive in the construction business.
- (2) Lack of finance (credit).
- (3) Lack of commitment.
- (4) Overprotection.

Over protection is one issue which generated a lot of discussion during the face to face interviews. M.O.W.H. & P.P. Officials were asked why they could not discipline contractors who failed to complete projects on schedule. The contract agreement provided for the application of the liquidated damages clause, and at worst, the determination of the contract and the levy of the liquidated damages. In response, they answered that these alternatives were only possible in theory. In practice the position was different. Application of any of the two normally generated a lot of problems. In the first place, it was the Ministry's responsibility to

develop an indigenous based construction industry. This is a Government policy. Surcharging contractors would drive them into bankruptcy, and this would be contrary to the interests of the Government. Secondly, most contractors knew a lot of "heavyweights" in the Government system and always found their way back to sites regardless of the action taken against them. The best alternative therefore was to keep extending the contract completion periods until the contractors finished all the works involved in the projects.

It was also learnt that in the last 3 consecutive financial years, the Government found it difficult to raise enough revenue to support all its programmes. It was therefore forced to withdraw funding on some of the on-going projects, or simply hold the payments until a later period. In essence this meant that the Government was the defaulter! Contractors took advantage of this by withdrawing their resources from the sites of projects they suspected or knew had no funds. In such cases, the Ministry of Works, Housing and Physical Planning found it extremely difficult to discipline the defaulting contractors - simply because the Government was the first defaulter. The Ministry had lost its control over the contractors.

- (e) Contractors: A lot has already been said about contractors. What should be added is that there are two sets of contractors designated: big contractors - usually multinational companies such as Solel Bonne, Zakhem, Laximanbai, etc. and small or African Contractors. The big contractors undertake big projects and generally finish on time. The small contractors undertake

small projects and generally finish months after the scheduled completion period. The problems afflicting the small contractors have already been mentioned as: poor organization on sites, lack of relevant technical skills, liquidity problems and lack of commitment. The contractors therefore generate delays on practically all projects they undertake, but nothing much seems to happen about it.

- (f) Builders Merchants: Essentially, these are outsiders to the project organization. They are however discussed here because they have been accused for late supplies of materials, and sometimes hoarding. African Contractors interviewed content that most merchants of building materials are Indians. These merchants, it is stated have been conspiring to eliminate the Africans from the construction business. They normally hike prices of the construction materials when Africans make orders, and then bring them down when their fellow Indians come. The point here is to make the Africans make losses, and in the long run, get out of business.

After discussing in length the responsibility of each individual party for the presence of delays in the implementation of projects, it is now possible to apportion the blame. The blame is scored out of 10. This conclusion is arrived at after taking into consideration the information collected through questionnaires, interviews and analysis of M.O.W.H. & P.P. projects documents.

- Client Ministries	- 2
- M.O.W.H. & P.P.	- 3
- Treasury	- 1
- Contractors	- 3
- Ministry of Lands	- 0.5
- Builders Merchants	- <u>0.5</u>
	10

(g) Consequences of delaying projects are several. It is not however the intention of this study to dwell on this aspect. Suffice it to note that as a result of delays on building projects.

- (i) Cost overruns are experienced on the affected projects. This has an effect of inflating the annual provision for building projects.
- (ii) More and more projects appear on the Annual Works Programmes. These crowd the programmes and generate more management problems.
- (iii) More overhead costs are suffered by all the parties involved.
- (iv) The beneficiaries of the completed facilities are denied essential services.
- (v) The Government losses alot of money, especially when it starts servicing external debts incurred on projects which are still incomplete.

Observations/Summary

In this part of the Chapter, comments are made on the findings that have been presented under various sub-headings. Also, note is taken of other information which could not be conveniently discussed under the fore-going headings.

- (i) There is very little to observe about the establishment of the Ministry of Works, Housing and Physical Planning. The same applies to its present day responsibilities. The little that can be noted however is that in the last 5 years, the Ministry's set-up and also its responsibilities, have changed 4 times. Regular changes in organizations normally disrupt the smooth flow of activities. Changes not only cause instability but also insecurity among the workers. For this reason, it can be observed that the regular changes experienced in the Ministry could have had an effect on the performance of projects. As to the seriousness of this effect, it is not possible to state here. This is because the delays experienced on the projects have been noted to be caused by various factors.
- (ii) The organization set-up of the Ministry is one aspect which received adequate attention. The issue to be resolved here is whether the prior organization structure (matrix in form) was better than the present one (functional in form). As this study comes to conclusion, it can be observed that the issue has not been adequately resolved. This is because projects implemented before 1980, although noted to have done marginally better than those after 1980,

were however not affected by the world economic recess. The factor which defeats the study's analysis is that the projects implemented before 1980 were done in the abundance of money generated by the "coffee boom". On the other hand, the projects done after 1980, were affected by the scarcity of money, generated by the global economic recess and the soaring prices of oil.

Despite nonconclusiveness of this study on this aspect, note should be taken of the fact that it was found out that there was general lack of co-ordination among the professionals responsible for the implementation of the projects. It was also noted that sometimes there was no common purpose, and attempts by Architects to instil this were frowned upon as their old desire to dominate others. Consequently, projects suffered.

These problems could be attributed to the existing organization structure which clearly separates various professionals and puts them in their respective departments.

- (iii) The workload undertaken by Ministry of Works, Housing and Physical Planning is no doubt enormous. The figures quoted in tables 5-2 indicate that it has been growing over the years. There is no indication however that attempts have been made to provide for it in terms of both manpower and capital resources required to effectively cater for it. No attempts have been made to limit or streamline the amount of work to be undertaken in a particular year. Finally, no proper attempts have been made to define the workload, and on a given basis, allocate the available resources. This is clear indication of lack of planning and order.

- (iv) The staff at the disposal of M.O.W.H. & P.P. for the purpose of implementing projects is noted to be in perpetual shortage. It is noted that to supplement it, sums of money are voted every year under the item of consultancy fees.

Two points emerge from the discussions on staffing. One that the Ministry has never seriously considered the use of other means to make up on the shortage of staff. Reference here is made to the use of standard designs and details. This could reduce the burden of the workload considerably. Secondly, it appears the consultancy fees is never properly utilized. The reason for this statement is that, consultants are paid money to supervise on-going projects, sometimes only meters away from M.O.W.H. & P.P. offices. This indicated lack of priority in the administration of this fund.

- (v) Implementation of building projects is an area which has received treatment in various parts of this study. This is befitting because the area is the focus of the study. In the preceding discussions, critical areas such as planning and control of the projects have specially, been explored with a view of establishing whether they are the major causes of the existing problem. It has been noted that both functions of planning and control are not practiced in great deptch by M.O.W.H. & P.P.

While noting the absence of planning and control in the implementation process of buildings, it has been noted along with it that the building activities that form the Ministry's day to day

responsibilities are many, exceeding 50. Although Ministry of Works, Housing and Physical Planning plays a central role, there are other parties involved. In the assessment of the delays experienced on projects, and thereafter the apportionment of the blame, it is clear that all parties involved are culprits in one way or the other. What should be observed here is that, notwithstanding this fact, M.O.W.H. & P.P. should receive the severest blame for failing to provide the required guidance. Guidance to all parties involved in the implementation programmes of buildings can only be provided through well worked out plans. Anything short of this, leaves alot of room for the interference of external factors. It also denies all those involved a chance to clearly visualize what is expected of them. Finally, it denies the projects the correct framework within which they should be implemented.

In view of this, it can be observed that most parties involved in project implementation, i.e. client Ministries, Treasury, Contractors, Sub-contractors and even the builders merchants find themselves causing delays because of lack of specific deadlines to meet. They work in a relaxed mood simply because they never realise the criticality of their actions. If Ministry of Works, Housing and Physical Planning produced clear programmes, stating the activities involved in each project, the deadlines to be met and the consequences of failing to meet these deadlines, it is possible that not everybody would be accused of causing delays during the implementation of projects as is the case now. This statement is strengthened by the fact that even in the developed countries, someone, i.e. the project manager has to define to

others their responsibilities and keep following them to ensure that they carry out these responsibilities to the fullest.

Reference to tables 5-8 - 5-13 and their graphs indicate that generally projects done by consultants perform better. The graphs indicate that of the total number of projects undertaken by consultants approximately 40 percent are completed on schedule. The rest of the projects are delayed, but only for a short while - high frequency intervals appearing at 10-20 weeks class interval. This is completely different from the projects done by the Ministry in head office and provincial offices. The highest frequency of delays for these projects are noted at 30-40 and 40-50 weeks class interval. The only logical explanation for this disparity is that the projects done by consultants benefit from the availability and use of good working plans. Note that consultants are required by the commissioning agreement not only to produce working programmes for the projects under their care, but also to give weekly reports on the progress of these projects.

It can also be observed from the same tables and graphs that the level of performance is not the same at the two different Government Centres, i.e. headquarters and provinces. It can be noted that projects at pre-contract stage, and done in the provinces, have a better level of performance. In the period 1975 - 1980, it can be noted that the provincial projects experienced a higher frequency of delays at the 10-20 weeks class interval. It can also be noted that less than 10 percent of the

projects were delayed for a period exceeding 30 weeks and practically all projects were completed before the 50th week of delay. In contrast to this, it can be noted that the highest frequency of delayed projects (headquarters projects) occurred in the 30-40 class interval. It can also be noted that the delays on some projects dragged on even up to the 100th week.

The position seems to change dramatically during the post-contract period. During this period, it appears headquarters projects moved faster and the level of delays was reduced considerably. Figures 5.3 illustrates this point. It can be noted that projects done in provinces suffered heavy delays. The mode (peak) appears at 40-50 weeks class interval. It can also be noted that some projects were even delayed for periods exceeding 100 weeks. The same diagram indicates that head office projects experienced lighter delays during this stage. The mode for these projects is observed at 10-20 weeks class interval.

These notable features of the performance of projects in head office and provinces also appear in the period 1981 - 1985. See figures 5.4 and 5.5. The study sought an explanation for the presence of these features and found out that most projects done in the provinces were relatively small and of simple designs. They utilized in most cases standard designs. This made it easy for the design work and documentation to be achieved without much delay. On the other hand, projects undertaken in the head office were relatively big and complex.

The professionals dealing with them therefore found it difficult to develop briefs, design and document them in good time. Besides this, there were other interest - mainly political.

On the delays at post-contract state, the projects in the provinces suffered mainly because they were small, and by virtue of that, qualified to be undertaken by small contractors. It has already been noted that small contractors are inefficient - but as part of the Government's policy to develop them, M.O.W.H. & P.P. exclusively sets aside small projects for them. Big projects, normally designed and controlled in head office attract big time contractors. These are more organized, have more resources and therefore complete projects on schedule or only with lighter amounts of delays.

Other observations which were made during the survey and possibly explain the presence of delays are as follows:-

- (vi) The Government's beauracratc system is not favourable for the quick implementation of projects. Reference here is made to the strigent Treasury regulations which stipulate that before a project is tendered, the Treasury's approval must be sought. A similar approval must also be given before the client Ministries sign the letters of acceptance. Then of course the client Ministries sign the letters of acceptance, return them to M.O.W.H. & P.P. before they are delivered to the contractors. This generates alot of delays as questions about the projects have to be asked and answered at every stage.
- (vii) There is also need for the Treasury to improve its funding procedures. For example, the funding of 20

projects under one block item is not desirable as it wastes a lot of time as officers responsible for the projects have to get together and sort out how much money each of them is to spend on his projects. Another area of criticism is where the Treasury allocates money without much serious considerations to the projected rate of expenditure. This leaves some projects with a lot of idle money while others are grounded. It is partly because of this problem that the Ministry finds it difficult to exert itself over some defaulting contractors.

- (viii) Besides planning and control, both functions which are missing in the M.O.W.H. & P.P. organizational setup, there is also need for serious reviews (Post Mortems) to be made immediately after the completion of each project. This is an aspect which is completely lacking and one wonders how the Ministry manages without exactly knowing the problems bedevilling it.
- (ix) A look at the findings on delays suffered by projects at various performance centres reveals that even consultants' projects are not free of this problem. One possible cause of this, it was observed, was the denial of the "decision authority" to the consultants. Consultants normally have limited authority and for every decision they have to make, they have to get clearance from M.O.W.H. & P.P. clearance is supposed to be conveyed in writing and this wastes time. Where Variation Orders and Site Instructions involving funds have to be made, a very protracted method has to be followed.

Questioned on this, M.O.W.H. & P.P. officials have no apologies to make. They counter that consultants normally increase the scope of work purposely to

increase their fees. There is therefore need for them to be closely supervised.

- (x) The final observation is that while there is an outcry of the shortage of professional staff to implement projects, it is also apparent that as professionals become more qualified (experienced), they move into general administration. This leaves the real professional work to the upcoming officers who by virtue of their inexperience are slow and make mistakes. Projects are therefore denied full attention which can only be provided by experienced professionals.

Footnotes

1. Presidential Circular No. 1/80 on the Organization of the Government of the Republic of Kenya, issued by the Office of the President, Nairobi.
2. Presidential Circular No. 2/80 on the Organization of the Government of the Republic of Kenya
3. Presidential Circular No. 1/83 on the Organization of the Government of the Republic of Kenya.
4. The Government Stores Form - what is known as the Supplies Branch. This is responsible for the stocking and supply of various items such as stationery, furniture for both offices and Government residential quarters. Textile products e.g. uniforms for subordinates, sanitary and hardware materials.
5. The Housing department does not deal with the day to day construction of houses. It concentrates on housing matters such as determination of housing needs, formulation of National Housing Policy, Mapping of strategies and revision of housing by-laws. It also helps in the negotiation of funds for housing development in urban centres with both internal and external financiers.
6. Kenya's Financial Years begin on 1st July and end on 30th June of the succeeding year.
7. Handbook of Architectural Practice and Management.
8. Calculations shown were made during the financial year 1983/84 - based on the 2nd Quarterly Job Status Report.

9. Details about how projects are prepared and submitted to MOWH & PP, and what conditions they have to meet, are contained in the Treasury Circular No. 5 of 7th May, 1974. The Circular is entitled "Government Building Programme" and is published in the "Buildings Organization and Operations Manual" (BOOM).
10. A token of £.10 is an indication by the Treasury that it has agreed to fund the project in future, and planning and other related documentation should begin. The lead time associated with this is 12 months.
11. Treasury Circular No. 5 of 7th May, 1974, entitled " Government Building Programme ".
12. In principal, the lowest bidder should be awarded the contract. This is however not always the case. The priced items of the lowest tender are scrutinized and if found too low to enable the tenderer to successfully undertake the work, the tenderer is asked to withdraw, and the second lowest considered. If the second lowest quotations are also unreasonable, the process continues until a reasonable tender figure is reached. Sometimes, the lowest bidder might be a non-citizen. Behind him and a few shillings less might be an African citizen. In such a case the national will be considered on condition that he lowers his tender sum to that of the lowest bidder. This part of the Government programme to assist African contractors and in the long run indegenize the construction industry.
13. After the expiry of the validity period, the tenderer is not in anyway obliged to honour his tender sum. Most tenderers opt for negotiations.
14. Buildings Organization and Operations Manual (BOOM) list contracts documents as the following:
 - (a) Articles of agreement signed by both parties.

- (b) Conditions of contract appropriate to the work being carried out, i.e. with or without bills of quantities or for minor works.
- (c) Drawings signed by both parties.
- (d) Priced bills of quantities or a specification signed by both parties
- (e) Surety bond signed by the surety (on main contracts over £5000 only).
- (f) The form of Tender submitted by the contractor.
- (g) A copy of the letter of acceptance signed by the relevant Accounting Officers.
The original copy of the contract documents kept by the Chief Quantity Surveyor in the strong room also includes:-
- (h) The original copy of the surety undertaking.
- (i) The original copy of the Schedule Tender Received.
- (j) The list of approved sub-contractor signed by the contractor.
- (k) A copy of the covering letter to the Permanent Secretary.
- (l) A copy of the letter to the Director of Industrial Training concerning training levy.
- (m) Any subsequent documentation pertaining to subcontracts related to the main contract.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

Introduction

This study was conceived mainly as investigation of the implementation of public building projects. Since most public building projects are implemented through Ministry of Works, Housing and Physical Planning, and in any case, it would have been an impossible task to cover all other institutions involved in public building construction, it was decided that emphasis should be placed upon the Ministry alone. The choice of the subject of study and the Ministry of Works, Housing and Physical Planning as the focal point, was largely prompted by the existing outcry about the poor implementation of building projects. In a preliminary survey, it was established beyond reasonable doubt that the outcries were genuine. It was noted that projects were delayed and as a result the Government spent more money on them. Besides that, 'Wananchi' were denied essential services. It was also noted that all these did not augur well with the development of Kenya, especially when the country was placing emphasis on the provision of infrastructural facilities as a means of ridding several social ills, including unemployment and poverty.

For the reasons cited above, it was found necessary to conduct the study. The Study's main objectives were,

- (i) to identify problems underlying the implementation of public building projects.
- (ii) Suggest practical means of solving these problems

- (iii) expose benefits inherent in the use of modern management techniques with a view of adopting the same on building projects implemented by Ministry of Works, Housing and Physical Planning.
- (iv) Note the influence of environmental factors on the performance of projects.

To give the study direction, it was decided that a hypothesis should be given. The hypothesis given was that "poor planning and control of public building projects was responsible for their inefficient implementation". This hypothesis was based on three assumptions. The assumptions are discussed in chapter I. For the same purpose of giving the study direction, it was deemed necessary not only to define the study area but also the scope involved.

The methodology to be used in conducting the study was also defined. It was felt that for the issues raised under the four Study Objectives to be adequately addressed to, there was first and foremost, need for an elaborate theoretical framework. On the basis of this framework, it was hoped that information gathered through interviews, questionnaires and data collected from projects documents on the implementation of projects by Ministry of Works, Housing & Physical Planning, would be analysed and observations in respect to the sources of the problem made.

The theoretical framework is taken care of through the literature discussed in chapters 2, 3 and 4. The three chapters discuss different but complimentary subjects of project Management. Chapter 2 deals with Management in general: its need and application in project situations.

Chapter 3 on the other hand specifically deals with planning. The chapter reviews the various techniques that can be utilized during project planning. It also highlights on the benefits inherent in the use of good plans. Chapter 4 discusses the function of control in project Management. Control procedures that can be utilized on projects are noted. It is also noted that because of the unpredictable nature of the environment and factors under which projects are executed, project control is a must for every project. Its absence could result into late completion of the projects, a factor which is normally accompanied by high office overheads and cost overruns on the contract sums.

The Survey

The survey is noted to have commenced in July, 1984 and completed in March, 1985. The purpose of the survey was to collect information which could be used in making observations (deductions) about the problems facing Public building projects done through Ministry of Works, Housing and Physical Planning. Three methods were used to collect this information. The information is tabled and discussed in chapter 5. Observations are also made. These observations provide a base on which the conclusions and recommendations are made.

On the basis of the information collected and analysed, and also the theoretical base provided in the earlier Chapters, it became possible to make the following conclusions about the existing problem.

The Conclusions

- (i) It is true that building projects undertaken through Ministry of Works Housing and Physical Planning are delayed. The Magnitude of the delays experienced on projects and the trends followed are depicted both in tabular and graphical form in chapter 5. Therefore the question of the presence of delays in project implementation does not carry much significance at this point.

What is of great significance however is the issue of the causes of delays. From the discussions in Chapter 5, it can be concluded that delays experienced on building projects are caused by several factors; the major ones being seven

While citing the chief causes of projects delays, it is important that reference should be made to the hypothesis which states that "poor planning and control of public building projects is responsible for their inefficient implementation". What can be said about this hypothesis is that it is completely valid as a statement. Its validity is qualified by the observations made in chapter 5 which indicate that planning and control as functions of project management are practised only in crude form. One might point out that this is planning and control all the same. The answer to this is No. This is because Ministry of Works, Housing and Physical Planning undertakes over 2,000 projects annually. These projects are many and contain several thousands of activities. With the limited number of staff available in the Ministry, it is impossible for all details on projects to be formulated, stored and despatched from a few heads. Good plans it was noted in chapter 3, facilitate the clear understanding of projects' objectives, serve as a means of communication among all involved in the projects, ensure timely completion of projects, serve as a basis on which corrections can be effected, permit rational allocation of resources within the projects and the organization as a whole, and finally, provide parameters necessary for the execution of the management function of control.

In order to have good plans, it was further stated, the use of modern management tools such as networks and computers is a necessary pre-requisite.

In Chapter 4, it is on the other hand stated that for projects to succeed, there is need to have good elaborate control procedures. These procedures, it is stated, help in eliminating the adverse effects of poor plans, reduce the effects of financial problems arising from escalation and fluctuation of prices, provide for rational re-allocation of resources and finally keep the influence of environmental factors under control. It is further stated that no rational control system can be developed and effected without the presence of good plans.

The fact therefore that Ministry of Works, Housing and Physical Planning does not utilize any proper plans, does not have well co-ordinated control procedures, is a clear indication as to why chaos exist, and to say the least, adversely affect the performance of projects. This is enough to qualify the validity of the hypothesis.

While qualifying the hypothesis, it should be added that the absence of planning and control is only one of the Major contributors to the presence of delays. Other contributors are discussed below and are all important.

- (ii) The study concludes that the internal organization of Ministry of Works Housing and Physical Planning is not conducive with the effecient implementation of building projects. The Organization Structure, as was noted, is of functional model. This Model, despite its strength, is noted to have two acute problems: it allows for conflicts to arise over the relative priorities in the allocation of resources; and also permits functional departments based on technical speciality to place more emphasis on their own speciality than the goals of the organizations. These two problems defeat the

element of unity of purpose which is a very important factor in the achievement of any undertaking.

Ministry of Works, Housing and Physical Planning does not only use this organizational model, but as noted in chapter 5, is a good example of an organization where the models weaknesses are notable in a big way. For example the professionals identify themselves with their departments. Each of them believes that the problems at hand are caused by his counterparts in other departments. This is a situation which does not permit for serious, honest review of the problems common to all those in project implementation. The same attitude, it was noted, has partly been responsible for non-existence of serious commital plans. This is because every department wants to follow its plans.

- (iii) Another conclusion arrived at as an explanation for mismanagement of building projects is the issue of overloading. Reference here is made to the high number of projects that the Ministry of Works, Housing and Physical Planning tries to implement with its limited staff. According to the data tabulated in table 5-5, there is no single year that the Ministry has undertaken projects with full staff. In most cases, its staff is less than half the ideal one.

According to the Ministry Officials, the problems is shortage of staff. According to this study, the problem is overloading, i.e. the Ministry having to accept and undertake several hundreds of projects despite its knowledge of the fact that it does not have sufficient staff to see these projects through. If the Ministry for example took a very firm stand and only accepted projects basing on its resources,

It is possible that there would be enough room for the practice of sound management principles, and thus elimination of chaos.

- (iv) The effects of the stiffling beauracratc system have been noted. The Treasury and its burdensome financial control procedures is noted to cause considerable amounts of delays.
- (v) The client Ministries are no doubt the other source of delays experienced on projects. Theirs stem more from the question of being asked to take a leading role in an unfamiliar situation. The issue here is that most officers in client ministries responsible for the determination of their respective Ministries' building needs, unfortunately have no knowledge about functional requirments of the facilities they need. They can not conceptualize right from the beginning what their Ministries require. It is therefore only after a lot of debriefing that the professionals understand what is wanted. Much time is wasted at this stage, and this therefore is another source of delays in the implementation of building projects.

Client Ministries are also responsible for delays at acceptance stage and during construction. At acceptance stage, they never give much consideration to the validity period and sometimes sign letters after the expiry of the period, even months after. During construction, they also unnecessarily hold payments to contractors, thus disturbing the contractors' working programmes.

Finally, the client Ministries often negotiate for inadequate funds with the Treasury. This results in the shortage of cash during the construction of projects, a factor which slows the progress of projects.

- (vi) Inefficient contractors are to a large extent responsible for delays experienced on projects at post contract period. As noted in chapter 5, the culprits are the small contractors. Their problem is that of poor contract organization. The study arrived at this conclusion basing on the evidence in chapter 5 which clearly shows that big projects which attract serious contractors, are often completed in good time. While small projects, on the other hand which attract small contractors suffer heavy delays during their construction.
- (vii) Interference of politicians is an issue which seems to put professionals to a lot of agony. The main area of interference is the awarding of building contracts. Here, some contractors without proper credentials manage to get jobs simply because someone influential is behind them. In the long run, these contractors cause delays, abandon projects and do all sorts of things that are not in the interest of the projects.
- Some politicians are also noted to support projects which are in their areas and to a large extent help in enhancing their public image. If projects are noted to have been initiated by rivals, the politicians concerned creates an environment not conducive for the smooth implementation of the projects.

Recommendations

The major causes of mismanagement of Government building projects undertaken by Ministry of Works, Housing and Physical Planning have been identified in the foregoing discussions. For the study to be considered complete, there is need also for possible solutions to these problems to be offered. It is for that reason that the following recommendations are made. A point of warning at this point is that most of the problems identified are closely interrelated. Therefore this rules out the adequacy of any or some of these recommendations offered as total solutions to the existing phenomenon. The best approach would be to try and utilize all the recommendations cited without exception.

(i) It has been observed and concluded that the lack of good plans and control procedures was to a considerable extent responsible for the presence of delays during projects implementation. The recommendation in respect to this problem is that Ministry of Works, Housing and Physical Planning should give more attention to this area. The Ministry officials should realise that the heavy workload they undertake is no excuse to negate the need for planning. Infact more work should mean greater emphasis on planning. This is because planning gives clarity to purpose. It makes people visualize clearly what they are faced with. In order for the Ministry officials to start feeling that planning is an integral part of project implementation, and not an outside activity that unnecessarily consumes time and efforts, they should as the first step to project implementation allocate time for planning. Secondly, they should try and utilize the modern planning techniques. This will guarantee them good plans. This study recommends the use of the Critical Path Method (CPM). This is because it is relatively simpler to learn and use than the other 3 network techniques discussed in Chapter 3.

Besides, its relative simplicity does not rob it of the advantages inherent in the other techniques.

The burden of having to make plans for every project can be simplified by the formulation of standard networks. These are easy to achieve especially where projects are of standard nature. The standard networks can be modified to reflect the features peculiar to the individual projects.

Planning should also be viewed by all professionals as a concerted effort - not a one man's job. The project leader should therefore request for inputs from all people likely to participate in the projects. This guarantees one necessary factor, i.e. commitment to the plans.

The production of good plans is normally the first step to effective control of the endeavour in question. It is therefore logical that after good plans have been produced, the Ministry officials should also try to utilize them as control tools. Targets to be achieved should be clearly identified and resources to be utilized correctly allocated. In event of the set targets failing to be realised, plans should be revised and resources reallocated.

It can be observed that what has been stated is in respect to projects at pre-contract stage. The same principles however apply to projects under construction. The study recommends that the first thing the project leader should do before construction commences, is to provide a framework within which the contractor can plan and control his project activities. The second thing is to request the contractor to give a comprehensive working programme showing the time and resources available for each activity.

to give a comprehensive working programme showing the time and resources available for each activity. This requirement should be made part of the Contract Agreement and before it is fulfilled, the contractor should not receive his first payment.

(ii) The problem of the Ministry's Organization Structure and its inherent weaknesses is one most difficult to provide a practical solution to. These sentiments are expressed in view of the apparent rivalry and hostilities among the various departments. What is practicable is for every department to streamline its structure so that it corresponds with the others. For example, if there is need to have 8 teams in the Architectural department, then the other departments should also each have 8 corresponding teams. This can facilitate ease of communication based on the linking pins theory (See Chapter 2). To eliminate some of the existing hostilities, project leadership should be given to the most experienced member of the team-regardless of his professional background. The critical point here is that the project leader should comprehensively understand what is involved in the project and what each team member should do to enhance the realisation of the project's objectives. It is completely unfair and ridiculous for an inexperienced architect to be in-charge of others simply because of tradition and yet has very little to offer.

(iii) Shortage of qualified staff is an issue whose solution is long term. The solution lies in training more people in the professions relevant to M.O.W.H & P.P. As to how this can be achieved is a different matter which can be answered by the Government's Directorate of Personnel Management.

Over the years, there has however, been a shortage of professional staff simply because of the heavy Government building programme. Since training of personnel is not achievable on short term basis, it should be recommended

here that the other possible solution is to reduce the existing building programme to manageable proportions. New projects should be started after old ones have been completed. The Ministry should work out a ratio relating projects on the drawing boards to those on sites. The ratio should provide a guidance as to how many projects of each category should be undertaken at each time given the existing resources. In cases where the resources have not increased, new projects should only be accepted as replacements to the completed ones.

Another possible solution is the use of standardized designs and re-usable details. These are facilities currently available - only that their use has been limited due to the apathy of the professionals. The advantages of using repetitive designs are discussed in Chapter 5 and need not be mentioned here. Suffice however to note that they can increase the production of designs, working documents and even bills of quantities very greatly. Standardization should even be extended into the construction aspect. Well known standard designs can open new horizons for Industrialized Building.

(iv) Beauracracitic systems are hard to change. They are designed to easily facilitate the achievement of order, efficiency and general harmony in the Government organization set up. They however normally work to the contrary. In respect to the study, it is noted that projects are delayed due to cumbersome procedures. The Treasury is heavily criticised in this respect. What can be recommended at this point is that the Treasury should be more forthcoming in the allocation of funds. It should first and foremost provide funds to on-going projects - then, new projects. On the issue of its approvals, the study found that they were not necessary. Once it has allocated money for a project and the same is reflected in the Development Estimates, there is no need

for its officers to be approached at tender and acceptance stages.

(v) Liaison officers who are in-charge of their Ministries' building programmes should receive some basic training on building construction. Under an ideal situation, qualified professionals working in M.O.W.H. & P.P. should be seconded to every Ministry to assist in streamlining the Ministries building requirements. In view of the shortage of the same professionals, this is not practicable. It should however be considered as a long term solution.

As a short term solution, it is desirable for M.O.W.H. & P.P. to improve on its brief taking procedures. Standard briefs can be prepared and used for discussions during the brief taking period. Sketches to help the client Ministries' officers to visualize their requirements should be prepared and used.

(vi) External interference is a factor which no solution can be offered in this study. In such cases, alot depends on the surrounding circumstances. Unfortunately these circumstances vary from place to place, from time to time.

(vii) Inefficient contractors noted to cause delays should be dealt with abit more severely than what it is now. The application of the Liquidated Damages Clause is rational and this should be done regardless of who is involved. Secondly, records on the performance of contractors should be kept. Poor contractors should be weeded out.

On the question of Africanizing the construction industry, there is need to seriously review it. This issue has an underlying danger of producing contractors who are not capable of undertaking projects. This does not mean that

the policy should be scrapped. It should be progressed, but in a rational manner. Upcoming contractors should be attached to established ones to receive practical training in contracts administration.

(viii) Post mortems should be carried out after the completion of every project. Review should be made on all aspects: designing, contracting, construction and Job finalization. The point here is to note the presence of impediments which could be eliminated on subsequent projects.

(ix) Finally, there is need to involve the top management in the day to day projects affairs. The people in reference are the Minister, his Assistants and the Permanent Secretary. This can be effectively done through the "reporting by exception" method. The top management should only be told of projects having serious problems. The point here is to have them exert their powers and hopefully get things straightened out more quickly.

Reporting by exception could be effected in the manner shown in table 6.1. The astericks indicate the level of reporting necessary.

Management	On schedule	To be delayed	Delayed			Standstill
			5%	10%	20%	
Minister & his Assist- ants					*	*
Permanent Secretary				*	*	*
Chief Arch.			*		*	
Other Chiefs		*	*			
Team Leaders	*	*	*			
Profes- sionals dealing	*	*	*			

Table 6.1 - Levels of reporting

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ANNUAL WORKS PROGRAMME INDEX

PAGE 1

Vote 31		Ministry of Works and Construction OFFICE OF THE PRESIDENT			Works Province RIET VALLEY			Year 1987/82	
Item Number	Job Number	Reference in Estimate	Description of job	Est Total Cost (£)	Spent as of 30.12.1981	198/82 Provision	D.R.	Remarks	
RV 601	5297A	017-092	KARPOKOT SUB DISTRICT	15 000	-	-	C.A.	NOT STARTED	
RV 602	5298A	017-092	LOKITAUNG POLICE STATION AND LINES - STAFF HOUSING	73 251	26 885	30 000	C.A.	UNDER CONSTRUCTION 30% COMPLETED	
RV 604	1109A	017-101	GILGIL S.T. UNIT 16 NO. CAT. 'F' HOUSES	128 000	-	-	C.A.	NOT STARTED	
RV 605	5302B	017-092	KARAROT POLICE DIV. HQRS. 60 NO. WEBB TYPE,	1 522 326	412 763	420 000			
			6 NO. CAT. 'D' + S.Qs. HOUSES				C.A.	UNDER CONSTRUCTION 35% COMPLETED.	
			1 NO. OFFICE BLOCK,						
			1 NO. M.T. WORKSHOP AND						
			1 NO. CANTEN						
RV 701	5297B	017-092	KACHELIBA POLICE STATION - PHASE I :	39 820	18 642		P.W.	PRACTICALLY COMPLETED TO BE HANDLED OVER	
			6 NO. WEBB TYPE HOUSES			180 000			
RV 701	5297C	017-092	KACHELIBA POLICE STATION - PHASE II	259 470	91 999		"	UNDER CONSTRUCTION 40% COMPLETED	
RV 801	1109D	017-101	GILGIL S.T. UNIT STAFF HOUSING	1 022 769	342 480	355 719	C.A.	PRACTICALLY COMPLETED TO BE HANDLED OVER	
RV 803	6430A	017-092	NGARWA POLICE STATION	384 024	82 270	350 000	P.W.	UNDER CONSTRUCTION 15% COMPLETED	
RV 804	6432A	017-092	KARARAK POLICE STATION	1 072 792	359 606	250 000	C.A.	UNDER CONSTRUCTION 95% COMPLETED	
RV 805	6298A	017-092	KARARAL POLICE DIV. HQRS. PHASE I :	86 008	69 393	WITH PHASE II	P.W.	UNDER CONSTRUCTION 90% COMPLETED.	
			12 NO. WEBB TYPE HOUSES						

MoW form 4.36(5/76)

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BLOCK FORECAST NEED

JOB STATUS REPORT

SUBVOTE & HEAD 133-421 (NEW OFFICES)

JOB STATUS REPORT										Date	
Vote 13		Ministry		WORKS							
Item Number	Description of job	Est. Total Cost (£)	Spent as of 30.6.79	1979/80 Provision	Forecast Need	Issued/Allocated	Certified 1979/80	Remarks			
CO 807	SHIMANZI M.O.W. DEPOT MOMBASA-ADDITIONAL OFFICE.										
CE 603	NYERI M.O.W. STORE 540M ² , STORE, YARD ETC.	39 278	25 731		13 500			ML	BUILDING WORKS COMPLETE A/c. TO BE FINALISED COMMENCED ON 14.3.79		
NE 802	GARISSA SUPPLIES STORES STANDARD WARE HOUSE.	82 412	57 272		55 000		40 500		EST. COMP DATE 2.4.80 PROGRESS - 94%		
NB 743	M.O.W. SUPPLIES BRANCH P.A.B.X. 100 LINES AND THE LINE.	17 279	12 899		4 500			NIL	PRACTICALLY COMPLETED AND COMMISSIONED		
NB 806	NAIROBI LIKONI ROAD STANDARD WARE HOUSE.										
NB 813	NAIROBI SUPPLIES BRANCH: SAMPLE STORE.	467			467	467	412		COMPLETED AND FINALISED		
NB 814	NAIROBI SUPPLIES BRANCH SECURITY WALL.										
NB 816	NAIROBI SUPPLIES BRANCH INFLAMMABLE STORE.	25 647	14 215		11 500		9 571		COMMENCED ON 12.2.79 E.C.D. 24.9.79 PROGRESS - 90% DONE		
NB 817	NAIROBI SUPPLIES BRANCH 2 BAY VEHICLE REPAIR WORKSHOP.	32 707	6 750		26 000		14 669		COMMENCED ON 12.2.79 EST. COMP. DATE 24.9.79 PROGRESS - 65%		
NB 751	NAIROBI SUPPLIES BRANCH - OFFICE EXTNS.	291 984			100 000		29 025		COMMENCED ON 28.12.79 E.C.D. 26.3.81 - 4% DONE		

BLOCK ALLOCATION 1979/80 £150,000

MoW form 4.36 (5/78)

QUESTIONNAIREPLANNING AND IMPLEMENTATION OF PUBLIC PROJECTS

1. Name:
2. Name of the organization you work for.....
.....
3. Position held in the organization.....
4. How long have you been involved in project implementation?
.....
5. Which one of the given has been your area of involvement?
(Feasibility studies, Designing, Bills of Quantities,
Contracting, Financial allocations, Supervision).
Tick the appropriate one.
6. Have you been involved in a project(s) from the start
to its/their end? (Yes/No).....
.....
.....
7. From this experience would you consider the performance
satisfactory (Yes/No).
8. If yes, what are the points of achievement that makes
you think so?.....
.....
.....
.....
9. If No, which areas do you reflect upon as having led to this
unhappy situation?.....
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.....
.....

10. Do you believe these areas of failure could have been identified at the preliminary planning stage and been taken care of?

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11. Generally Wananchi, including politicians, believe that public projects are delayed due to the rather slackish approach used by the implementing officers. Evaluate this statement:-

(a) If No, and still agreeing that projects are delayed, who do you think is to blame?

.....
.....
.....
.....
.....

(b) If Yes, please indicate which public officers.

(Score the blame out of 10 points)

2 - Ministry of Works, Housing and Physical Planning

4 - Treasury

3 - Client Ministries

1 - Ministry of Lands

12. What practical measures can be adopted to rectify the situation?

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13. Have you noted any significant difference between projects implemented through consultants and those done in house?

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14. Name some of the projects (only identify the name, value and year of implementation. Other details will be dug from the records in MOW and other offices)

(a)
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(b)
.....
(c)
.....
(d)
.....
(e)
.....

(f)

.....

(g)

.....

(h) 

(j)

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(k)
.....

15. To what factors would you attribute the difference?

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16. Do you regard planning procedures in use in various public offices as adequate?

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(a) Note areas of inadequacy.....

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(b) Or do you think they are adequate but there is some element of non-adherence?

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.....
.....

(c) Suggest how this can be overcome.....

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.....

17. What do you think about the feedback system?

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18. Contractors, especially African Contractors have also been blamed for the poor implementation of projects. Is this blame justified?

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19. The Government has two obligations which at the moment seem incompatible. The first one is to provide facilities to Wamachi. These facilities vary considerably but all need buildings as a place of operation. The second Government obligation is to support and develop an indigenous based construction industry. Can you suggest

how these two ends can be met without any unnecessary sacrifice on either side.

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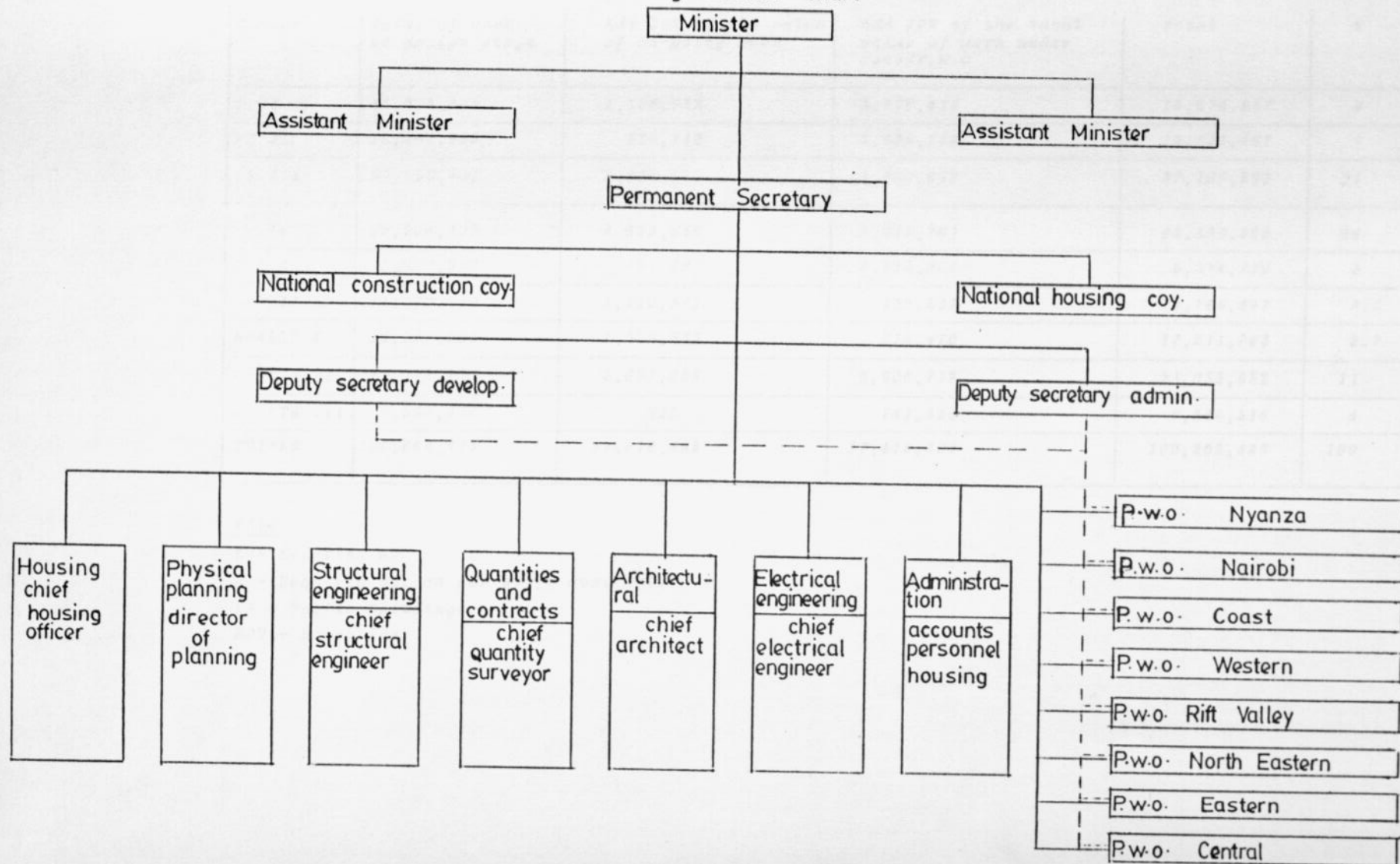
(a) Can these suggestions be accommodated at the planning stage?

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20. Standardization of building documents i.e. drawings and Bills of Quantities. Can this alleviate the problem?

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Ministry of Works, Housing and Physical Planning
Organization Chart



WORKLOAD IN HEADQUARTERS VS STAFF - 1981/82

Groups	Value of work at design stage	Add 25% of the value of on-going work	Add 10% of the total value of work under Cons/P.W.O	Total	%
FB I	11,239,469	1,158,352	3,176,416	15,574,837	9
FB II	10,207,419	820,710	2,698,538	13,732,667	7
FB III	34,566,408	1,143,557	1,450,818	37,100,863	21
FB IV	35,368,122	6,918,546	3,017,761	45,304,429	26
EDU I	4,957,977	311,797	1,215,005	5,214,779	3
EDU II	14,662,739	1,710,371	492,537	16,765,647	9.5
HEALTH I	14,939,960	1,555,333	716,470	17,211,763	9.7
HEALTH II	11,448,914	3,697,289	2,906,719	21,052,822	11
HEALTH III	6,503,486	NIL	741,036	7,244,516	4
TOTALS	144,864,473	17,916,555	17,415,309	180,202,328	100

KEY:

E - Existing NO

R - Required No. as per staff available

FB - Public Buildings

EDU - Education

WORKLOAD IN HEADQUARTERS VERSUS STAFF

1982/83

Groups	Value of work at design stage	Add 25% of the on-going work	Add 10% of the total Value of work under Cons/ PWO	Total	%
PB I	9,931,712	2,192,075	3,869,006	15,992,793	8.2%
PB II	6,048,550	1,512,137	3,357,879	10,918,566	5.6%
PB III	36,027,370	9,006,967	2,329,285	47,364,122	24.1%
PB IV	22,841,006	7,460,251	4,064,215	41,365,972	22%
PB V	7,242,034	1,810,508	2,183,719	11,236,261	5.7%
EDU	6,503,021	1,625,755	985,977	9,114,753	4.6%
HEALTH I	37,262,223	9,315,555	1,710,432	48,288,210	25%
HEALTH II	7,584,627	1,896,157	751,764	10,232,540	5.2%
TOTALS	141,970,268	35,467,565	17,065,583	194,513,044	100%

KEY:

E - Existing No. of staff

R - Required No. as per staff available

PB - Public Buildings

EDU - Education

WORKLOAD IN HEADQUARTERS VS STAFF - 1983/84

Groups	Value of work at design stage	Add 25% of the value of on-going work	Add 10% of the total value of work under Cons/P.W.O.	Total	%
PB I	16,183,971	2,031,105	3,179,080	21,694,156	10.4
PB II	7,241,360	1,790,023	2,855,007	11,886,390	5.9
PB III	43,205,763,	14,223,463	1,004,239	58,433,465	27.4
PB IV	29,123,841	6,139,551	4,183,964	39,447,356	19
PB V	7,934,628	1,723,489	2,164,871	11,822,988	6
EDU	4,826,351	1,004,560	852,510	6,683,421	3.2
HEALTH I	35,641,573	9,751,349	1,187,751	47,033,234	22.1
HEALTH II	9,672,945	921,223	676,326	900,094	5.4
TOTALS	154,130,432	37,584,763	15,976,905	207,692,100	100

KEY:

E - Existing No. of staff

R - Required No. as per staff available

PB Public Buildings

EDU - Education

WORKLOAD IN HEADQUARTERS VS STAFF - 1983/84

Groups	Value of work at design stage	Add 25% of the value of on-going work	Add 10% of the total value of work under Cons/P.W.O.	Total	%
PB I	16,183,971	2,031,105	3,179,080	21,694,156	10.4
PB II	7,241,360	1,790,023	2,855,007	11,886,390	5.9
PB III	43,205,763,	14,223,463	1,004,239	58,433,465	27.4
PB IV	29,123,841	6,139,551	4,183,964	39,447,356	19
PB V	7,934,628	1,723,489	2,164,871	11,822,988	6
EDU	4,826,351	1,004,560	852,510	6,683,421	3.2
HEALTH I	35,641,573	9,751,349	1,187,751	47,033,234	22.1
HEALTH II	9,672,945	921,223	676,326	900,094	5.4
TOTALS	154,130,432	37,584,763	15,976,905	207,692,100	100

KEY:

E - Existing No. of staff

R - Required No. as per staff available

PB Public Buildings

EDU - Education

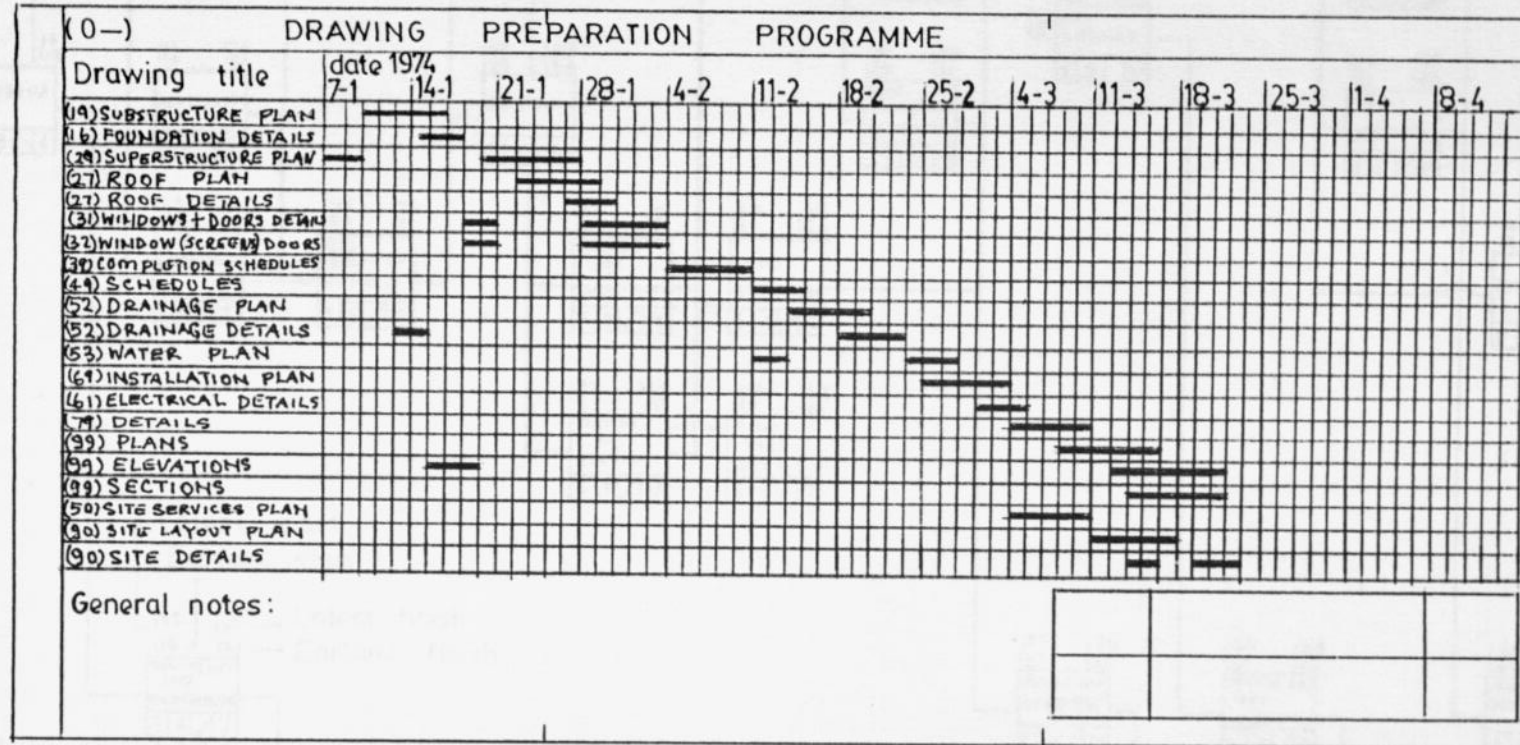
TABLE OF CUMULATIVE EXPENDITURE VS CONTRACT VALUE (KE 000'S)

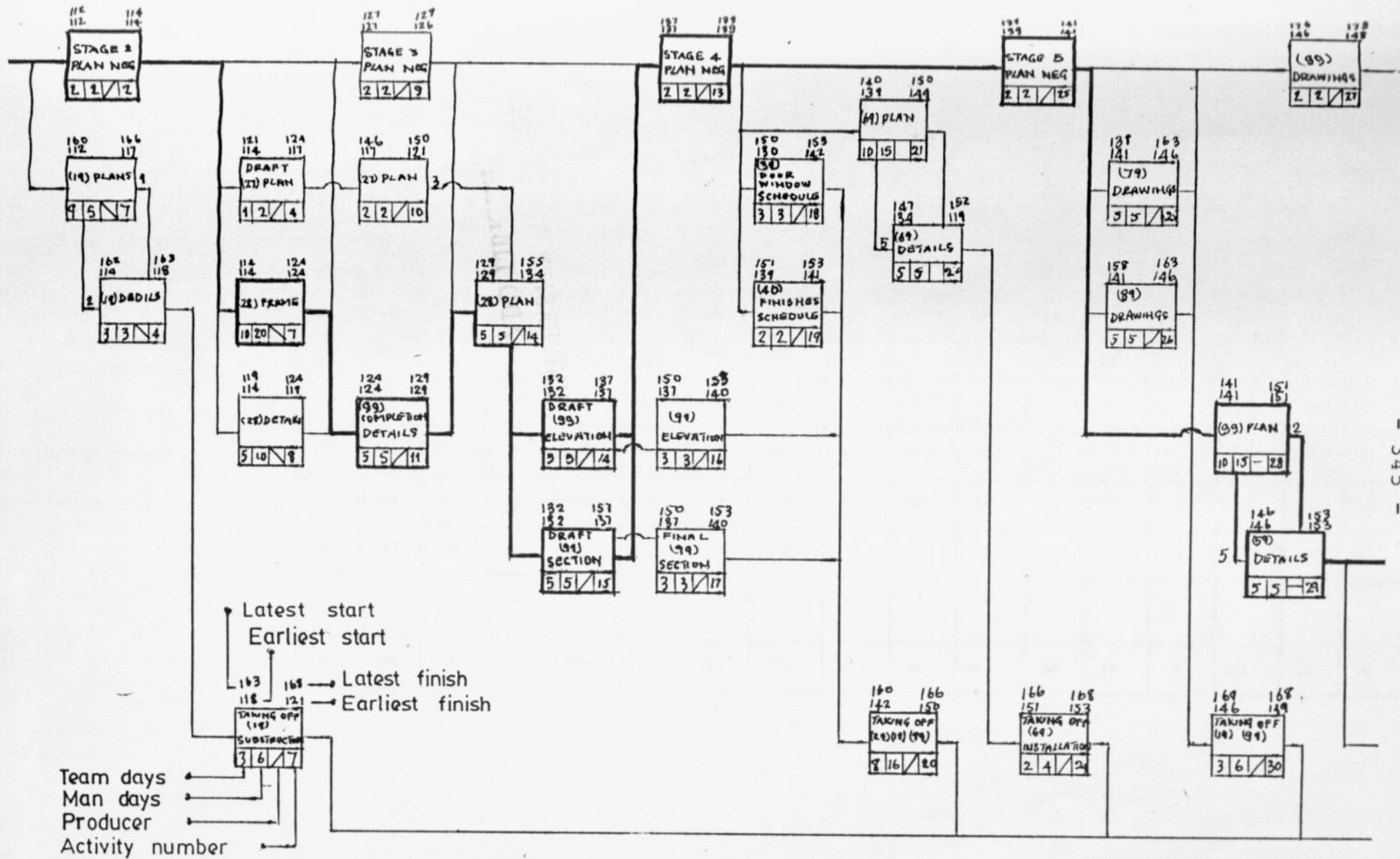
MONTH \ CONTRACT VALUE	5	10	20	30	40	60	80	100	150	200	250
1	0	0	0	0	0	0	0	0	0	0	0
2	1.0	2.0	2.8	3.3	3.8	5.0	6.0	7.0	9.0	11.0	12.0
3	2.0	4.0	5.4	6.6	7.2	9.0	11.0	12.0	16.0	20.0	22.0
4	3.0	6.0	8.2	9.6	10.6	13.0	16.0	17.0	24.0	29.0	32.0
5	4.0	8.0	10.0	12.7	14.0	18.0	21.0	23.0	32.0	37.0	43.0
6	4.7	9.5	13.5	15.9	17.6	22.0	26.0	28.0	39.0	46.0	53.0
7	4.7	9.5	16.2	19.0	20.8	26.0	31.0	34.0	46.0	55.0	62.0
8	4.7	9.5	19.0	22.3	24.4	31.0	36.0	40.0	53.0	64.0	74.0
9	5.0	10.0	19.0	25.3	27.6	35.0	41.0	45.0	61.0	73.0	84.0
10			19.0	28.5	30.4	40.0	46.0	51.0	68.0	82.0	94.0
11			20.0	28.5	34.4	44.0	51.0	56.0	75.0	91.0	104.0
12				28.5	38.0	48.0	56.0	61.0	83.0	100.0	114.0
13				30.0	38.0	53.0	61.0	67.0	90.0	109.0	124.0
14					38.0	57.0	66.0	73.0	98.0	117.0	134.0
15					40.0	57.0	71.0	78.0	105.0	126.0	145.0
16						57.0	76.0	83.0	113.0	135.0	155.0
17						60.0	76.0	89.0	120.0	144.0	165.0
18							76.0	95.0	128.0	154.0	175.0
19							80.0	95.0	135.0	162.0	185.0
20								95.0	143.0	171.0	195.0
21								100.0	143.0	180.0	206.0
22									143.0	190.0	216.0
23									150.0	190.0	226.0
24										190.0	238.0
25										200.0	238.0
26											250.0

TABLE OF CONTRACT VALUE VS CONTRACT PERIOD

CONTRACT VALUE (£)	CONTRACT PERIOD (MONTHS)
<i>less than 10,000</i>	6
<i>10,001 to 20,000</i>	8
<i>20,001 to 30,000</i>	10
<i>30,001 to 40,000</i>	12
<i>40,001 to 60,000</i>	14
<i>60,001 to 80,000</i>	16
<i>80,001 to 100,000</i>	18
<i>100,001 to 150,000</i>	20
<i>150,001 to 200,000</i>	22
<i>200,001 to 250,000</i>	24
<i>over 250,000</i>	26+

Figure 8.1 standard Bar chart for Estimating duration of drawing preparation





ANALYSIS : GROUP WORK LOADS
END FEB 1984

PRE-CONTRACT STATUS								POST-CONTRACT STATUS								
Group	No. of projs	Delete	Actual No.	Sketch Plans	Gen design	Contr. docs	No. of projs	Delete	Actual No.	Pract. compl.	On goin.	DELAYS CAUSED BY:				
												Client	Consul	Contr	Sub C	Invest.
I	396	298	98	68	-	30	64	-	64	30	2	5	-	18	2	7
II	144	38	46	7	11	28	203	7	136	109	9	21	-	32	17	2
III	247	155	32	33	16	37	145	8	135	60	3	7	-	45	7	13
IV	255	176	79	57	-	18	144	11	153	54	11	3	-	24	7	34
V	124	40	84	52	8	24	150	18	132	60	4	9	1	32	19	7
VI	37	10	27	26	-	1	32	1	31	12	1	1	1	4	1	11
CSA (D)	2	-	2	-	-	2	3	-	3	2	1	-	-	-	-	-
Totals	1205	777	428	249	33	190	739	45	694	327	31	46	2	161	55	74