

COMPARISON AND EVALUATION OF TANZANIAN CONSTRUCTION PROCEDURES

Thesis by

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Thanks

Halid

ABSTRACT

This research describes the study into construction delays in building projects in Tanzania. The main objective was to determine the causes and extent of construction delays and cost overruns on building projects. The findings from this study were also compared with studies in New Zealand and Australia.

Summary of the major factors influencing construction time delays and cost overruns were pointed out and possible solutions to these factors discussed with the aim of improving the performance of the building industry in Tanzania.

The study was based mainly on 42 completed projects with an average value of TShs. 19.5 million per building. The study has shown that the average extra time overrun on specified building contract time exceeded 50% and that the average cost overrun on specified building contract cost exceeded 26%.

The study cited poor economic conditions and management problems as the major factors which had attributed to the poor performance of the majority of the projects. These factors were also found to be common on the 30 ongoing projects and 14 abandoned projects included in this study.

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## ABBREVIATIONS

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DLYFTR	=	Delay factor
% DELAY	=	Percentage delay
BCAT	=	Building category
O	=	Office and Administration buildings
I	=	Industrial buildings
C	=	Institutional/Community buildings
S	=	Institutional/Special buildings
MGRP	=	Main building groups
A	=	Commercial buildings
B	=	Institutional buildings
RESP	=	Respondents
Arch	=	Architects
QS	=	Quantity surveyors
Engrs	=	Engineers
ArcEng	=	Architects and Engineers
ArEgQS	=	Architects, Engineers and Quantity Surveyors
DRT(wks)	=	Contract duration in weeks
TVAL(m)	=	Tender value in millions of Tanzanian Shillings
CLASS	=	Class of building contractor
C1	=	Class one building contractor
C2	=	Class two building contractor
C3	=	Class three building contractors
CLTNAM	=	Client name
Para	=	Parastatal Organisation
Govt	=	Government
Priv	=	Private Organisation
CONTYPE	=	Types of contract documentation
unirat	=	Unit rates
lumpsum	=	Lumpsum
C.fee	=	Cost and fixed fee
T.price	=	Target price
TTENDER	=	Types of tender
seldtr	=	Selected tender
opetdr	=	Open tender
negtdr	=	Negotiated tender
%COMPL	=	Percentage of work completed
TOWN	=	Name of town project constructed
Dar	=	Dar-Es-Salaam
Morgro	=	Morogoro
Shynga	=	Shinyanga
DLYMTRS	=	Lack of building materials

CLTFUND	=	Shortage of funds from client
CEQUIPT	=	Lack of construction equipment
TRANSPT	=	Transport problems
SCINCOMP	=	Sub-contractors incompetence
MISCLT	=	Misunderstanding between contractor and client
MCONSULT	=	Misunderstanding between consultant and contractor
MCINCOMP	=	Main contractor incompetence
MCBANKPT	=	Main contractor bankrupt

## I. INTRODUCTION

### 1.1 PROBLEMS OF CONSTRUCTION INDUSTRY

#### 1.1.1 General

The problems and difficulties of the construction industry have been observed with major concern in most countries. However, the extent of these problems differ from country to country but it is more pronounced in the less developed countries.

In an effort to find solutions to some of these problems, a number of countries, both industrialised and less developed, have conducted research studies, published journals and even books with the aim of providing guidance to professional groups within the construction industry, i.e. managers, related professionals and all those who are connected in one way or another to the construction industry. This however, has been done mostly in developed countries compared to the developing nations.

#### 1.1.2 Construction Industry in Developing Countries

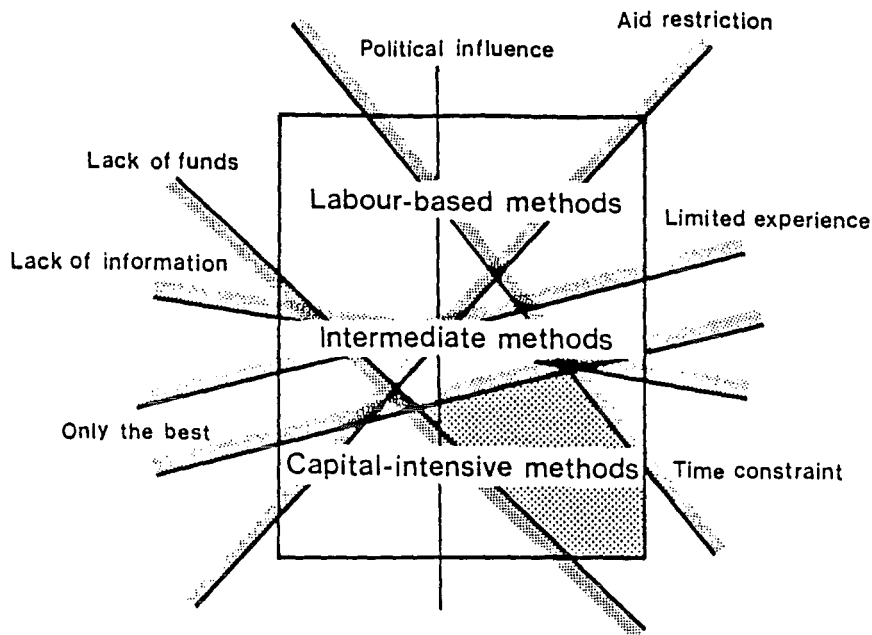
The construction industry in any country is considered to be a yardstick of development and economic progress. Stone (1966) showed that capital formation of construction in a country is about one-tenth of its gross national product. This shows a need for frequent research studies in this field, whereby problems could be investigated, with hope that these investigations would come out with solutions and new ideas to improve the industry.

In most of these countries construction activities have been expanding rapidly along with the overall development of national economy. However, the industry has in most cases been at risk of failure due to problems some of which are beyond the control of these countries, as outlined below.

Scott (1986) examined some of these problems and constraints which limit engineering choices and factors which create the constraints based on his experience in a number of developing countries (eg. Nigeria, Thailand etc). He described the problems encountered by civil engineers in these countries as being due to chronic shortage of funds, lack of manpower, scarcity of foreign exchange with which to import essential equipment, and materials, corruption and its effects, distortions of industry by foreign packages and constraints imposed by government policies and funding.

These difficulties and restrictions occur in concert to restrict the ranges of options available to the engineer on, for example, the methods of construction possible for a particular project (fig.1).

Fig 1: An illustration of the restrictions on the choice of construction method imposed by various constraints



## 1.2.0 REASONS AND SCOPE OF THE STUDY

### 1.2.1 Reasons for study - Construction Industry Problems in Tanzania

Tanzania like any other developing nation faces a lot of problems in this field. This study therefore, intends to investigate these problems encountered especially in buildings.

Experience shows that in every country the building industry is always under pressure from the clients to have their projects delivered to them in as short time as possible. The result of this sometimes, combined with other problems outlined in item 1.1.2, has in most cases been negative, in that many projects tend to overrun their proposed completion dates resulting in financial loss and inconvenience to clients and related professionals in the industry.

The Tanzanian Government under its technical ministry, Communication and Works is also aware of these problems. For example, the formation of technical advisory bodies like, National Construction Council (NCC), and National Board of Architects, Quantity Surveyors and Building Contractors, was intended to control and monitor construction industry in the country. Since no major research study has been conducted to investigate the causes and extent of construction delays on building projects in the country, the initiation of this study could be a good example for other future related studies in Tanzania.

### 1.2.2 Scope of Study

This study is aimed at investigating construction delays in building projects in Tanzania. The major objectives will be:

- i. To identify variables that experience shows tend to influence construction times.
- ii. To determine the most significant factors from those in (i).
- iii. To investigate how cost-overrun in projects varies with construction time delays.
- iv. Determine possible solutions for these factors in comparison with other studies conducted in countries like New Zealand and Australia.

## II. LITERATURE REVIEW

### 2.1.0 RESEARCH STUDIES IN CONSTRUCTION INDUSTRY

For some years, there has been an increasing awareness that inefficiency in the transfer of information in building has led to decisions which are faulty in timing as well as nature. The performance differences from those which were originally anticipated, and at the same time to pressures which have increased in intensity, and to business practices which have become markedly harder (Bromilow 1969).

Late completion of building contracts is a source of inefficiency, financial loss, and intense irritation in the industry. The difference between expectation when the contracts were entered into on the one hand, and the reality on the other, are substantial and larger than commonly supposed (Bromilow 1969).

Research studies conducted in countries like Australia, New Zealand and Thailand, to investigate the problems of the construction industry with reference to buildings, have come out with guidelines, which are of great importance to the parties involved in project management in their respective countries.

### 2.2.0 RESEARCH STUDY ON CONSTRUCTION TIME DELAYS - AUSTRALIA

The first major study of construction delays in Australia was conducted by Bromilow in 1967 at the CSIRO division of building research in Melbourne. The aim of the study was to establish whether departures from expectation were significant in building contracts.

#### 2.2.1 Scope of Data

The study was based on the time performance of 329 buildings with an average value of A\$ 0.89m per building. Buildings were differentiated by cost because this parameter has the advantage in that it reflects complexity and quality as well as physical size. The data however, did not include housing.

#### 2.2.2 Findings

The study has shown that only one building in eight was completed within the expected time. The following conclusions were drawn from the study:

- i. That the time taken for the construction of a building of a given value does not depend very strongly on the type of building or its location.
- ii. That the average extra time overrun (at that time-1969) on Australian specified building contract times exceeded 40%.

- iii. The estimated cost of a new contract could be combined with the historical correlation between time and cost to provide an estimate of construction time for the new contract. Bromilow plotted construction time against cost (size) on a graph using logarithmic scales and found that the mean trend line had a simple cost-time relationship of the form (fig.2a);

$$T = KC^B$$

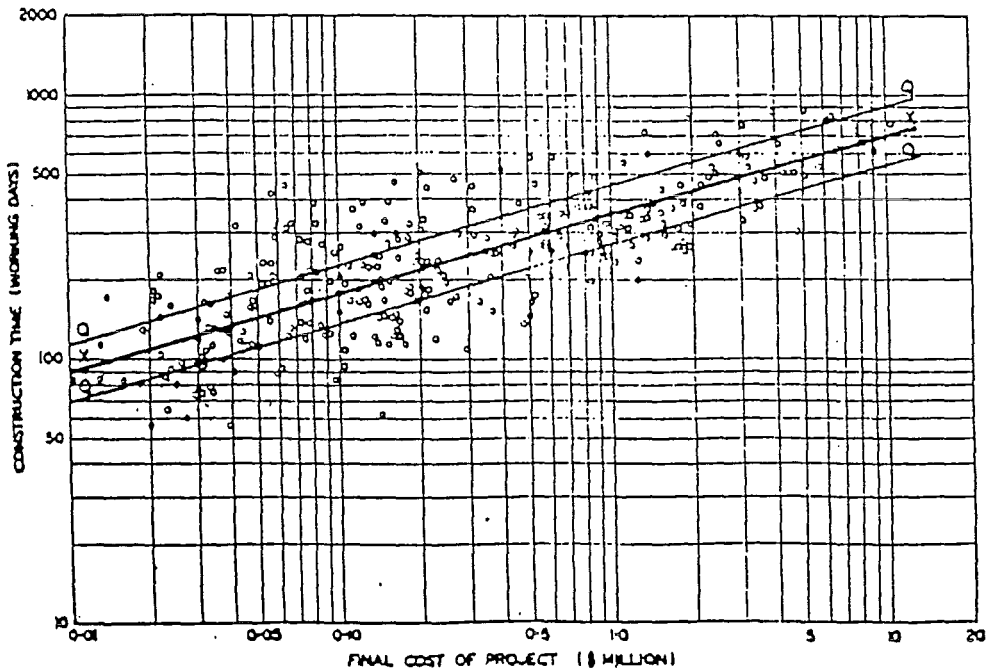
where T = actual construction time in working days  
 C = final cost of building in millions of dollars  
 K = constant characteristic of building time performance in Australia (350 in this case).  
 B = constant indicative of the sensitivity of performance to cost level ( 0.30 in this case).  
 That is, slope of the line X-X, see fig.2 below.

The formula could be used in following way:

when C = 1 (a \$ 1,000,000 project) T=350 days.  
 so K = is the average working time for such a project.

The study however, lacks information as to the causes of time delays and cost overruns.

Fig.2a: Standards of Time Performance realised in 303 building projects.



### Explanation of Fig.2a:

50% of projects fall within the band bounded by lines Q-Q in a clearly defined trend (surprising for "an activity such as building where projects differ widely from each other in design, location, quality, and administrative procedure").

Bromilow concluded that "this information now (1969) provides norms of performance and measure of likelihood of departure from these norms which can be used as measures against which to compare the realism of expectation as written in the contracts."

### 2.3.0 CONSTRUCTION TIME DELAYS STUDIES - NEW ZEALAND

Similar research studies on construction delays to that conducted in Australia were conducted in New Zealand by the Building Association of New Zealand - BRANZ (report R22-1976), Ministry of Works and Development - MWD (Arch 389-1986), and Industrial Research Group - IRG in 1987.

#### 2.3.1 Research studies into cost/time performance of building contracts (BRANZ)

BRANZ report R22 by Soeterik, Foster (1976) describes the findings of a study of time/cost performance of New Zealand commercial building contracts. The study was intended to make comparisons with findings from Bromilow's study. It was specifically aimed at providing a quantitative means of estimating construction time together with estimated cost of any particular building converted to constant prices using similar chart as in fig.2a.

##### 2.3.1.1 Scope of Data

A total of 97 contracts with a total value of \$NZ121m were studied. Higher value contracts (eg. above \$NZ 40,000) were selected. Dwellings, alterations and additions, and other construction were omitted from the data.

##### 2.3.1.2 Findings

The study has shown that;

- i. Cost is a less consistent measure of construction time than the method already used by industry. It was found that planned construction time correlates much more strongly with actual construction time than does the planned cost (table 1a).
- ii. Time overruns on building contracts, show an average of 20% on the 68 projects (ie. those with complete time and cost data).

The study however, did not show the causes of time delays and cost overruns.



Table 1a: Regression analysis of actual time, specified time and cost for 68 contracts

Simple regression	100 R (% variance explained)
$\log t_a$ vs $\log \$$	69
$\log t_s$ vs $\log \$$	71
$\log t_a$ vs $\log t_s$	90
Bivariate regression	.
$\log t_a$ vs $\log t_s$ and $\log \$$	90

$t_a$  = Actual construction time  
 $t_s$  = Specified construction time  
 $\$$  = Final construction sum

### 2.3.2 Research into Construction Time Studies - (MWD & IRG)

Research studies in construction time delays were also conducted by Ministry of Works and Development (MWD) in 1986 and later reviewed by Industrial Research Group (Bruhns, Tippet-1987).

#### 2.3.2.1 Scope of Data

The aim of the study was to determine the causes and extent of construction delays and cost overrun on building projects. A data base of 55 building projects from private architects, MWD-architects, and NZ's main design/build contractors in Auckland, Wellington and Christchurch centres was undertaken. Dwellings and alterations were omitted from this study.

#### 2.3.2.2 Major Findings and Recommendations

The research established:

- i. Management factors are the prime cause of construction delays and cost overruns.
- ii. That serious construction delays are considerably more likely when the client is a government agency or when the MWD is involved.
- iii. That factors like climate, site, technical and labour are not important causes of construction delay.

IRG found the survey data to have important limitations which reduced the reliability and extent of conclusions that can be made from the survey:

- i. That detailed information about the parties involved in the project was lacking.
- ii. Database contained too few buildings in some categories to be able to draw useful conclusions even though the data suggested important information.

However, IRG considers the main conclusions from the study as being sufficiently reliable to justify selected remedial activities by management. A further study was recommended before implementation of any of the above findings are made.

#### 2.4.0 RESEARCH STUDIES IN CONSTRUCTION INDUSTRY - DEVELOPING COUNTRIES

A number of research studies in the construction industry have been conducted in most of the developing countries. This section examines a brief report by the World Bank, and International Labour Organisation (ILO).

##### 2.4.1 Research Reports by World Bank, and International Labour Organisation (ILO)

The World Bank, and International Labour Organisation have published, for example, basic texts on labour-intensive methods of construction based on experiences and observations of projects which they have sponsored or supported.

##### 2.4.1.1 Available Information and its Use

The productivity rates established by World Bank studies, ILO, together with local labour and equipment costs, has for example, provided the possibility of estimating unit production costs for alternative methods of construction as shown on fig.2b and table 1b below. These studies which concentrates on earthworks calculations, have been made for various locations to determine the most suitable (least cost) equipment for different jobs<sup>7</sup>.

Fig.2b Costs of alternative methods of hauling earthwork in Zimbabwe.

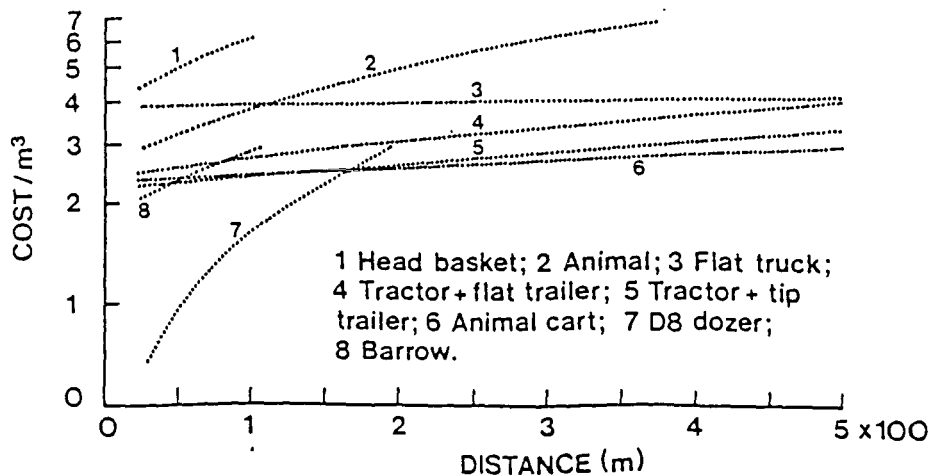


Table 1b Cost and Variance analysis of data from Zimbabwe; from a typical worksheet output

Method*	Mode	Cost	Variance	Std. deviation	Coefficient of variation
1	Tractor + flat trailer	3.454	0.241	0.491	14
1	Tractor + tip trailer	2.939	0.182	0.426	14
1	Flat-bed truck	3.995	0.419	0.647	16
1	D8 dozer	4.054	0.684	0.827	20
0	621 Scraper + D8 dozer	0.000	0.000	0.000	0
1	Mule carts	2.682	0.211	0.495	17
1	Donkeys	5.713	0.787	0.887	16
1	Wheelbarrow	4.356	0.558	0.747	17
1	Head basket	9.486	3.375	1.837	19
0	Dump truck	0.000	0.000	0.000	0

\* 1 = Available; 0 = Not available.

Notes: Standard deviation = Observed data value/6. Haul distance = 250 m.

Both fig.2b and table 1b show a typical example in which unit costs of labour and equipment in Zimbabwe are expressed as a function of haulage distance and the method of executing earthworks can be determined from this diagram for any haulage distance.

#### 2.5.0 Research outline

The following is the research outline for this study:

- i. A brief summary of construction industry in both developed and developing countries.
- ii. A review of relevant research studies that have been conducted in some countries (eg. Australia, New Zealand) and their respective findings.
- iii. The research method used to obtain data relating to this study.
- iv. Analysis of the whole data, grouping into various factors for analysis.
- v. Time analysis of collected data, discussion of the results, and presentation of the results.
- vi. Cost analysis of collected data, discussion and presentation of the results.
- vii. Cost and time relationship; Cost and time are investigated to see if any functional relationship exists between them.
- viii. Summary of findings from this study.
- ix. Comparisons of the findings from this study with those conducted in New Zealand and Australia.
- x. Conclusion, and recommendation for future study.

### III. RESEARCH METHOD

#### 3.1.0 RESEARCH DATA

This research is based on the data of building projects collected from building contractors and consulting firms based in Tanzania. The method used to conduct the research study is to examine, in depth, a number of Tanzanian building contracts and to extract findings relating to time and cost performance. Data was collected in the form of questionnaires.

##### 3.1.1 Questionnaire Design

The purpose of the questionnaire was to build up an overall picture of the building projects with regard to performance. Basically the questionnaire format consisted of two types. The first type was sent to building contractors, and the second type to consulting firms, (i.e. registered and practicing engineers, architects and quantity surveyors).

Each questionnaire had three main sections; Details of the firm, project information and general questions (appendix-i). Most of the questions were multiple choices, mainly for easy filling, and analysis purposes.

##### 3.1.1.1 Details of Firm

This section gives a brief description of the firm with regard to personnel, location and for building contractors, the registration class and year of registration.

##### 3.1.1.2 Project Information

Detailed information of each project executed by the respective firm was asked for in this section. Each respondent was required to fill in the questionnaire for at the most six completed projects. Respondents were also asked to fill in the questionnaire for one abandoned and one on-going project which had suffered substantial delays (refer appendix-i).

The outline of project information required in this section include;

- i. Project description and location.
- ii. Project cost; this includes tender value, and cost at completion, ongoing, or abandoned stage.
- iii. Name of the consultant/contractor
- iv. Name of the client
- v. Type of tender
- vi. Date of start and initial contract duration
- vii. Extension of time; authorised and overrun
- viii. Type of contract

- ix. Project status and percentage completion
- x. Reasons for delays

#### 3.1.1.3 General Questions

This section sought the general views of each respondent with regard to their experiences on project implementation. The questions were based on the following main items:

- i. Building materials
- ii. Funds
- iii. Construction equipment
- iv. Technical personnel
- v. Transport
- vi. Labour
- vii. Project location
- viii. Clients
- ix. Weather
- x. Subcontractors
- xi. Any recommendation

#### 3.1.1.4 Accompanying Letter

An accompanying letter and instruction sheet was attached to each questionnaire. The aim was to introduce the research work to each of the participants (respondents), an outline of the type of data required and general instructions regarding completion of the questionnaire.

### 3.3.0 SCOPE OF DATA

Data from projects was limited to all completed, ongoing and abandoned building projects executed in the last ten years, with tender value for each project exceeding TShs.10.0m. Projects in the higher price range are important for these cases because they reflect longer construction time, hence individual differences in performance of projects are likely to become more apparent.

#### 3.3.1 Limitation to the Number of Questionnaires

There was no limit to the number of questionnaires to be sent to the respondents. However, an overall 60 questionnaires which seemed to be adequate for this study were sent as shown on table 2 below.

Table 2: No.of questionnaires sent to respondents

Type of Respondent	Number of Questionnaires Sent	Number of Projects per Questionnaire	Total Number of Projects
Consulting firms	25	6	150
Building contractors	35	6	210
TOTAL NUMBER OF PROJECTS EXPECTED			360

### 3.3.1. Respondents

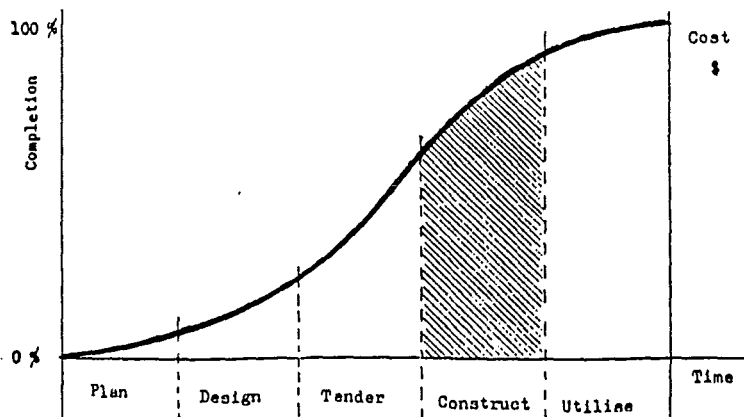
The term respondents here applies to all participants to whom the questionnaires were sent. These were:

1. Building contractors in class I,II, and III.  
Classes here limit the contractor to the cost of any single project for which he can tender and execute. This is in accordance with By-Laws and Regulations of Board of Registration in Tanzania.
2. Registered consulting firms in Architectural, Engineering and and Quantity Surveying both in public (Govt) and private.

### 3.4.0 PROJECT DELIVERY PROCESS

Building is a process involving planning, designing, tendering, construction and utilisation (refer fig.3 below) involving long periods of time. These activities are distinct, but merge to form the building process (Arch 389-1986). This study concentrates mainly on the construction part, as accurate information both on time and cost performance can be obtained to measure this period, allowing relative comparisons with each projects.

Fig.3: Project delivery process



### 3.4.1 Construction Time

The time measured here is of the construction period from the date the contract was let (ie.construction commencement) until the date that practical completion was certified. That is when the building was complete enough to be able to function in the capacity intended.

#### 3.4.1.1 Delays

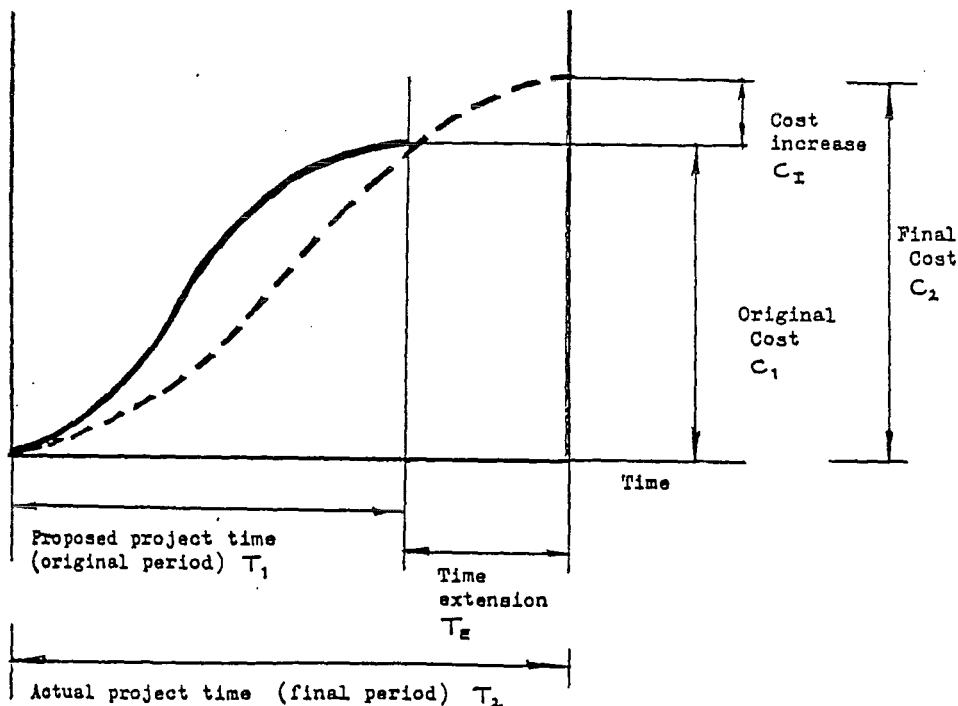
Delays (time overrun) here measured the difference between the time specified (planned) before work started and the actual construction time. It therefore takes into account the average time of extension, and the inaccuracy of planned time.

A time delay factor may be calculated to determine how far a contract has overrun its construction period as shown on fig.4 below.

$$\begin{aligned} \text{Delay} &= \frac{\text{Final contract period} - \text{Original contract period}}{\text{Original contract period}} \\ &= \frac{T_2 - T_1}{T_1} = \frac{T_e}{T_o} \end{aligned}$$

where  $T_e$  = time overrun  
 $T_o$  = specified (planned)time

Fig.4: Time extensions



## IV. ANALYSIS OF COLLECTED DATA

## 4.1 SURVEY RESPONSE

Out of the 60 questionnaires sent to the respondents, only 19 questionnaires were returned. Overall, 102 projects were received out of the 360 projects expected, giving a response of 28.3%. The 102 projects were then grouped according to their status; ongoing, completed and abandoned for analysis purposes (table 3).

Table 3: Distribution of projects by status

Project Status	Total	Ongoing Projects	Completed Projects	Abandoned Projects
Number of projects	102	37	49	16
Distribution (%)		36.3	48.0	15.7

## 4.1.1 Cost and Time Information

Table 4 shows the distribution of projects for each of the three status (ongoing, completed, abandoned) according to cost and time data.

Table 4: Cost and Time data

Project Status	Number of Projects	Time Data		Cost Data	
		Complete Data	Incomplete Data	Complete Data	Incomplete Data
Completed	49	42	7	40	9
Ongoing	37	19	18	12	25
Abandoned	16	8	8	6	10

NB: Time data - includes both planned and actual times.  
 Cost data - includes both tender value and cost at either completion, abandoned/ongoing stage.



#### i. Ongoing Projects

Out of the 37 ongoing projects, only 19 projects have complete time data, whereby 12 have complete cost data. Overall only 12 projects have complete time and cost data (table 8b).

#### ii. Completed Projects

Out of 49 completed projects, 42 have complete time data, whereby 40 have complete cost data. Overall, 40 projects have complete time and cost data (table 8a).

#### iii. Abandoned Projects

Out of 16 abandoned projects, 8 have complete time data, whereby 6 have complete cost data. Only 4 projects have complete time and cost data (table 8c).

#### 4.1.2 Other Grouping of Data.

The overall data (102 projects) were classified and analysed according to the following seven major items below, for each of three projects status (table 3).

- i. Clients  
Government, parastatal organisation, and private organisation.
- ii. Contract types  
Unit rates, lump sum and cost and fixed fee.
- iii. Tender types  
Open, selected and negotiated tenders.
- iv. Building contractors  
Class one (C1), class two (C2), class three (C3).
- v. Building categories  
Refer table 6 below
- vi. Main building groups  
Commercial (A), and Institutional (B) refer table 6.
- vii. Towns  
Analysis by towns was omitted as more than 50% of all the projects were constructed in Dar.

#### 4.1.3 Respondents

Overall 19 participants responded, 10 of these are building contractors while 9 are consulting firms. With the exception of one building contractor, all the participants are from Dar-es-salaam (Dar), the capital of Tanzania. Below is the list of all respondents.

## LIST OF RESPONDENTS:

## A. CONSULTANTS:

Registered Name	Speciality	H/Office
1. Barker & Barton	Q.S.	Dar
2. Design Collaborative	Architects	Dar
3. Design Partnership	Engineers	Dar
4. Design Services	Architects	Dar
5. QS-Consultancy	Q.S.	Dar
6. MD-Consultancy	Architects	Dar
7. NEDCO	Arch.Eng.QS.	Dar
8. Plan Associates	Arch.Eng.	Dar
9. W.O. & Partners	Q.S.	Dar

## B. BUILDING CONTRACTORS:

Registered Name	Class	H/Office
1. BECCO Ltd	C2	Dar
2. Builders (V.M.Chavda Ltd)	C1	Dar
3. Corporation Sole W/Supt.	C3	Dodoma
4. G.D. Raj (1974) Ltd.	C1	Dar
5. Hem Sigh	C1	Dar
6. J.W. Ladwa (1974) Ltd	C1	Dar
7. Millo Construction Company	C3	Dar
8. Newcon Contractors	C3	Dar
9. Patel Construction Co. Ltd	C1	Dar
10. Southern Enterprises	C3	Dar

NB:-

C1 = Class one building contractors  
Over TShs.25 million for any single contract (i.e. No limit)

C2 = Class two building contractors  
Not exceeding TShs.25 million for any single contract

C3 = Class three building contractors  
Not exceeding TShs.15 million for any single contract.

SOURCE: National Board of Architects, Quantity Surveyors and Building contractors (Tanzania 1986). These cost limitations are subject to change by the Board depending on the economy of the country.

Table 5: Classification of buildings

Type of Buildings	Category Abbreviation	Main Group
1. Office, Administration	Office (O)	Commercial  (A)
2. Warehouses, Factories Power Houses etc.	Industrial (I)	
3. Hospitals, Nursing homes, Cultural, Recreation, etc	Institutional Special (S)	Institutional  (B)
4. Hotels, Motels, Homes, Boarding, Educational- buildings, Multi-storey flats, Housing Estates	Institutional Community (C)	
5. Dwellings, Renovation, Alterations and others	Miscellaneous (M)	This group omitted

#### Building categories:

Building types were grouped into 5 main categories-called Building Categories, and finally rationalised into 2 major groups called Main Building Groups; Commercial (A), and Institutional (I). Miscellaneous Category (M) is omitted for analysis to avoid ambiguity.

Consequently, the number of projects for analysis for each of the three project status (ongoing, completed and abandoned) becomes 30, 42 and 14 respectively (table 8a, 8b, 8c).

#### 4.2.0 ANALYSIS OF DATA

Graphical method of analysis was opted as the number of projects for each of the three project status (table 4), where analysis is to be done separately, was not sufficient for the statistical analysis method. Statistics can distort reality, especially with small data (Arch 389-1986), as in this case. VP-Planner software package was used to tabulate the data into required formats, and plotting graphs.

##### 4.2.1 Tabulation of Data

For each of the three projects status (i.e. ongoing, completed, uncompleted and abandoned), projects were tabulated in order of decreasing delay (tables 8a, 8b, 8c), then analysed for each of the seven main items (refer item 4.1.2). This was achieved by calculating the percentage delay as shown below.

$$\text{Delay} = \frac{\text{Time extension}}{\text{Original period}}$$

$$\% \text{ Delay} = \frac{\text{Final period} - \text{Original period}}{\text{Original period}}$$

#### 4.2.1.1 Delay Factor

The % delay was then arranged to the delay factors in order that the amount of delay could be grouped into meaningful units (table 7). This was achieved by plotting the % delay (in ranges of 10%) against the cumulative number of projects less or equal to that of a given delay margin. By dividing the cumulative projects into equal units four delay factors were obtained as shown below.

Table 7: Delay factors

Delay Factors	Range (% Delay)
0	No delay
1	Up to 34% Delay
2	34% upt to 67% delay
3	Over 67% delay

#### 4.3.0 PRESENTATION AND COMMENTS ON THE RESULTS

Chapter 5 presents the results of time analysis of the data and short comments for each of the completed, ongoing, and abandoned projects separately.

Chapter 6 presents the results of cost analysis of the data and short comments for each of the completed, ongoing, and abandoned projects separately.

Chapter 7 investigates into cost and time relationship, to see if any functional relationship exists between the two variables.

Chapter 8 summarises the findings obtained from the study.

Chapter 9 compares the findings from this study with those conducted in Australia and New Zealand.

Conclusions and recommendations for future study are presented in Chapter 10.

## V. TIME ANALYSIS - PRESENTATION AND DISCUSSION OF RESULTS

### 5.1.0 COMPLETED PROJECTS

Table 8a lists all completed projects in order of decreasing delay factors. The effect of delays against each of the major items, such as clients, contract types, tender types, building contractors, building categories and main building groups are plotted. Inter-relations between each was investigated. Factors that contributed to delays are also presented and comments given.

#### 5.1.1.0 PROJECTS BY CLIENTS

##### 5.1.1.1 Overall Distribution (Table 9a)

Parastatal organisation shows a higher number of projects (62%), than both Government (14%) and private organisation (24%).

##### 5.1.1.2 Delays

###### a. Comparisons by Individual Clients (Fig.5a)

###### i. Government

The number of projects increases with higher delays (except for delay factor 3). No project was completed on time and more than 2/3 of the projects had higher delays (table 9b). This indicates a relatively poor performance.

###### ii. Parastatal

A slight difference in the number of projects is noted for those completed on time and those adversely delayed (delay factor 4). About 1/3 of the projects were completed on time (table 9b).

###### iii. Private

Generally the number of projects increases with longer delays. Though 10% of the projects were completed on time (table 9b), more than 2/3 had longer delays (delay factor 2&3).

b. Comparisons of Clients as Combined Group (Fig.5b)

Projects by parastatal show a relatively higher number of projects for each of the delay factor 0-3. Despite the percentage shown by frequency distribution of projects (table 9a) for government, parastatal and private as; 14%, 62% and 24% respectively, their respective ratios from delay factor 0-3 are;

Dlyftr:	0	1	2	3
Ratio :	0:8:1	2:5:1	3:4:4	1:9:3

Implications:

The lower ratio (0 at delay factor-0) shown by government and higher ratio (3 at delay factor-3) by private indicates relatively good performance of projects whose client was parastatal, followed by private organisation. Poor performance is shown in government projects.

5.1.2.0 PROJECTS BY CONTRACT TYPES

5.1.2.1 Overall Distribution of Projects (Table 10a)

Unit rates show the highest number of projects (83%), followed by lumpsum (14%) and cost and fixed fee (3%). This indicates that Unit rates is the most frequently used of the three.

5.1.2.2 Delays

a. Comparisons of Individual Contract Types (Fig.6a)

i. Unit Rates

The highest number of projects is shown by higher delays. Though 20% of the projects were completed on time (table 10b), about 2/3 (delay factor 2&3) had longer delays. Overall, 80% of the projects were delayed.

ii. Lumpsum

The highest number of projects were shown by shorter delays. 33% of the projects were completed on time compared to 1/3 adversely delayed (delay factor 2&3). Overall, 67% of the projects were delayed, indicating a reasonable performance (table 10b).

iii. Cost and Fixed Fee

Omitted due to a relatively small number of projects.

b. Comparisons of Contract Types as Combined Group (Fig.6b)

A relatively higher number of projects is shown by unit rates for each of delay factors 0-3. Though the percentage shown by frequency distribution of projects (table 10a) by unit rates and lumpsum is; 83%, 14% and 3% respectively, their their relative ratio from delay factor 0-3 are;

Dlyftr:	0	1	2	3
Ratio :	7:2	6:2	11:0	11:1

Implications:

The lower ratios (7,6 at delay factor 0,2) and higher ratios (11,11 at delay factor 2,3) shown by unit rates indicates lumpsum projects to have a better performance than unit rates.

5.1.3.0 PROJECTS BY TENDER TYPES

5.1.3.1 Overall Distribution of Projects (Table 11a)

Open tender shows higher number of projects (48%), than both selected (38%), and negotiated (14%) tenders.

5.1.3.2 Delays

a. Comparisons of Individual Tender Types (Fig.7a)

i. Open Tender

The largest number of projects were noted for longer delays. Though 15% of the projects were completed in time (table 11b), more than 2/3 had longer delays (delay factor 2,3). In overall, 85% of the projects were delayed. This indicates a relatively poor performance.

ii. Selected Tender

Both long and short delays show the same number of projects. About 31% of the projects had no delays, while 1/2 had longer delays (delay factor 2,3). Overall 67% of the projects were delayed (table 11b). The number of projects shown by shorter delays to those of longer delays indicates a relative better performance.

iii. Negotiated Tender

Short delays (delay factor 0,1) were more common than longer delays. About 33% of the projects had no delays (table 11b) compared with 33.4% with longer delays (delay factor 2,3).

b. Comparisons of Tender Types as Combined Group (Fig.7b)

Selected tenders show a relatively higher number of projects for delay factor-0. However open tenders show relatively larger numbers of projects for longer delays. Though the percentage shown by frequency distribution of projects (table 11a) for open, selected and negotiated tenders is; 48%, 38% and 14% respectively, their respective ratios for delay factor 0-3 are:

Dlyftr:	0	1	2	3
Ratio :	3:5:1	3:3:3	7:3:1	7:5:1

Implications:

Open tenders show higher ratios for both delay factor 2 and 3. Selected tenders show a balanced number of projects for both delay factor 0 and 3. Negotiated tenders show higher ratios for lower delays. In terms of performance, both selected and negotiated tenders show a relatively better performance than open tenders. This shows the preference of either selected, or negotiated tenders during tendering

5.1.4.0 PROJECTS BY BUILDING CONTRACTORS

5.1.4.1 Overall Distribution of Projects (Table 12a)

Class One (C1) building contractors show the highest number of projects compared to both class two (C2) and class three (C3).

5.1.4.2 Delays

a. Comparisons of Individual Contracts (Fig.8a)

i. Class One (C1) Contractors

More projects had longer delays. About 18% of the projects had no delays (table 12b), while 60% had longer delays (delay factor 2,3). Overall, 71% of the projects were delayed.

ii. Class Two (C2) Contractors

No project was completed on time (table 12b), while delay factor 3 alone shows in 62.5% of the projects. A poor performance.



iii. Class Three (C3) Contractors

The majority of projects were completed on time and none for delay factor 3. More than half of the projects (57%) had no delays (table 12b), a relatively better performance.

b. Comparisons of Contractors as Combined Group (Fig.8b)

Class one contractors show relatively higher number of projects for each of delay factor 0-3. Though the frequency distribution (%) of projects (table 12a) by C1, C2, and C3 are; 64%, 19% and 17% respectively, their respective ratios for each of the delay factors 0-3 are:

Dlyftr:	0	1	2	3
Ratio :	5:0:4	6:1:2	8:2:1	8:5:0

Implications:

Though C1-contractors show higher ratios for delay factor-0, the highest are on delay factors 2 and 3. Class two contractors (C2) show higher ratios for longer delays. Class three contractors (C3) show higher ratios for shorter delays. Therefore in terms of performance class three contractors are more reliable in keeping to schedule followed by class one contractors. Poor performance is noted for class two contractors.

5.1.5.0 PROJECTS BY BUILDING CATEGORIES

5.1.5.1 Overall Distribution of Projects ( Table 13a)

The Institutional category (S), accounted for the lowest number of projects (7%), as compared to Office (26%), Industrial (13%), and Institutional special which contributed 36%.

5.1.5.2 Delays

a. Comparisons of Individual Bldg.Categories (Fig.9a)

i. Category -0 (Office)

The highest number of projects is shown in delay factor 1. No project was completed on time, while more than 1/2 of the projects had longer delays (delay factor 2,3) as shown on table 14b.

ii. Category -I (Industrial)

A constant number of projects were noted from delay factor 0-3. 23% of the projects had no delays (table 13b), while 60% had longer delays (delay factor 2,3). Overall three-quarters of the projects were delayed.

iii. Category -S (Institutional/Special)

No project was completed on time. About 2/3 of the projects (table 13b) had longer delays. This indicates poor performance. However, because of the relatively small number of projects in this category as compared to the other categories, the findings cannot be justified.

iv. Category -C (Institutional/Community)

A greater number of projects were completed on time compared to those adversely delayed. Overall, 40% of projects were completed on time (table 13b), a relatively better performance.

b. Comparisons of Bldg. Categories as Combined Group (Fig.9b)

Both categories I and C show a relatively larger number of projects for shorter and longer delays. Ommitting category (S) which had a relatively small number of projects, the percentage distribution of projects (table 13a) by 0, I, and C are; 26%, 31% and 36% respectively. However, their respective ratios for delay factors 0-3 are:

Dlyftr:	0	1	2	3
Ratio :	0:3:6	5:3:0	3:3:4	3:4:5

Implications:

The higher ratios shown by both Institutional/community (C), and Industrial (I) for delay factor-0, than their actual distribution indicate their relatively better performance than those by category (0) office.

5.1.6.0 PROJECTS BY MAIN BUILDING GROUPS

5.1.6.1 Overall Distribution of Projects (Table 14a)

57% of the projects were classed as commercial (group A) while the remaining 43% were classed as institutional (group B).

5.1.6.2 Delays

a. Comparisons of Individual Bldg. Groups (Fig.10a)

i. Group -A (Commercial)

The least number of projects were shown by a delay factor of 0. Only 1/8 (12.5%) of the projects were completed on time (table 14b), indicating a relatively poor performance.

ii. Group -B (Institutional)

The number of projects completed on time (delay factor 0) balance with those adversely delayed (delay factor-3). Only one-third of the projects were completed on time (table 14b).

b. Comparisons of Main Bldg.Groups as Combined (Fig.10b)

With the exception of delay factor-0, where Institutional (group B) showed a relatively longer number of projects, a different trend was noted for those with a delay factors 1,2,and 3. With a larger number of projects on delay factor-0, and a lower number of projects on delay factors 1-3, Institutional projects show a relatively good performance.

Implications:

Although Institutional buildings are shown to have improved in performance compared to Commercial ones, the difference shown is too small to form a definite conclusion.

5.1.7. INTER-RELATIONSHIP; CLIENTS, CONTRACT TYPE AND TENDER TYPE

This section investigates the inter-relationship between client/type of tender, client/type of contract, and contract type/type of tender.

5.1.7.1 Client/Types of Tender (Fig.11)

The Government used mostly open tenders for its contracts. More than three-quarters (83%) of its projects (table 15) were open tender.

Parastatal organisation however, was shown to use both open and selected tenders. 54% of the projects were open tender, while 40% were selected tenders (table 15).

For private clients, both selected and negotiated tender were predominant. Half of the projects (50%) were negotiated tenders compared to 40% by selected tender (table 15).

5.1.7.2 Client/Types of Contract (Fig.12)

Unit rates contract documentation was predominant in most projects. 100% of government projects, 85% of parastatal, and 70% of private projects.

Lumpsum contract documentation was mostly used in the private projects (30%), while parastatal projects accounted for 12% (table 16).

### 5.1.7.3 Contract type/Type of Tender (Fig.13)

Open tender accounted for a large proportion of projects (57%) where contract documentation is in unit rates, followed by selected (34%), and negotiated (9%) tenders.

For lumpsum projects, a large proportion were of the selected tender type (67%), followed by negotiated tenders at 34% (table 17).

Cost and fixed fee tenders were omitted because of the relatively small number of projects.

### 5.1.8.0 REASONS FOR DELAYS

#### 5.1.8.1 Contributing Factors to delays (Table 18)

Table 18 gives the tabulation of all 42 completed projects in order of decreasing delay factor, along with reasons that contributed to their delays. Frequency distribution of projects for each of the factors causing delays is shown on table 19.

#### a. Findings:

i. The major problems seem to be the availability of building materials (73.8%), followed by transport (35.7%), labour (26.2%), funds from clients (23.8%), design, and weather (21.4%) respectively.

ii. The relatively lower percentage of the other remaining five indicated that the reason for delay was of less importance.

#### b. Major Factors contributed to delays (Fig.14)

Table 20 shows the detailed frequency percentage for each of the major factors which contributed to delays.

With the exception of labour and design problems (fig.14), the number of projects was greater with longer delays. This indicated that, most of the delayed projects were affected by building materials, transport problems, and to a lesser degree by weather and lack of funds from clients.

## 5.2.0 ONGOING PROJECTS

Table 8b lists all the ongoing projects in order of decreasing delay factors. The effects of delays on each of the major items, such as clients, type of contract, type of tender, contractors and main building groups are investigated. This analysis is based on 19 ongoing projects with complete time data (see sect. 4.1.1 (1), and table 4).

## 5.2.1 Projects by Clients

Table 21a: Ongoing projects.

Delay Factors vs Percentage Projects by Individual Clients

Clients	Number of Projects	Distribution Percentage	Delay Factors			
			0	1	2	3
Government	9	100	11.1	0.0	33.3	55.6
Parastatal	9	100	0.0	44.4	22.2	33.4
Private	1	100	100.0	0.0	0.0	0.0

Table 21a shows the following for each of the clients;

- Government: The majority of the projects (more than 4/5) had longer delays (delay factor 2,3). 11% of the projects were on schedule (ie. no delays).
- Parastatal: More than 1/2 of the projects (56%) had longer delays (delay factors 2,3). All projects were delayed.
- Private: Omitted (the only project which was in this group had no delays).

Comments:

There was a larger proportion of projects with longer delays for government client than parastatal clients, and therefore may indicate that less delays were likely to be encountered in parastatal contracts.

However, this conclusion is not proven especially when all the parastatal projects were delayed.

## 5.2.2 Projects by Contract Type

Table 21b: Ongoing Projects  
 Delay Factors vs Percentage Projects by Individual  
 Contract Types

Type of Contract	Number of Projects	Distribution Percentage	Delay Factors			
			0	1	2	3
Unit rates	14	100	0.0	28.6	35.7	35.7
Lumpsum	4	100	25.0	0.0	0.0	75.0
T/Price	1	100	100.0	0.0	0.0	0.0

Table 21b shows the following for each type of contract;

Unit Rates: 71% of the projects had longer delays (delay factor 2,3). All projects were delayed.

Lumpsum: 75% of the projects had longer delays (delay factor 3). 25% of the projects had no delays.

Target Price: Omitted (ie. the only project in this group had no delay).

Comments:

Both contract types were associated with longer delays. The fact that all projects by unit rates contract were delayed may suggest that lumpsum contract is preferable to unit rates contract. However, this conclusion is not proven especially when the number of projects by unit rates is much larger and therefore cannot provide a sound comparison with lumpsum ones.

## 5.2.3 Projects by Type of Tender

Table 21c: Ongoing projects  
 Delay Factor vs Percentage Projects by Tender Types

Type of Tender	Number of Projects	Distribution Percentage	Delay Factors			
			0	1	2	3
Open	14	100	7.1	14.3	35.7	42
Selected	2	100	0.0	100.0	0.0	0.0
Negotiated	3	100	33.3	0.0	0.0	67.7

Table 21c shows the following for each of the type of tender;

Open: 79% of the projects had longer delays (delay factors 2,3). 93% of the projects were delayed.

Selected:

All projects had short delays. However, all projects were delayed.

Negotiated:

67% of the projects had longer delays (delay factor 3). 33% of the projects had no delays.

Comments:

The above results indicate that in terms of delays both selected and negotiated tender contracts are preferable to open tender contract. The former had the majority of its projects with longer delays. However, the smallness of number of projects in both selected, and negotiated tender compared to that of open tender, reduces the reliability of the above conclusion.

5.2.4 Projects by Building Contractors

Table 21d: Ongoing projects  
Delay Factors vs Percentage Projects by Individual  
Building Contractors

Type of Contractor	Number of Projects	Distribution Percentage	Delay Factors			
			0	1	2	3
C1	11	100	0.0	36.4	36.4	27.2
C2	2	100	0.0	0.0	50.0	50.0
C3	6	100	33.3	0.0	0.0	66.7

Table 21d shows the following for each of the type of contractors;

Class 1: 64% of the projects had longer (C1) delays (delay factors 2,3). All projects were delayed.

Class 2: All projects were delayed and had longer delays (C2) (delay factors 2,3).

Class 3: 67% of the projects had longer delays (delay factor 3). 33% of the projects had no delays.





Table 22: Ongoing Projects  
Delay Factors vs Percentage of Work Completed by Individual  
Projects

Delay Factors	Work Completed Percentage vs Percentage Delays for each Project								
0	Work completed (%)	75	80						
	% Delays	0	0						
1	Work completed (%)	95	80	65	45				
	% Delays	9	22	22	31				
2	Work completed (%)	36	30	90	30	16			
	% Delays	45	46	50	50	61			
3	Work completed (%)	95	96	99	80	60	94	70	85
	% Delays	105	161	190	226	259	387	400	646

The following results can be deduced from table 22;

i. Delay factors vs projects

The majority of ongoing projects were delayed and longer delays represented a large proportion of the projects.

ii. Delay factors vs percentage of work completed

Delay factor 0: Two projects in this group had more than 75% of their work completed.

Delay factor 1: The percentage of delays increase with decreasing percentage of work completed for each projects. The highest percentage of work completed is 95% and the lowest is 45%, with corresponding delay factors of 9% to 31% respectively.

Delay factor 2: The percentage of delays increase with decreasing percentage of work completed for each project. The highest percentage of work completed is 90% and the lowest is 16%, with corresponding delay factors of 61 to 45% respectively.

Delay factor 3: The percentage of work completed for most of the projects is above 80% and the percentage of delays exceeded 100% for all the projects.

Comments:

Lower delays (delay factor 0,1) had the majority of the projects with more than three quarters of their work completed. Most of the projects with one third of their work completed had percentage delays in a range between 45-50%. Majority of the projects with longer delays ( >100%) had more than 80% Of their work completed.

The general conclusion which can be drawn from these results is that, the majority of the ongoing projects were adversely delayed and a large proportion of these projects were on the finishing stages.

However, we cannot rely on this conclusion because the extent of these longer delays could probably have been accumulated in the due course of the whole work.

## 5.2.7 Major contributing factors to delays.

Table 23 shows the factors that have contributed to delays for the ongoing projects in order of decreasing frequency. Out of 30 ongoing projects (item 4.1.1 (i) ), 4 projects were indicated to have had no delay problems. Therefore the distribution percentage shown in table 23 was drawn from 26 ongoing projects for each factor.

Table 23: Factors contributing to delays

Reasons for delays	Distribution	
	No.of Projects	Percentage
1. Building materials	21	80.8
2. Transport problems	12	46.1
3. Labour problems	10	38.5
4. Funds from clients	9	34.6
5. Construction equipment	5	19.2
6. Design problems	5	19.2
7. Weather	4	15.4
8. Subcontractor's incompetence	4	15.4
9. Main contractor's incompetence	3	11.5

Table 23 showed that;

- i. Most of the ongoing projects were delayed because of shortages in supply of building materials and inadequate transport facilities and to a lesser extent the shortage of labour and the non payment of funds from clients.
- ii. That lack of adequate construction equipment, design problems, weather, subcontractor's and main contractor's incompetences showed to have less effect on the delays of most of the projects.

### 5.3.0 ABANDONED PROJECTS

Table 8c lists all the abandoned projects in order of decreasing delay factors. Since only 8 projects out of 14 abandoned projects had complete time data (item 4.1.1 (iii)), analysis of these projects would be unrealistic. However, general comments regarding the 8 projects are presented below.

Table 24: Delay factors vs Percentage of Work Completed

Delay Factors	1	1	1	2	3	3	3	3
% Delays	24	29	33	37	80	105	118	400
% Work completed	20	36	-	50	90	20	80	80

Table 24 shows that;

- i. All projects were abandoned at a stage where progress of work was already delayed.
- ii. Half of the projects were abandoned when half of the work was already completed and the remaining projects had more than 20% of their work completed.

### 5.3.1 Abandoned projects vs Clients, Type of Contract/Tender, Contractors, and Main Building Groups.

- i. Clients: That no project by private client was abandoned. More than half of the projects were by parastatal clients.
- ii. Type of Contract: That unit rates had a larger proportion of the abandoned projects.
- iii. Type of Tender: That selected tender had the majority of the abandoned projects.
- iv. Contractors: A large proportion of projects were by class 1 contractors, followed by class 2 contractors.
- v. Building Groups: The majority of the buildings were of the commercial type.

### 5.3.2 Major Contributing Factors to Delays and Abandonment.

Table 25 shows the distribution percentage of projects for each of the main factors that have contributed to abandonment of the projects. Out of 14 abandoned projects (item 4.1.1-iii), two projects had no reason given as why they were abandoned. Therefore the frequencies shown were drawn from 12 abandoned projects for each factor.

Table 25: Factors contributing to abandonment

Factors	Distribution	
	No. Projects	Percentage
1. Funds from clients	9	75.0
2. Building materials	5	41.7
3. Misunderstanding with client	4	33.3
4. Main contractor's incompetence	3	25.0
5. Transport problems	2	16.7

## Comments:

Lack of funds from the clients was sited as the major reasons for the abandonment of most of the projects. The shortage of building materials, misunderstandings among contractor/client/ consultant, incompetence of main contractors and transport problems were the major contributing factors to delays in some of the abandoned projects (table 25).

#### 5.4.0 QUESTIONNAIRE RESPONSE

This section sought further information from the respondents about the factors which contributed to the delays as tabulated in item 5.1.8 and table 15. The questions were of two types, one for consultants and the other for building contractors.

#### 5.4.1 QUESTIONNAIRE RESPONSE -CONSULTANTS

The frequency percentage as shown for each of the following answers was gained from the 9 consultants. Refer to appendix-i for the questions.

##### 5.4.1.1 Contractors Experience

QUESTION 1: From your experience, are you pleased as to the way the projects are awarded to the contractors taking into consideration their class and past experience.

ANSWER: Yes = 6/9 (67%) ; No = 3/9 (33%)

QUESTION 2: Then, what changes if any, do you think could improve this trend?

ANSWER: The following answers were given;

- i. Tighten control on contractors capability/resources by Registration Board when registering/upgrading contractors (1/9)
- ii. Eliminate corruption in the awarding of contracts (3/9).
- iii. Clients should employ professionals who can work together with consultants (2/9).
- iv. Type of work should be taken into account together with the cost limitation in the classification of contractors (2/9).

#### Implications:

The awarding of contracts needs re-examination. The need for the Registration Board to re-examine the registration/upgrading procedures, and advise clients on projects management could be one of the factors to be investigated.

QUESTION 3: Do you think over commitment to projects is a significant factor in contractors not completing projects on time.

ANSWER: Yes = 2/9 (22%); No = 0 (0%); Not Always = 7/9 (78%)

QUESTION 4: If yes, then what could be the optimum number of projects the following contractors should have at any given time.

ANSWER:	CONTRACTORS	1-2	1-3	1-4	1-5	1-6	N/A
	C1	2	3	0	0	2	3
	C2	2	2	3	0	0	2
	C3	1	3	2	0	0	4

N/A = Not applicable

Implications:

The over commitment of projects by contractors seemed not to be a major factor in projects delays. Perhaps, a need for both consultants and clients to look at the workload of a given contractor before awarding the contract, taking into consideration of the problems summarised in chapter 7 could be very important.

5.4.1.2 Building Materials

QUESTION 1: Are the delays encountered because of the non-availability of building materials taken into consideration when fixing the duration of contracts?

ANSWER: Yes = 3/9 (33%); No = 4/9 (44%); Difficult = 2/9 (23%)

QUESTION 2: If no, then do you think taking the above factor into account could have produced a more realistic contract duration for projects?

ANSWER: Yes = 4/9 (44%); No = 2/9 (23%); Never = 0 (0%);  
Not Always = 3/9 (33%)

Implications:

Expected delays due to non-availability of building materials are not taken into consideration when estimating contract duration.

5.4.1.3 Types of Contracts

QUESTION 1: What form of contract conditions do you normally use?

ANSWER: The following were mentioned;

- i. East African Institute of Architects standard forms (7/9)
- ii. Ministry of works forms (2/9).

QUESTION 2: What method of contract documentation do you normally use?

ANSWER: The following were mentioned;

- i. Conventional contracts = 9/9
- ii. Cost Plus fixed % = 0/9
- iii. Cost and fixed fee = 1/9

QUESTION 3: What financial incentives do you normally use in contracts?

- i. Bonuses for early completion = 0/9
- ii. Liquidated damages = 9/9
- iii. Others = 0/9

Implications:

Consultants use mostly East African Institute of Architects standard forms for the contract conditions. No other financial incentives other than "Liquidated Damages" were used in contracts.

5.4.1.5 Contract Period

QUESTION 1: How is contract period normally determined?

- ANSWER:
- i. Ministry of works standard schedules = 10%
  - ii. Client requirements = 22%
  - iii. Consultants standard schedules = 22%
  - iv. Others -contractor state in tender = 56%

QUESTION 2: Who sets the contracts period for projects?

- ANSWER:
- i. Architects = 2/9
  - ii. Engineers = 1/9
  - iii. Quantity surveyors = 1/9
  - iv. Project managers = 0
  - v. Contractors = 4/9
  - vi. Client requirements = 3/9

Implications:

Despite the fact that both clients and consultants can set the contract duration, it seems the majority of the projects are likely to have their duration determined by the contractors.

#### 5.4.1.5 Method of Construction

QUESTION 1: Traditionally, cast-in-situ method of reinforced concrete construction is used in Tanzania. Can you think of any other method of construction not normally used in the country that could result in an improvement in construction in terms of cost and time?

ANSWER: Use of semi-prefabricated concrete elements in module forms. (3/9)

#### 5.4.1.6 Additional Comments

The following are major comments given by consultants;

- i. There is lack of experienced personnel in most clients who could work in hand with consultants. 2/9
- ii. There is a laxity in specification and supervision by consultants 1/9
- iii. High inflation affects the large projects which are financed in local currency. 1/9
- iv. Irregularity in awarding of contracts is a common procedure by clients and this has an effect in general project performance. 2/9
- v. Majority of contractors lack technical qualified personnel at all levels. 2/9
- vi. Because of a lack of advanced technology cast-in-situ concrete is opted as the best method of construction. 2/9

#### Implications:

The comments pointed out above may indicate weaknesses by consultants, contractors, and clients in project management. However, the frequencies (number of consultants) shown on each of the comments suggest that these weaknesses do affect few of them.

#### 5.4.2.0 QUESTIONNAIRE RESPONSE - BUILDING CONTRACTORS

The frequency percentage shown on each of the following answers is drawn from 10 building contractors.



## 5.4.2.1 Building Materials

QUESTION 1: How do you rate the availability of building materials in this country? (ie. Are they readily available whenever they are needed).

ANSWER:

FACTORS	EXCELLENT	FAIR	DIFFICULT	VERY DIFFICULT
Freq	0/10	1/10	9/10	0/10

QUESTION 2: Then, which of the following building materials have been a contributing factor to delays in a significant number of projects?

ANSWER:

Type of Materials	Cement	Reinforced Steel	Timber	Paints	Fittings
Freq.	10/10	10/10	1/10	3/10	9/10

QUESTION 3: Which of the following fittings have contributed to delays in projects?

ANSWER:

Type of Fittings	Sanitary	Electrical	Glass	Plumbing	Iron Mongery
Freq.	9/10	9/10	8/10	4/10	4/10

QUESTION 4: Have the price rises in the above items (questions 2 and 3 above) considerably affected the progress of the projects?

ANSWER: Yes = 9/10; No = 1/10

Implications:

It seems the supply of building materials does not cope with the demand. The most critical are cement, reinforcing steel, and fittings. For fittings, the supply of sanitary, electrical, and glass was shown to be unreliable. The effect of unreliable supply of these materials inevitably causes higher prices.

## 5.4.2.2 Construction Equipment

QUESTION 1: Do you consider the construction equipment you have is sufficient for the projects you executed?

ANSWER: Yes = 9/10 ; No = 1/10

QUESTION 2: What equipment could have improved the efficiency of all executed projects, but the company does not own?

Equipment	Concrete Mixer (Lge)	Tower Cranes	Earth Moving Equipment	Compactor
Freq.	6/10	3/10	5/10	4/10

QUESTION 3: Is this equipment available from dealers?

ANSWER: Yes = 2/10; No = 8/10

Implications:

Most contractors have indicated they have the most needed construction equipment. Most contractors need large capacity concrete mixers, earth moving machinery, but less have a need of tower cranes, and compactors. All this equipment are not available from local dealers.

5.4.2.3 Funds

QUESTION 1: From your experience, with which of the following clients have you experienced difficulties in regard to payment whenever your claims were submitted to him?

Clients	Government	Parastatal	Private	None
Freq.	7/10	6/10	2/10	2/10

Implications:

It seems non-payment to the contractors is mostly felt when the client is government and parastatal organisations.

5.4.2.4 Technical Personnel

QUESTION 1: Do you think your company has adequate technical personnel?

ANSWER: Yes = 6/10; No = 4/10

QUESTION 2: Had there been difficulties finding and retaining qualified experienced personnel (eg. Engineers, Architects, Q.S. etc.).

ANSWER: Yes = 6/10; No = 4/10

QUESTION 3: Which of the following personnel are you still in need of?

ANSWER:

Professionals	Engineers	Q.S.	Archs.	Techns.	Survs.
Freq.	9/10	4/10	0/10	9/10	1/10

Implications:

Because of the higher demand indicated by contractors for engineers, technicians, and quantity surveyors, this proves there is a shortage of qualified and experienced personnel in most of the construction companies.

5.4.2.5 Transport

QUESTION 1: Which of the following means of transport do you use?

ANSWER:

Means of Transport	Roads	Railways	Lake	Sea
Freq.	9/10	6/10	0/10	1/10

QUESTION 2: Which transport system has contributed to delays regarding the supply of building materials to the sites?

ANSWER:

Means of Transport	Roads	Railways	Lake	Sea
Freq.	3/10	6/10	0/10	1/10

QUESTION 3: When road transport is taken into consideration, how do you normally cart materials to sites?

ANSWER:

Means Used	Comp.Trucks	Hired Trucks	Both
Freq.	5/10	0/10	4/10

Implications:

Both railways and roads are the major means of transport of materials. Of the two (railways, roads), railways seemed to have not provided an adequate service.

## 5.4.2.6 Labour

QUESTION 1: Do you frequently face labour shortage?

ANSWER: Yes = 8/10; No = 2/10

Implications:

Labour shortages in construction sites is a problem in most parts of the country.

## 5.4.2.7 Weather

QUESTION 1: Do you find weather one of the reasons for delays in most of your projects?

ANSWER: Yes = 5/10; No = 5/10

QUESTION 2: If so, which seasons were critical?

ANSWER: Rainy seasons = 5/10

Implications:

Weather does not seem to be a critical problem, despite the fact it could slow the progress of work especially during the rainy season.

## 5.4.2.8 Project Location

QUESTION 1: Given chance, which of the following areas would be the most favourable for you to excute projects?

ANSWER:

i.	Coast zone	-	10/10
ii.	Northen zone	-	5/10
iii.	Lake zone	-	0/10
iv.	Central zone	-	1/10
v.	Southen zone	-	0/10
vi.	Southen highlands	-	7/10

IMPLICATIONS:

Most contractors prefer to work in the Coast zone, Northen zone and Southern highlands. This conclusion could be biased especially when nine out ten building contractors in this study are located in the coast zone (Dar-Es-Salaam). However, accessibility (ie. industries, good means of transport etc.) could account for the Northen Zone and and Southern Highlands.

## 5.4.2.9 Sub-Contractors

QUESTION 1: Have you ever worked with sub-contractors?

ANSWER: Yes = 9/10; No = 1/10

QUESTION 2: Have you ever experienced significant delays in working with subcontractors?

ANSWER: Yes = 6/10; No = 4/10

QUESTION 3: What type of subcontractors did you work with?

ANSWER: The majority of contractors mentioned major installation subcontract like; electrical, telephone, air conditioning, piling etc.

Implications:

The majority of main contractors worked with subcontractors. Most of the main contractors have experienced significant delays in working with subcontractors.

The type of subcontracts and the extent of the delays suffered by each of the main contractors was not included in this survey.

## 5.4.2.10 Clients

QUESTION 1: From your experience, how do you consider the client (ie.govt, parastatal, or private) can contribute to the successful completion of project on time?

ANSWER: The followings answers were given:

- i. Payment of contractors interim certificates within the stipulated time.(6/10)
- ii. Clients should employ competent professionals on project management who have final decision on all matters concerning contracts. (4/10)
- iii. Selection of experienced consultants.(2/10)
- iv. Having all working drawings ready before tendering. (1/10)
- v. By keeping variations to a minimum. (1/10)
- vi. Termination of contracts to be seriously observed, as the quotations from a new contractor could rise tremendously compared to variation order by the older contractor. (1/10)

Implications:

A lack of coordination between the contractors and clients is observed from the above points (i-vi). Though the points suggest remedial action to both consultants and clients, the frequency shown on each of the answers (i-vi) indicates that these problems are not common to the majority of consultants and clients.

## VI. COST ANALYSIS - PRESENTATION AND DISCUSSION OF RESULTS

## 6.1 GENERAL

This chapter investigates into the effect and causes of cost overruns of the 40 completed projects, the 12 ongoing projects and the 6 abandoned projects. These are projects with complete cost data (see sect. 4.1.1 and table 4). However, detailed cost analysis of both the ongoing and the abandoned projects would not be analysed in detail because of the relatively small number of projects in each.

## 6.1.1 Cost Overrun

Cost overrun is the difference between the planned cost and the actual cost at completion.

$$\text{Cost overrun} = \frac{\text{Final Cost at Completion}}{\text{Planned cost}} = \frac{C1}{C0}$$

$$\% \text{ Cost overrun} = \frac{C1 - C0}{C0} \times 100\%$$

The percentage cost overrun has been divided into four categories for analysis purposes as shown on table 26 below.

Table 26: Ranges of cost-overruns

Category	Range of Cost Overrun
< 0%	Less or zero cost overrun
0 - 25%	Up to 25% cost overrun
25 - 50%	25% up to 50% cost overrun
50 - 100%	50% up to 100% cost overrun

## 6.2.0 COMPLETED PROJECTS

## 6.2.1 Percentage Cost Overrun vs Projects

The distribution percentage of projects against the cost overrun percentage is shown on figure 15. The results show that 85% of the projects had experienced cost overrun and the majority of these projects have cost-overrun in the range of between 0-50%. In general, the projects showed an average cost overrun of 23%.

### 6.2.2 Percentage Cost-Overrun vs Percentage Time-Overrun

Table 27 shows the distribution percentage of projects within individual cost-overrun categories in terms of delay factors. The distribution of these projects are presented in graphical form in fig.16. The results show that for the cost-overrun of;

- i. <0% : Short delays represent the majority of projects in this category of cost-overrun. 67% of the projects had no delays, and 33% had delay factor 2.
- ii. 0%-25% : Longer delays represent 63% of the projects in this category of cost-overrun. 21% of the projects had no delays.
- iii. 25%-50% : Longer delays represent a large proportion of projects in this category of cost-overrun. 9% of the projects had no delays.
- iv. 50%-100% : Longer delays represent a large proportion of projects in this category of cost-overrun. All projects were delayed.

#### Implication:

The results show that the number of projects associated with shorter delays is larger the less the cost-overrun. And that the number of projects completed on time decreases substantially when the cost-overrun is higher.

These results indicate that, cost-overrun is likely to be encountered in delayed projects and that the amount of cost-overrun is likely to increase the longer the duration of the delays. The effect of inflation and variations which could be expected in delayed projects could have a direct impact on the cost of most of the projects. Hence, the effect of cost-overrun could be substantial.

### 6.2.3 Percentage Cost Overrun vs Clients, Type of Contract, Type of Tender, Building Contractors and Main Building Groups

#### 6.2.3.1 Percentage Cost-Overrun vs Clients (Table 28, Fig.17)

**Government:** All projects experienced cost-overrun. However, the number of projects decreases with increasing percentage cost-overrun in a sequence of 50%, 33.3% and 17% for cost-overruns of 0-25%, 25-50% and 50-100% respectively.

**Parastatal:** About one-quarter of the projects had no cost-overrun. The projects that did have cost-overrun decrease in number in a sequence of 50%, 27% and 12% for increasing cost-overruns of 0-25%, 25-50% and 50-100% respectively.



Private: More than one third of the projects had no cost-overrun. The projects that had cost-overrun decrease in number in a sequence of 37.5%, 25% and 0% for increasing cost-overruns of 0-25%, 25-50% and 50-100% respectively.

Implication:

The large proportion of projects that experienced cost-overrun in government and to a lesser degree to parastatal projects, gives an indication that less cost-overrun is likely to be encountered in private contracts than in either government and parastatal projects.

The fact that most government projects experienced longer delays and that the effect of cost-overrun is likely to increase the longer the delay (sect. 6.2.2), supports the above conclusion.

6.2.3.2 Percentage Cost-Overrun vs Contract Type (Table 29, Fig.18)

Unit Rates: 85% of the projects in this group had cost-overrun. However, 15% of the projects experienced no cost-overrun.

Lumpsum: 80% of the projects in this group had cost-overrun. However, 20% had no cost-overrun.

Target Price: Omitted (ie. there was only one project).

Implication:

Cost-overruns in both contract types (Unit rates, Lumpsum) were shown to be substantial despite the fact that, the relatively small number of projects in lumpsum contract (table 18) does not provide a sound comparison with unit rates contract.

6.2.3.3 Percentage Cost-Overrun vs Type of Tender (Table 30, Fig.19)

Open Tender: 90% of the projects in this group had cost-overruns and show a distribution of 45%, 35% and 10% for cost-overruns 0-25%, 25-50% and 50-100% respectively.

Selected Tender : 81% of the projects in this group had cost-overruns and show a distribution of 56%, 13% and 13% for cost-overruns 0-25%, 25-50% and 50-100% respectively.

Negotiated Tender : 75% of the projects in this group had cost-overruns and show a distribution of 25%, 50% and 0% for cost-overruns 0-25%, 25-50%, and 50-100% respectively.

Implication:

A small number of projects with no or little cost-overruns in both selected and negotiated tenders suggests that, less cost-overruns are likely to be encountered in these types of tender than in open tender contracts. However, the fact that the majority of projects in all the types of tender experienced cost-overruns does not really support this conclusion.

The fact that both selected and negotiated tender projects were associated with shorter delays and that long delays were found to be associated with high cost-overruns (sect. 6.2.2), gives an indication that the use of negotiated and selected tender in contracts could have an effect in reduction of cost-overrun in projects.

## 6.2.3.4 Percentage Cost-Overrun vs Building Contractors (Table 31, Fig.20)

Class 1 Contractors:	Low cost-overruns account for a large proportion of the projects in this group. However, 84% of the projects had cost-overruns.
Class 2 Contractors:	High cost-overruns accounted for a large proportion of the projects in this group. All projects had cost-overruns.
Class 3 Contractors:	Low cost-overruns accounted for a large proportion of the projects in this group. 71% of the projects had cost-overruns.

Implication:

The results show that the effect of cost-overruns is higher for a large proportion of the projects executed by class 2 contractors, and less for class 2 and class 3 contractors.

The longer delays experienced by the majority of the projects executed by class 2 contractors could have a substantial effect on the high cost-overrun in these projects.

## 6.2.3.5 Percentage Cost-Overrun vs Main Building Groups (Table 32, Fig.21)

Group A Commercial :	91% of the projects in this group had cost-overrun and showed a distribution of 60%, 27% and 5% for cost-overruns 0-25%, 25-50%, and 50-100% respectively.
Group B Institutional:	78% of the projects in this group had cost-overruns, and showed a distribution of 34%, 28% and 16% for cost-overruns 0-25%, 25-50% and 50-100% respectively.

Implication:

Institutional projects showed an fairly even distribution of projects through the whole range of cost-overruns. The higher number of projects with no cost-overruns in this group compared to commercial projects give an indication that, less cost-overruns are likely to be encountered in institutional contracts than commercial ones. However, the fact that more than two thirds of the projects in both groups had cost-overruns, therefore providing no proof for the conclusion.

The fact that a large proportion of commercial projects were found to be associated with longer delays could account for the relatively higher cost overrun in this group than in institutional projects.

## 6.3.0 ONGOING PROJECTS

Table 8b lists all the ongoing projects in order of decreasing delay factors. The fact that only 12 ongoing projects had complete cost data (table 4), makes the analysis of these 12 projects as a sample of all the ongoing projects unrealistic. However, general comments from the 12 projects are given below.

## 6.3.1 Cost-Overruns vs Projects

Table 33: Percentage Cost-Overrun vs Projects

	Total No. of Projects	% Cost-Overruns			
		<0%	0-25%	25-50%	>50%
Distribution	12	6	2	2	2
% Distribution	100%	50%	16.7%	16.7%	16.7%

Table 33 gives the distribution percentage of projects in terms of percentage cost-overrun, with the following results;

- i. That half of the projects had not exceeded their planned construction cost.
- ii. That the remaining half showed equal distribution for cost-overruns of 0-25%, 25-50% and >50%.

## 6.3.2 Percentage Cost-overflow vs Delay Factors

Table 34: Cost-Overflow (%) vs Delay Factors

Cost-overflow	No. of Projects	% Distribution	Delay Factors			
			0	1	2	3
<0%	6	100%	16.6	16.6	66.8	0.0
0-25%	2	100%	0.0	0.0	50.0	50.0
25-50%	2	100%	50.0	0.0	0.0	50.0
>50%	2	100%	0.0	0.0	0.0	100.0

Table 34 and Fig.22 showed the distribution percentage of the projects by the individual cost-overflow in terms of delay factors. The results drawn here indicate that, for the cost-overruns of;

- <0% : 67% of the projects had longer delays (delay factor 2,3). Overall, 83% of the projects were already delayed.
- 0-25% : All projects were delayed with a delay factor of 2,3.
- 25-50% : Half of the projects were delayed, with delay factor 3.
- >50% : All projects were delayed, with a delay factor of 3.

Comments:

The majority of projects which had cost-overflow were associated with longer delays.

These results give an indication that, higher cost-overflow is likely to be encountered for most of the delayed projects. This is likely in practise especially when the effect of inflation, variation etc. the longer the project is delayed.

### 6.3.3 Percentage Cost-Overrun vs Percentage of Work Completed.

#### i. Ongoing Projects with no Cost-Overrun

Table 35a: Cost Spent Percentage vs Percent of Work done

Cost Spent %	24.0	28.7	35.9	68.2	80.0	90.0
% Work Done	30	36	30	75	80	90

#### ii. Ongoing projects with cost-overrun

Table 35b: Percentage Cost-Overrun vs Percentage of Work done

Cost-Overrun %	15.7	22.3	48.4	48.4	53.6	110.7
% Work Done	30	94	96	75	95	99

### 6.3.4 Comments

Tables 35a and 35b show that;

There is a uniform increase in the both percentage cost spent with corresponding percentage of work done for individual projects with no cost-overrun. Higher cost-overrun represents the majority of the projects with the percentage of work done above 75% for the projects already encountered cost-overrun. The fact that there are only six projects in each of the above two tables, no conclusive comments can be given for the above results.

#### 6.4.0 ABANDONED PROJECTS

The list of abandoned projects is listed on table 8c. Since only six abandoned projects had complete cost data (table 4), it was unrealistic to perform any analysis of these projects. However, the following results are derived from the table below;

#### 6.4.1 Percentage Cost Spent vs Percentage of Work Completed

Table 36: Cost Spent Percentage vs Percentage of Work Completed

Cost spent (%)	15.6	18.7	30.1	32.5	37.2	76.9
% Work Done	0	5	20	50	36	80

#### 6.4.2 Comments

Table 36 shows that:

No abandoned project had encountered cost-overrun. That majority of the abandoned projects had spent between 15-38% of the budgeted cost, with the corresponding percentage of work done between 0-50%. This again indicates that the majority of the projects were abandoned in the early stages of construction.

## VII. COST AND TIME RELATIONSHIP

### 7.1.0 PRESENTATION AND DISCUSSION OF RESULTS

This chapter investigates into cost-time relationship of 40 completed projects. Bromilow (1969,1971) established cost and time relationship for Australian building projects (sect. 2.2.2), and such relationship were established for Newzealand building projects (sect. 2.3.0). The aim of this section is to investigate the existance of a similar relationship with Tanzanian data.

#### 7.1.1 Method of Analysis

All projects final costs (ranging from 1979-1987) were adjusted to 1987 values by using cost index (see appendix-ii for calculation). Graphs of actual construction time ( $T_a$ ) against final cost and actual construction time ( $T_a$ ) against original (planned) time- $T_o$  were plotted on logarithmic scales. A mean trend line of project performance for each graph was determined and plotted using simple linear regression analysis. The results are summarried in table 20 (appendix iv).

### 7.2.0 Findings

#### 7.2.1 Actual Construction Time as Function of Final Cost

A low correlation is shown by the data points (fig.18). The degree of correlation ( $r$ ) is 0.39, and the coefficient of determination ( $R$ ) is 0.15 (table 23). The importance of coefficient of determination is that it measures how well the estimated regression line fits the data points (see appendix iii). In this case only 15% of the construction time variance can be accounted for in terms of contract cost.

#### 7.2.2 Actual Construction Time as Function of Planned Time

A fairly high correlation is shown by the data points (fig 19). The degree of correlation ( $r$ ) is 0.89 and the coefficient of determination ( $R$ ) is 0.79 (table 23). Therefore, 79% of the actual construction time can be accounted for in terms of planned construction time. The importance of this graph is that it illustrates the ability of the industry to estimate (planned) construction time.

### 7.2.3 Comments from the Results

The above results has shown that there is a fairly strong correlation between planned construction time ( $T_o$ ) and actual construction time ( $T_a$ ) than does the construct sum. Despite a very low correlation shown by actual construction time ( $T_a$ ) vs. final construct sum ( $C$ ) graph (fig.18), the results show some similarities to those conducted in New Zealand (BRANZ report R22 1976), which concluded that "contract times are already being specified in a much more self-consistent way than could be done using the construction time-contract cost correlation to estimate construction time from estimated cost". Therefore, it will be misleading also in this case to use fig.18 to estimate construction time using estimated contract cost. The low correlation shown by graph in fig.18 (Log  $T_a$  vs Log  $C$ ) could have possibly been contributed by many factors, for example;

1. The data base was too small that statistical analysis could in this case be misleading.
2. Most of the projects were affected by the poor economy of the country which resulted from many factors (eg. The war with the neighbouring country (Uganda) in 1979), where most of the projects were reshcheduled due to lack of funds. (About half of all the projects were in one way or another affected by the war)
3. A substantial spread of results is to be expected in activity such as building where projects differ widely from each other in design, location, quality and administrative procedure (Bromilow 1969).

Therefore, a wide range of data would be suggested to re-check the above findings and conclusions drawn thereafter (see chapter 10).

Table 20: Regression Analysis of Actual Time, Planned Time and Cost for 40 Completed Projects

Simple Regression	Correlation Coefficient (r)	100R (% explained)	Mean trend line (log scale)
log $T_a$ vs log $C$	0.39	15%	$y = 0.24x + 1.7$
log $T_a$ vs log $T_o$	0.89	79%	$y = 1.023x + 0.12$
log $T_o$ vs log $C$	0.46	21%	$y = 0.25x + 1.35$

$T_a$  = Actual construction time  
 $T_o$  = Planned construction time  
 $C$  = Final construction sum  
 $r$  = Correlation coefficient  
 $R$  = Coefficient of determination



## VIII. SUMMARY OF FINDINGS

### 8.1 GENERAL REVIEW

The study has shown that there are substantial problems in the building industry from the fact that majority of projects are not completed in time and delays (overrun) to more than 100% were noted in about one third of all the projects surveyed. For the 42 completed projects studied, 30% had delays over 100%, where by 50% had delays up to 100%. Only 20% of the projects were completed on time of which more than half of these were housing projects. Although the findings produced by this study most probably reflect the prevailing picture of the building industry in Tanzania, there are factors which reduce the reliability of the findings;

1. The number of completed projects studied is relatively small compared to the overall completed projects in the period of study (1979-1980).
2. That the study concentrated mainly on the construction stage of the whole project delivery process.
3. That most of the questions were designed to avoid the need for great detail in the responses with the aim of avoiding too long a questionnaire, which could probably discourage respondents.

However, the picture presented by the data is as good review of Tanzanian construction industry as can be compiled bearing in mind the difficultness of communication, lack of sophisticated data collection procedure, and lack of skilled personnel in the industry.

#### 8.2.0 TIME ANALYSIS-PROJECT MANAGEMENT FACTORS AND PROJECT DELAYS

##### 8.2.1 Completed Projects

###### 8.2.1.1 Clients

- |             |  |
|-------------|--|
| Government: | Longer delays were common for majority of the projects, with none completed on time.                 |
| Parastatal: | Shorter delays were common for majority of the projects, with more than one third completed on time. |
| Private:    | Longer delays were common for majority of the projects. However, one tenth had no delays.            |

#### Conclusion:

Longer delays were more likely to be expected for government projects and to lesser extent on private projects. Less delays shown by parastatal client which is an indication of good performance to private clients. However, the highest number of projects by parastatal in this category (clients) compared to private projects could probably have contributed a lot to the performance shown by parastatal client.

### 8.2.1.2 Contract Types (Methods of contract documentation)

- Unit Rates: Longer delays were common with large proportion of the projects. One fifth of the projects were completed on time.
- Lumpsum: Shorter delays were common with a large proportion of the projects. One third of the projects were completed on time.
- Cost and Fixed Fee :  
Omitted as there was only one project in this group.

#### Conclusion:

The use of lumpsum contract may be associated with short delays.

Shorter delays encountered by lumpsum projects could probably be explained by the fact that most of the lumpsum contracts are not so uncertain and in most cases the contract time is relatively short and more predictable.

### 8.2.1.3 Type of Tender

- Open Tender: Longer delays were common with the majority of the projects. 15% of the projects had no delays.
- Selected Tender: Short and long delays show in equal proportions. 31% of the projects had no delays.
- Negotiated Tender: Shorter delays were associated with majority of the projects. 17% of the projects had no delays.

#### Conclusion:

Less delays are likely to be encountered in contracts when selected, or negotiated tender is used. This shows they are preferable to open tenders.

The fact that most government projects used open tenders (item 5.1.7.1) and that most government projects were associated with longer delays (item 8.2.1.1) supports this conclusion.

#### 8.2.1.4 Building Contractors

Class 1* Contractors:	Longer delays were common with a large proportion of the projects. 19% of the projects had no delays.
Class 2* Contractors:	Longer delays were more common with majority of the projects. All projects were delayed.
Class 3* Contractors:	Shorter delays were common with majority of the projects. 57% of the projects had no delays.

#### Conclusion:

There is an indication that longer delays are likely to be encountered in projects when class two and class one contractors are involved. The relatively better performance by class 3 contractors could probably be explained by the fact that, the larger projects executed by class 1 and class 2 contractors have longer duration and that effects of inflation, shortages of materials etc. may be substantial over this large period.

#### 8.2.1.5 Main Building Groups

Commercial buildings :	54% of commercial projects had longer delays. Only 12% of the projects had no delays.
Institutional buildings :	60% were associated with longer delays. 33% of the projects had no delays.

#### Conclusion:

The larger number of institutional building projects completed on time shows a better performance than the commercial projects. However, the difference in the number of projects showing long and short delays between the two types is too small to support this as a definite conclusion.

Delays shown by commercial projects could have been attributed to the fact that the majority of these projects (eg. Industries, high rise buildings etc.) depend more on foreign exchange for imported raw materials and equipment (eg. Installation). Also they need more technical expertise than for institutional projects.

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\* Refer to section 4.1.3

## 8.2.1.6 Clients/Type of Tender, Contract

Government:	More than three quarters of government projects used open tenders. All government projects used unit rates contract documentation.
Parastatal:	Open tenders and selected tenders were predominant. 85% of the projects used unit rates contract documentation compared to 12% by lumpsum (extra 3% by cost and fixed fee contract).
Private :	Selected and negotiated tenders were predominant. 70% of the projects used unit rates contract documentation compared to 30% by lumpsum.
Unit Rates projects :	54% used open tenders, 34% used selected tenders and 9% used negotiated tenders.
Lumpsum projects :	67% used selected tenders, and 34% used negotiated tenders and none by open tenders.

## Conclusion:

Unit rates contract documentation is most commonly used in projects. The fact that selected and negotiated tenders are predominant in lumpsum projects (sect. 5.1.7) and that less delays were common in selected and negotiated tender contracts (sect. 8.2.2), support the conclusion that less delays are likely for lumpsum contracts.

## 8.2.1.7 Major contributing factors to delays

Building Materials:	74% of the projects had experienced shortage of supply of building materials. Longer delays accounted for a large proportion of projects affected by material shortage.
Transport Problems:	36% of the projects were delayed because of transport problems. Most of the projects affected by transport problems were associated with longer delays.
Labour :	26% of the projects were delayed because of labour problems, but were of shorter duration.
Funds :	24% of the projects were delayed because of shortage of funds from clients, and these were of longer duration.
Design & Weather :	21% of the projects were delayed because of both design and weather problems and these were of longer duration.

## Conclusion:

There is an indication that the shortage of supply of building materials and transport problems had contributed to a larger extent for project delays. However, project delays due to lack of funds, labour, design and weather problems were apparent to a lesser extent.

The dependence upon imported raw materials, parts and equipment for most of the industries had resulted in low production. The lack of foreign exchange had probably contributed a great deal to these problems.

### 8.2.2 Ongoing Projects

#### 8.2.2.1 Clients, Type of Contract/Tender, Contractors, Building Groups

##### a. Clients

More projects with longer delays were common for government projects than for parastatal projects. Private client was omitted (refer 5.2.1).

##### b. Type of Contract:

Lumpsum contracts showed a relatively good performance, although longer delays were common for the majority of the projects in both unit rates and lumpsum contracts.

##### c. Type of Tender:

Short delays were more common for both selected and negotiated contracts than for open tender contracts.

##### d. Building Contractors:

The results showed that shorter delays were likely to be encountered by class 3 contractors than by both class 2 and class 1 contractors.

##### e. Main Building Groups:

Both commercial and institutional buildings were associated with delays. The results showed no preference between the two.

The above factors (a, b, c, d, e) showed similarities with those found on completed projects (sect. 8.2.1). Indicating that the effects of delays were common both completed and ongoing projects despite the small number of projects on the latter.

#### 8.2.2.2 Delays vs Percentage of Work Completed

Longer delays were more common for the majority of projects which were on the finishing stages. The extent to these delays might have accumulated on due course of the whole construction period.

### 8.2.2.3 Contributing Factors to delays

Prime Factors: Shortage of supply of building materials and inadequate means of transport and to a lesser extent by labour shortage and non-payments of funds from clients. These factors were also common for the completed projects.

### 8.2.3 Abandoned Projects

The effects of time delays against clients, type of contract/tender, contractors and main building groups were not considered in abandoned projects (sect. 5.3.0). However, the data showed that :

#### 8.2.3.1 Stage of Abandonment and Delays

All projects were abandoned at a stage where they were already delayed (table 24), with the majority having 50% of the work completed. The projects also showed the followings :

- i. Clients: The majority of projects were by parastatal and none by private clients.
- ii. Type of Contract: The majority of projects were of unit rates contracts.
- iii. Type of Tender: Selected tender had a large proportion of the projects.
- iv. Contractors: A large proportion of the projects were by class 1 contractors followed by class 2 contractors.
- v. Type of Buildings: Most buildings were commercial.

#### 8.2.3.2 Reasons for Abandonment:

Lack of funds from clients was the prime reason for abandonment of most of the projects. The shortage of supply of building materials, misunderstandings between contractor and client, incompetence of main contractor and transport problems were the main causes of delays.

### 8.2.4 Site, Technical Factors and Time Delays

The findings outlined in this section were not derived from direct comparisons of each factor concerned with time delays, but from views expressed by respondents (consultants and contractors) on the general performance of building industry.

#### 8.2.4.1 Building Materials

Supply: Supply to most of the contractors (9/10) had been difficult. Shortages were high for; cement, reinforcing steel, fittings (electrical, sanitary and glass) and to a lesser extent for paint.

#### Conclusion:

These views support the conclusion in section 8.2.1.7, that material supply was one of the major factors which contributed to projects delays.

#### 8.2.4.2 Transport Problems

Major means: Railways and roads were indicated as the major means of transporting materials and that inadequate services were experienced when using railways, rather than roads.

#### Conclusion:

Indications are that an inadequate transport system is one of the contributing factors to delays.

The need to improve transport systems is vital. The effects of this combined with the shortage of materials would have an adverse effect on project performance. This effect would probably be more for upcountry regions which rely largely on rail transport.

#### 8.2.4.3 Funds

Availability: Non-payment to the contractors were commonly experienced for government projects, compared to the parastatal projects. This was negligible however on private projects.

#### Conclusion:

The fact that most of the government projects experienced longer delays and that non payment to contractors was evident in these projects, supports the conclusion that unavailability of funds was one of the contributing factors to delays for most of the government projects.

The need for both government and parastatal organisation to make funds available at every stage of work is very essential. This would probably have improved the performance of most of their projects.

#### 8.2.4.4 Technical Personnel

Need: Nine tenths of the contractors have indicated their need for more experienced qualified personnel. Those mentioned were predominantly engineers and technicians.

Conclusion:

The need for experienced and qualified personnel by the majority of contractors would have improved the general performance of most of the delayed projects, although there was no direct evidence to prove this.

8.2.4.5 Construction Equipment

Adequacy: The majority of contractors were satisfied with the construction equipment they had. A desire for other equipment (eg. large capacity concrete mixers, tower cranes etc.) was expressed by most of the contractors. This equipment is not available from the dealers in the country.

Conclusion:

Construction equipment seemed to have little effect on project performance (delays). However, replacement of older equipment and parts will probably be a problem in future especially when foreign exchange would be needed to import them.

8.2.4.6 Labour

Most contractors indicated that there is an shortage of experienced skilled labour in the country. The extent and type of labour shortage was however not indicated.

Conclusion:

The shortage of labour could have an effect on poor project performance despite the fact that project delays due to labour shortage problems, was of less effect (sect. 8.2.1.7).

8.2.4.7 Project Location

Most desired Areas : Coast zone, Northern zone, and Southern highlands zone were the most preferred areas by the majority of contractors in this study.

Conclusion:

Accessibility to these areas (infrastructure, industries, etc) could probably have accounted for most of the contractors preferring to have projects in these areas.



### 8.3.0 COST ANALYSIS-PROJECT MANAGEMENT FACTORS AND PROJECT COST-OVERRUNS

#### 8.3.1 Completed Projects

##### 8.3.1.1 Clients, Type of Contract/Tender, Contractors, Building Groups.

a. Clients:

Cost-overruns were more common for the majority of government projects as compared to both parastatal and private projects.

b. Type of Contract:

The extent of cost-overrun for both unit rates and lumpsum contracts showed to have a similar pattern.

c. Type of Tender:

Less cost-overruns were more common for the majority of selected and negotiated contracts, than by open tender contracts.

d. Contractors:

Higher cost-overruns were more common for most of the projects executed by class 2 and class 1 contractors than by class 3 contractors.

e. Main Building Groups:

Higher cost-overruns were common for the majority of the commercial buildings.

The effects of cost-overrun on the above factors (a, b, c, d, e) showed to be similar as those by the delay factors (sect. 8.2.1).

##### 8.3.1.2 Cost-Overrun vs Delays

The results have shown that higher cost-overruns were common for the majority of the projects with longer delays indicating that higher cost-overruns are likely to be encountered the longer the delays.

#### 8.3.2. Ongoing Projects

##### 8.3.2.1 General Findings

These items were not considered in terms of cost-overrun because there were only 12 projects with complete cost data (sect. 6.3.0). However, the data showed :

- i. That half of the ongoing projects had not exceeded their budgeted construction cost.
- ii. That the remaining half had the majority of the projects with cost-overrun exceeding 25%.
- iii. That the majority of projects which had cost-overruns were already experiencing longer delays.

### 8.3.3 Abandoned Projects

#### 8.3.3.1 General Findings:

- i. No abandoned project had encountered cost overrun.
- ii. The majority of abandoned projects had spent in between 15-38% of the budgeted construction cost.
- iii. That the respective percentage of work completed for the majority of the projects was between 0-50%.

These findings indicate that the majority of projects were abandoned in the early stages of construction.

### 8.4.0 COST - TIME RELATIONSHIP : COMPLETED PROJECTS

The main objective of this investigation was to use construction time - contract cost correlation as a way of estimating construction time from estimated cost.

The study has however shown that, planned construction time correlates more with actual construction time than does with contract sum (see chapter 7). Hence, it is unrealistic in this case to use time-cost graph as a means of estimating construction time of contracts.

The magnitude of correlation for both results could have probably been contributed to by many factors. The fact that only 42 projects were investigated in this survey could have substantial effect on these results. Also due to the author's limited knowledge on statistics, no further analysis was made.

### 8.5.0 OTHER GENERAL FINDINGS

#### 8.5.1 Awarding of contracts

Most of the consultants were satisfied with the way contracts were awarded to contractors. Ways to improve the existing procedure were pointed out by some of the consultants. (sect.5.4.1.1). Although these suggestions indicated some weaknesses in the general procedure, they were less individual.

#### 8.5.2 Over-commitment to projects

Most of the consultants showed that over commitment to projects by contractors was not a major contributing factor to projects delays. In spite of this conclusion by the consultants, the need to investigate work load in relation to delays would be very important in future taking into consideration the problems already outlined in this chapter.

### 8.5.3 Contract Type

#### a. Form of contract conditions used

Private consultants used mostly East African Institute of Architects standard forms. Ministry of works and NEDCO ( parastatal) used Ministry of works forms.

#### b. Method of contract documentation

Conventional methods were used by all consultants. Cost and fixed fee was used by one private consultant.

#### c. Financial Incentives

All consultants used liquidated damages only.

### 8.5.4 Contract Period

The study has shown that despite the fact that either the consultant or the client can estimate and specify the contract duration, it seems that in the majority of projects the duration is likely to be set by the contractor.

### 8.5.5 Brief comments by contractors and consultants

The brief comments by consultants and contractors (sect. 5.4.1.6 & 5.4.2.10), showed a lack of coordination among the whole team involved in the project management. A lack of professional personnel was given as one of the contributing factors. However, as most of the comments were by individual's there is a need for further investigation before these can be given any weight.

## IX. COMPARISON OF FINDINGS WITH RELATED STUDIES CONDUCTED IN NEW ZEALAND AND AUSTRALIA

### 9.1.0 General Views

There are similarities and also differences between the findings in this study and those from related studies conducted in New Zealand and Australia.

Tanzania differs from New Zealand and Australia in terms of economic conditions, cost structures, building regulations and requirements (eg. building codes for earthquakes etc.) and therefore comparisons between them is not always possible.

Because of the small database used for this study, the method used to analyse the data differs slightly. Where most of the findings from the New Zealand study were statistically drawn from the data, the analysis of data in this study was mainly graphical.

The survey data for this study covers mainly the construction stage of the whole project delivery process, while the New Zealand studies covered planning, tendering, designing and construction. Therefore, comparisons are made to those areas which were investigated in all studies. This excludes most of the Australian studies where the cause of project delay was not investigated.

### 9.2.0 Factors associated with delays

#### 9.2.1 Management factors

##### a. Clients/Respondents:

Tanzania : The majority of the government projects were associated with longer delays. Shorter delays were more common in most of the parastatal projects followed by private projects.

New Zealand: Serious construction delays are much more likely when the client is a government agent, or when the MWD is involved.

#### Comments:

Although there was no direct comparison between respondents and time delays for the Tanzanian study, the fact that Ministry of Works is the consultant for most of the government contracts, indicates that Tanzania has similar delay problems to New Zealand government contracts with Ministry of Works as the consultant.

## b. Building types

Tanzania : There seemed to be no marked difference in terms of performance between Institutional and Commercial projects. However, less delays were likely in Institutional projects.

New Zealand: Institutional buildings tend to be associated with greater delays as compared to Commercial ones.

### Comments:

Unlike New Zealand projects, most of the commercial projects in Tanzania depend to some extent on foreign exchange (eg. for machinery, installation of equipment etc.). As more expertise is required in these projects, delays would probably be more prevalent in these projects than Institutional ones. This could be one of the reasons for difference between the two studies.

## c. Forms of Contract Conditions used

Tanzania : This factor was not considered in terms of project delays. However, two main forms were used;

i. East African Institute of Architects forms used mainly by private consultants.

ii. Ministry of Works forms used by Ministry of works and NEDCO (National Estate & Designing Co.)

New Zealand: Four main forms were used;

i. NZ Standard 623

ii. MWD used mostly by Ministry of Works and Development.

iii. NZIA used mostly by private architects

iv. Master Builders

NZIA: Less delays were common on projects with this form of contract condition.

The study concluded that, "it cannot be immediately concluded that NZIA contracts are preferable to MWD contracts, because the former are used mainly by private firms and the latter by MWD. The effect of contract conditions may be due to other factors related to the firms that use them".

**Comments:**

Despite the fact that contract conditions (forms) were not analysed as a cause of delays in this study, there were some similarities between the forms of contract conditions mainly used by private consultants and Ministry of Works in both countries. Therefore the fact that MWD forms were associated with long delays in New Zealand projects, shows a need to investigate the forms of contract used in Tanzania.

**d. Method of Contract Documentation**

Tanzania : Conventional methods were used for almost all the projects. Longer delays were more common with Unit rates contracts, compared to the Lumpsum contracts.

New Zealand: Four main ones were used; Conventional contract (used for most projects), Staged construction (separate contracts), Fast track and Design/build.

No projects using staged construction, fast track, or design build contract documentation had delays greater than 29%. Only one project out of those that used these forms of contract documentation, had cost overrun of less than 5%.

The study concluded that, the use of fast track, staged construction, or design/build contract documentation may be associated with the lower percentage delays and higher cost overrun.

**Comments:**

There is an indication that conventional contract documentation is the most commonly used in both countries, and that the method had shown to be associated with longer delays. The fact that conventional contract documentation is the most common type used in Tanzania, does not allow comparison with New Zealand where four main contract forms of documentation were used.

**e. Types of Tender used**

Tanzania: Three types were used; Open tender (used for most projects and mainly for government clients), selected tender and negotiated tender (most commonly used for parastatal and private projects).

Longer delays were more likely with open tender projects than both selected and negotiated tenders. The fact that projects by government clients experienced substantial delays and that most of these projects used open tenders, supports the two conclusions.

New Zealand: Three types were used; Open tender was used for most of the projects and in the majority by MWD, selected tender and negotiated tenders were used mostly by private architects and Design/build contractors.

There was no significant relationship between the type of tender and percentage delay.

Comments:

There is an indication that the type of consultants mostly likely to use the three types of tenders are similar for both countries. That is, open tender contracts are mainly used for government clients and in most cases the consultant is Ministry of Works. Selected and negotiated tenders are mainly used by private consultants. Comparison on the effect of delays on the three types of tender for the two studies is not possible.

f. Financial incentives used.

Tanzania: All contracts used liquidated damages. This factor was not compared with time delays.

New Zealand: Three types were used; Liquidated damages used for most of the projects, bonuses for early completion and fixed sum financial packages.

The study concluded that the use of bonuses and fixed sum financial packages for early completion may be associated with reduced percentage delays. However, this relationship was not statistically proven.

Comments:

The need to try other financial incentives in Tanzanian contracts other than liquidated damages would probably give motivation to contractors and consequently improve the projects performance.

### 9.2.2 Weather, Site and Building Factors

New Zealand: General conclusions were drawn from these factors: Climate, site characteristics, design and construction, materials and equipment, labour, state of industry, mechanical services, electrical services, etc.

That, "there was little among of these factors that has even a possible association with construction delay or cost overrun. Some of the factors (eg. delays due to rail transport problems) were cited for a few quite highly delayed projects, but since no data on the magnitude of the resulting delays was collected, it was not possible to generate statistical information that was sufficiently reliable to allow extrapolation beyond the survey".

Tanzania: Shortage of supply of building materials and transport problems accounted for longer delays in a large proportion of projects.

Although shortage of labour, shortage of funds from clients, construction equipment, design problems and weather were to a lesser extent associated with delays, the number of projects in each category were too small to support this conclusion.

#### Comments:

The effect of site and building factors (eg major installation) was shown to have a pronounced effect on the project performance for the Tanzanian building industry, compared to New Zealand. Shortage of foreign exchange to import raw materials for major industries, parts, equipment and machinery could have probably contributed a lot to the performance of most major projects in Tanzania. The problem which is probably not common in New Zealand building contracts.

### 9.2.3 Manpower problems

Tanzania: Although this factor was not investigated in detail, there were indications of shortages of experienced personnel among the parties involved in the project delivery process (ie. consultants, contractors and clients).

New Zealand: Not an important cause of delays.

#### Comments:

The problem of the shortage of experienced manpower which exists in Tanzania, could be a subject of further investigation.



#### 9.2.4 Cost and Time relationship.

**Tanzania:** The correlation shown by the relationship between planned construction time and actual construction time was much higher, compared to the correlation between planned construction time against final contract sum.

**New Zealand:** The study concluded, "It is apparent that specified construction time correlates much more strongly with actual construction time than the contract sum (Soeterik, Foster 1976).

#### Comments:

This study has shown some similarities in terms of the functional relationship between planned time and final construction time in both studies.

Soeterick, Foster (1976) found that, cost is a less consistent measure of construction time than the method already used by the industry (as has also been found in this study). These findings contradicted those by Bromilow (1969,1971) which found cost-time relationship as a consistent measure (estimation) of construction time for projects.

#### 9.3.0 Summary of comparisons.

Three main conclusions were drawn from the New Zealand study (Bruhns, Tippett 1987), that:

Management factors are the prime cause of construction delays and cost overruns. Secondly, that serious construction delay is considerably more likely when the client is a government agency, or when MWD (Ministry of Works and Development) is involved. Thirdly, that the remaining factors surveyed (climatic, site, technical and labour) are not important causes of construction delay.

This Tanzanian study has shown some similarities with New Zealand studies especially on the first two conclusions, despite the fact that the magnitude and extent of these problems differ between the two countries (sect. 9.1).

The poor performance of Tanzanian contracts found in this study were also contributed to by the poor economy of the country and to some extent manpower problems. The dependence of imported raw materials for major production industries, machinery, parts and major equipment had always been affected by shortage of foreign exchange. This would probably give substantial differences between the findings of the studies of the Tanzanian and New Zealand construction industries.

## X. CONCLUSION AND RECOMMENDATION

### 10.1 CONCLUSION

The study has shown that the general performance of the building industry in Tanzania has been affected by a number of problems.

For the 42 completed projects studied, 30% had delays over 100%, 50% had delays up to 100% and 20% were completed on time. In general the completed projects showed an average time overrun and cost overruns of 50% and 26% respectively.

The study has also shown that the majority of ongoing projects were behind schedule. Only two projects were on schedule and delays of over 100% were noted for 26% of the ongoing projects. The effect of cost overruns were not considered in detail and hence no decisive conclusion was drawn because the majority of the projects had incomplete cost data.

On the abandoned projects, no major conclusion was drawn due to a relatively small number of projects in this group. However, the study has shown that most of the projects were abandoned in the early stages of construction with the majority of these already behind schedule.

The factors which were found to be associated with poor project performance in this study can be summarised under two basic headings, that is economic and management problems.

The findings from this study which fall under the two basic headings (ie.economic and management) were summarised in detail in chapter 8. The relationship between cost and time which also forms part of this study has its findings summarised in chapter 8.

The extent of cost overrun and causes which though not investigated in detail were also summarised in chapter 8. This part of the study has been recommended for future studies (item 10.2 (7)).

#### 10.1.1 Economic Problems.

- i. The study has shown that the effect of projects delays due to the shortage of building materials and transport problems were the most substantial (sect. 8.2.1.7, 8.2.4).
- ii. That delays due to shortage of funds, shortage of construction equipment,labour were also predominant, although to a lesser degree (sect. 8.2.1.7, 8.2.4).

The prevailing situation within the production sector of most of the major industries in the country reflects most of these problems. The shortage of foreign exchange has resulted in;

- a. Lack of imported raw materials for manufacture of locally produced materials. Low production in most of these industries had therefore failed to cope with the demand.
- b. Lack of imported materials, spare parts to maintain production equipment, mechanical plants and transport.

It may be suggested that since the problems of foreign exchange is probably not a short term problem, a need to reduce the volume work (projects) in the market could probably be one alternative to improve the industry (item 10.2 (8)). As Barton (1981) stated "There would appear to be little value in pushing increasing volume of work into the market chasing a dwindling material supply".

#### 10.1.2 Management problems.

- i. The study has also shown that there was a direct relationship between projects delays with each of the following factors (see chapter 8 for details).
  - a. Client: Longer delays were common with the majority of government projects.
  - b. Type of Contract: That the use of lumpsum contracts were associated with shorter delays compared to unit rates contracts.
  - c. Type of Tender: That selected and negotiated tenders were preferable compared to open tender in terms of delays.
  - e. Contractors: That the performance shown by class 3 contractors was relatively better compared to class 1 and class 2 contractors.
- ii. Most of the contractors have commented on the shortage of engineers and technicians. Although this factor was not considered in terms of delays, it reflects the effect it has in terms of project management on the side of the contractors.
- iii. That there was an indication of lack of coordination among the parties (consultants, contractors and sub-contractors) involved in the project delivery process. The lack of professionals available to most clients was sited as having contributed more weight to this problem (see sect. 7.3.8.4).

There can not be substantiated in contributing to delays, despite the fact its existence has a substantial effect to project performance.

### 10.1.3 Cost and Time Relationship

The study has shown that;

- i. Planned construction time correlates more with actual construction time than does the contract sum.
- ii. These results show some similarities with the New Zealand studies (Soeterick, Foster 1976) despite the differences in the magnitude of the data and the extent of the degree of correlation of the data. Therefore it is compatible with the conclusion that, "Contract times are already being specified in more self consistent ways than could be done using the construction time - contract cost correlation to establish construction time from estimated cost".

Although, we consider the main conclusions from this study sufficiently reliable to justify selected remedial activities by all those involved in the building industry in Tanzania, the limitations in the analysis must be noted (sect.8.1, items 1,2,3).

The picture presented by the data is as good a review of the Tanzanian construction industry as can be compiled, bearing in mind the difficulties of communication, the lack of sophisticated data collection procedures and the poor response from the participants.

It is therefore recommended that a related future study to re-investigate these factors in more detail would be beneficial, especially taking into account the recommendation outlined below.

## 10.2 RECOMMENDATION FOR FUTURE STUDY

The findings generated from the study have implications for the building industry in Tanzania. Despite the limits on the information obtained from the respondents in the questionnaires and consequently to the number of completed projects studied, the useful information provided by the survey has pointed out factors which were associated with construction delays.

Though the findings cannot be used to make a generalisation for every section of the building industry in the country, the conclusions drawn are sufficient to justify some remedial action by the parties studied (clients, contractors, consultants etc.).

With these limitations, a further related study is recommended, with emphasis to be given to those items which were found to be associated with construction delays. Some of the points which would be useful for further studies are;

1. A large database of at least 300 projects ( as suggested by by Australian and New Zealand studies), which would provide a sufficient number of projects to make a sound comparison of the factors during analysis of the data.

2. The questionnaire should include more information on the whole project delivery process (ie.planning, designing, tendering and construction). Information on the parties involved in the process such as who innitiated and financed the projects, in addition to the planned and completion costs would be very useful.
3. The direct comparison of project performances among consultants (eg. private public) and regions was not considered under this study due to high variation in the number of projects among them. It is suggested that the data should also include a reasonable number of projects in these categories.
4. Besides confining the study to those projects executed by class one, two and three building contractors, the survey should also consider other groups of contractors (classes 4-7). Despite the fact that the value of a single contract decreases the lower the class (under By-law), the majority of contractors lie in this range. This could probably be done separately and the results compared to those of class 1-3 contractors.
5. Due to the time limit of study for the author, and the problems of follow up with questionnaires, building contractors were included in this survey in addition to the consultants with the aim of getting more data. Taking into consideration that their choice of project selection and information given could be biased, it would be necessary that the person who conducts the survey be based in the country for the convenience of counter checking the information given by the other parties involved in the project delivery process.
6. It is recommended that the range of the survey data be reduced to a 5 year period instead of 10 (1979-1987), as in this case due high variations in economic inflation. The 5 year period would probably produce good results.
7. The effect of cost overrun in relation to delays could also be investigated in more detail.
8. Shortage of buiding material supply should be looked into in detail. Information such as yearly production capacity of major industries (eg. cement, steel, fittings, finishes etc.) could be sought and compared with the country's demand. This could provide a guide especially to governments, and parastatal organisations whether to give priority to some of their new projects, and if there would be any necessity to devise a system which would be able to monitor and probably reduce the volume of new projects to match the material supply.

Data on many buildings will be needed to gain a substantial improvement in the knowledge of the causes of construction delays and cost overruns and detailed data on a few of them (Bruhns,Tippet 1987). Hence two survey phases would be appropriate. The first phase should obtain a limited amount of information for a random selection of quite a large number of buildings (refer para.1).

The use of stratified samples should be considered, as a stratified sample would ensure an adequate numbers of buildings within each category of interest. Sampling should not be left to the respondents, rather the projects should be selected by a random procedure from a suitable source of construction information (eg. building permits). What has been done is the a start (first stage) of a survey of the Tanzanian building industry. The continuation of this study is strongly recommended.

Table 8a: Completed projects  
Projects data in decreasing delay factors

No.	PROJECT NAME	DLYFTR	ZDELAY	BCAT	MGRP	RESP	DRT(wks)	TVAL(m)	ICOSTINCR	CLASS	CLINAM	CONTYPE	TTENDER	TOWN	YEAR
1	Office Block for NPF	3	125	0	A	Arch	8	13.00	16.1	C1	Para	unirat	opetdr	Kibaha	-
2	Berger Fire Godown	3	125	1	A	QS	48	4.77	.2	C1	Priv	luasum	selldr	Dar	1985
3	Housing Estate -TIB	3	117	C	B	Arch	75	22.10	17.6	C1	Para	unirat	opetdr	Dar	1983
4	Stor. Godown for TAT.	3	113	1	A	Engrs	64	19.99	18.2	C2	Para	unirat	opetdr	Morgro	1979
5	KIA Hangar	3	108	1	A	Contr.	96	184.00	34.6	C1	Govt	unirat	opetdr	Arusha	1979
6	Acheles Factory Ext.	3	103	1	A	QS	29	5.31	3.6	C2	Priv	unirat	selldr	Dar	1984
7	NIC Staff Flats	3	100	C	B	ArchEng	288	12.60	58.7	C2	Para	unirat	opetdr	Dar	1984
8	Off. Acc. Sch. Complex	3	100	0	A	Engrs	361	44.33	33.1	C1	Priv	unirat	negtdr	Dar	1978
9	Vocat. Training Ctr	3	100	S	B	ArchEng	364	12.00	83.3	C1	Para	unirat	opetdr	Dodoma	1979
10	Godown, Office bldg.	3	100	0	A	Contr.	40	9.00	11.1	C1	Para	unirat	opetdr	Dar	1984
11	NOC Housing Estate	3	100	C	B	ArchEng	196	17.60	1.1	C1	Para	unirat	selldr	Morgro	1980
12	Block of Flats	3	100	C	B	QS	72	23.00	52.2	C2	Para	luasum	selldr	Dar	1981
13	Bank Flats and M/Hse.	3	88	C	B	Arch	88	12.00	58.8	C2	Para	unirat	selldr	Mbeya	1979
14	AMREF R/Hqs.	2	67	0	A	QS	78	7.20	-	C1	Priv	unirat	selldr	Dar	1985
15	Office Accom. Scheme	2	54	0	A	Contr.	100	13.00	16.1	C1	Para	unirat	selldr	Kibaha	1982
16	IHA Training School	2	50	C	B	Contr.	96	21.00	42.9	C1	Para	unirat	opetdr	Dar	1981
17	Diesel Locom. Depot	2	50	1	A	Contr.	192	32.00	9.4	C2	Para	unirat	opetdr	Moshi	1980
18	Tourist Hotel	2	50	C	B	Contr.	96	25.00	40.0	C1	Priv	unirat	opetdr	Morgro	1982
19	Train. Ctr-Orthopaedic	2	48	S	B	QS	54	6.57	-9.9	C1	Priv	unirat	selldr	Moshi	1981
20	Off/Accom. Tiab. Struct.	2	46	0	A	Contr.	104	9.00	40.8	C3	Govt.	unirat	opetdr	Dar	1984
21	Lab, Foundry, Godown	2	44	1	A	Contr.	90	31.00	12.9	C1	Govt	unirat	opetdr	Dar	1984
22	Godown, Offices	2	43	1	A	Contr.	78	10.00	28.0	C1	Govt	unirat	opetdr	Dar	1982
23	Staff Housing	2	38	C	B	Contr.	32	3.30	36.4	C2	Para	unirat	opetdr	Dar	1986
24	Int. Sch; Hall Complex	2	35	C	B	Engrs	184	20.00	25.0	C1	Priv	unirat	negtdr	Dar	1984
25	Grain Stores: Irg, Song.	1	34	1	A	Contr.	152	19.00	31.6	C1	Para	unirat	opetdr	Songea	1981
26	Coconut Creaming Fact.	1	33	1	A	Arch	72	7.00	114.3	C1	Priv	luasum	negtdr	Dar	1986
27	Mech. Eng. Laboratory	1	33	1	A	Contr.	72	17.40	34.5	C2	Para	unirat	opetdr	Dar	1984
28	Workshop, Off. Block-BHL	1	33	0	A	Engrs	90	8.00	-	C1	Priv	unirat	negtdr	Dar	1980
29	CCM H/Q. Extension	1	29	0	A	Contr.	40	14.55	68.4	C3	Govt	unirat	selldr	Dodoma	1983
30	NIC Office Blocks	1	22	0	A	QS	68	34.00	47.1	C1	Para	c.ffee	negtdr	Mbeya	1984
31	Vocat. Training Ctr.	1	13	S	B	Contr.	104	3.90	23.1	C3	Govt	unirat	opetdr	Tanga	1984
32	Bank of Tanzania Bldg.	1	13	0	A	Arch	256	40.00	15.0	C1	Para	luasum	selldr	Mbeya	1980
33	Bank of Tanzania Bldg.	1	11	0	A	Arch	216	40.00	20.8	C1	Para	unirat	selldr	Mwanza	1977
34	DAFCO Godown	0	0	1	A	Contr.	43	31.00	.0	C1	Para	unirat	opetdr	Dar	1986
35	Bank Flats & Houses	0	0	C	B	QS	78	12.44	4.5	C3	Para	unirat	selldr	Moshi	1983
36	Res. Houses	0	0	C	B	QS	48	15.00	38.7	C3	Para	luasum	selldr	Dar	1985
37	Res. Houses 13. Nos.	0	0	C	B	QS	54	15.90	-1.3	C3	Para	unirat	selldr	Arusha	1982
38	Res. Houses 6. Nos.	0	0	C	B	QS	124	22.10	8.6	C1	Para	unirat	selldr	Dar	1985
39	Housing Estate - TRDB	0	0	C	B	Arch	110	20.00	.8	C1	Para	unirat	opetdr	Dar	1985
40	Constr. 4 Nos. Houses	0	0	C	B	Contr.	32	15.00	.0	C3	Priv	luasum	negtdr	Dar	1986
41	M. V. Assembly Plant	0	0	1	A	Engrs	98	18.00	18.8	C1	Para	unirat	selldr	Kibaha	1979
42	Warehouse - CRDB	0	0	1	A	Arch	58	12.78	1.7	C1	Para	unirat	negtdr	Dar	1987

Table 8b Ongoing projects  
Projects data in decreasing delay factors

No.	PROJECT NAME	DLYFTR	ZDELAY	BCAT	MGRP	RESP	DRT(wks)	TVAL(m)	ZCOSTINCR	CLASS	CLTNAM	CONTYPE	TTENDER	ZCOMPL	TOWN	YEAR
1	S/Market,Offices,Flt.		-	0	A	Arch	0	28.00	-	C1	Para	unirat	seltldr	0	Dodoma	1985
2	TPDF Hosp,Dormit.	3	646	S	B	Contr.	52	4.96	-	C3	Govt	lumsun	opetdr	85	Mwanza	1976
3	Workshop Disabled	3	400	I	A	Contr.	52	7.70	-	C3	Govt	lumsun	opetdr	70	Dar	1982
4	Hous.Scheme-Kiabali	3	387	C	B	ArEgOs	62	10.60	22.3	C1	Govt	unirat	opetdr	94	Musoma	1978
5	Telephone House	3	259	0	A	ArcEng	75	24.00	-	C2	Para	unirat	negtdr	60	Moshi	1982
6	CCM Hostel-Roabo	3	226	C	A	Arch	38	9.00	-	C3	Govt	lumsun	negtdr	80	Moshi	1986
7	Post Office,T/Exch.	3	190	0	A	Contr.	72	7.12	110.7	C3	Para	unirat	opetdr	99	Kondoa	1983
8	Textile Mill Project	3	161	I	A	Contr.	132	120.00	40.4	C1	Para	unirat	opetdr	96	Mbeya	1980
9	TPDF Housing Complex	3	105	C	A	Contr.	130	69.00	53.6	C1	Govt	unirat	opetdr	95	Kibaha	1982
10	Housing Scheme Ikoma	2	61	C	B	ArEgOs	152	94.35	15.7	C1	Govt	unirat	opetdr	16	Musoma	1982
11	CCM Printing Press	2	50	I	A	Arch	72	64.00	-64.1	C2	Para	unirat	opetdr	30	Dodoma	1987
12	NBC Flats	2	50	C	B	Contr.	96	49.00	-10.2	C1	Para	unirat	opetdr	90	Dar	1985
13	Warehouses,godown	2	46	I	A	Contr.	130	84.00	-76.2	C1	Govt	unirat	opetdr	30	Dar	1986
14	Flats,Houses,Library	2	45	C	B	Contr.	150	150.00	-71.3	C1	Govt	unirat	opetdr	36	Kibaha	1986
15	Office Blocks & Flats	1	31	0	A	Contr.	150	64.91	-	C1	Para	unirat	seltldr	45	Kibaha	1984
16	TRC Staff Hous.Scheme	1	22	C	B	Contr.	55	31.00	-	C1	Para	unirat	opetdr	65	Morogoro	1986
17	Block of Flats -3Nos.	1	22	C	B	Contr.	130	37.04	-	C1	Para	unirat	seltldr	80	Dar	1984
18	Staff Host.;Canteen	1	9	C	B	Contr.	96	66.00	-31.8	C1	Para	unirat	opetdr	95	Dar	1985
19	Lab.Mineral Process.	0	0	I	A	Contr.	72	9.41	40.0	C3	Govt	lumsun	opetdr	75	Dodoma	1985
20	Administration Bldg	-	-	0	A	Contr.	200	175.00	-	C1	Govt	unirat	opetdr	35	Kibaha	1986
21	DCA (Civil Aviation)	-	-	0	A	ArEgOs	100	24.00	-	C1	Govt	unirat	opetdr	35	Dar	1980
22	H/Est.-Tanz.KARATASI	-	-	C	B	Arch	70	13.22	-	C1	Para	unirat	opetdr	90	Dar	1982
23	Off.Accom.Scheme -NPF	-	-	0	A	Arch	136	95.79	-	C1	Para	unirat	opetdr	5	Dar	1986
24	Telephone House	-	-	0	A	ArcEng	0	0.00	-	C3	Para	unirat	opetdr	60	Iringa	-
25	Bauda Hotel	0	0	C	A	Arch	72	10.00	-20.0	C3	Priv	tprice	negtdr	80	Dar	1986
26	Stor.Building for TAT.	-	-	I	A	Engrs	75	10.65	-	C2	Para	unirat	opetdr	90	Songea	1980
27	Office,Flats,Mgr.Hse	-	-	0	A	Contr.	150	46.62	-	C1	Para	unirat	seltldr	45	Shynga	1984
28	Staff H/Est.;Recr.Ctr.	-	-	C	B	Contr.	90	64.01	-	C1	Para	unirat	seltldr	60	Dar	1986
29	TTC Housing Estate	-	-	C	B	Contr.	192	193.00	-	C2	Para	unirat	opetdr	19	Dar	1985
30	Constr.General Hosp.	-	-	S	B	Contr.	52	34.00	-	C3	Para	unirat	opetdr	5	Morogoro	1987



**Table 8c:** Abandoned projects  
Projects data in decreasing delay factors

No.	PROJECT NAME	DLYFTR	%DELAY	BCAT	MGRP	RESP	DRT(wks)	TVAL (m)	%COSTINCR	CLASS	CLTNAM	CONTYPE	TTENDER	%CDHPL	TOWN	YEAR
1	Hostels, Offices	3	400	C	A	ArcEng	52	13.00	-23.1	C2	Para	unirat	seldr	80	Morgro	1980
2	Office & Lab. Block	3	118	D	A	Contr.	65	7.89	—	C1	Govt	lumsun	seldr	80	Kibaha	1979
3	Mtwara Hostel	3	105	C	A	QS	95	29.53	-69.9	C1	Para	unirat	seldr	20	Mtwara	1981
4	Office Block	3	80	D	A	QS	45	38.00	—	C2	Para	lumsun	seldr	90	Dar	1985
5	TES Hous. Est. - Tabata	2	37	C	B	Contr.	130	92.17	-67.5	C1	Para	unirat	opetdr	50	Dar	1984
6	Godown for RTC	1	33	I	A	Arch	120	15.00	—	C1	Para	unirat	seldr	—	Iringa	1980
7	Hostel, Canteen, P/Unit	1	29	C	B	Contr.	70	16.00	-62.0	C1	Govt	unirat	opetdr	36	Dar	1983
8	Godown, Office Block	1	24	I	A	QS	100	38.00	—	C1	Para	lumsun	seldr	20	Dar	1984
9	NBC Branch	—	—	D	A	Contr.	52	5.03	—	C3	Para	unirat	opetdr	—	Iringa	1980
10	Office Accom. Scheme	—	—	D	A	Contr.	152	96.00	-84.4	C1	Para	unirat	opetdr	—	Dar	1985
11	Stad. Sports Complex	—	—	S	B	Arch	72	80.00	-81.3	C2	Govt	tprice	negtdr	5	Kibaha	1985
12	Office Block	—	—	D	A	QS	96	49.00	—	C1	Para	lumsun	seldr	—	Dar	1984
13	Office Complex - TIRDO	—	—	D	A	Arch	242	40.00	—	C1	Para	unirat	seldr	—	Dar	1978
14	Block of Flats - TES	—	—	C	B	ArEqGs	130	92.12	—	C1	Para	unirat	opetdr	30	Dar	1984

Table 9a: Completed projects by clients  
 Delay factors vs % projects by respective clients

CLIENT	No. OF PROJECTS	TOTAL %	DELAY FACTORS			
			0	1	2	3
GOVT.	6	100.0	0.0	33.3	50.0	16.7
PARA.	26	100.0	30.8	19.2	15.4	34.6
PRIV.	18	100.0	10.0	20.0	40.0	30.0

Fig 5a Completed projects by clients  
 Delay factors vs % projects by respective client

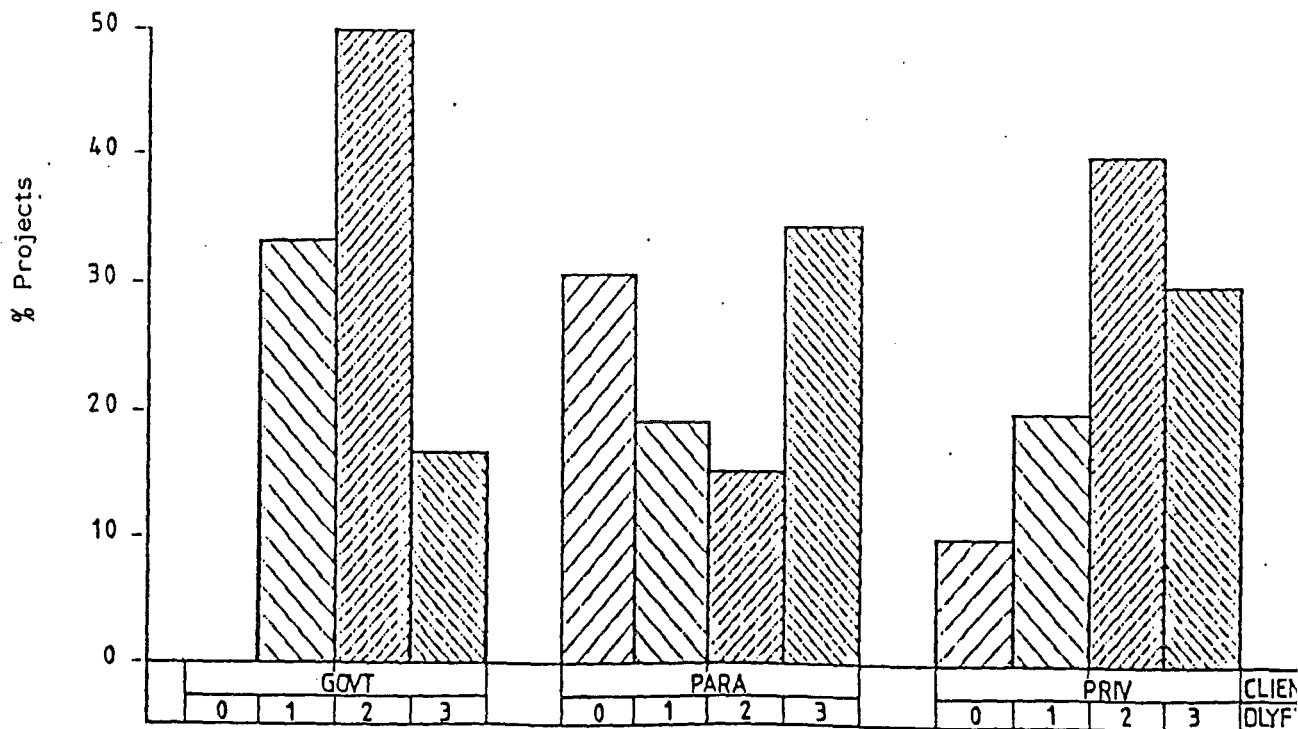


Table 9b: Completed projects by clients  
Delay factors vs No. of projects

CLIENT	No. OF PROJECTS	% DISTRIB.	DELAY FACTORS			
			0	1	2	3
GOVT.	6	14.0	0	2	3	1
PARA.	26	62.0	8	5	4	9
PRIV.	10	24.0	1	2	4	3
TOTAL	42	100.0	9	10	13	16

Fig 5b Completed projects by clients  
Delay factors vs projects

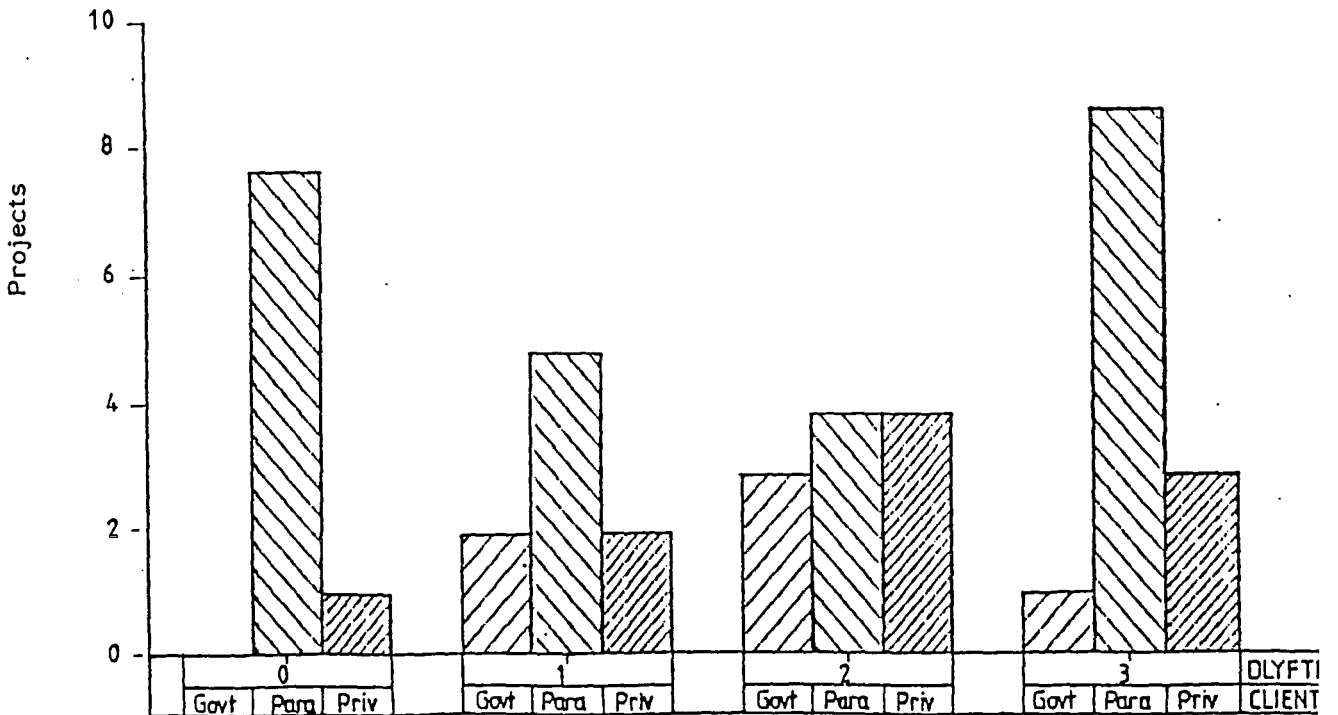


Table 10a: Completed projects by contract types  
 Delay factors vs % projects by respective contact types

CONTRACT TYPE	No. OF PROJECTS	TOTAL %	DELAY FACTORS			
			0	1	2	3
UNIT RATES	35	100.0	20.0	17.2	31.4	31.4
LUMP SUM	6	100.0	33.3	33.3	0.0	33.3
COST & F.FEE	1	100.0	0.0	100.0	0.0	0.0

Fig 6a Completed projects by contract types  
 Delay factors vs % projects by respective contract types.

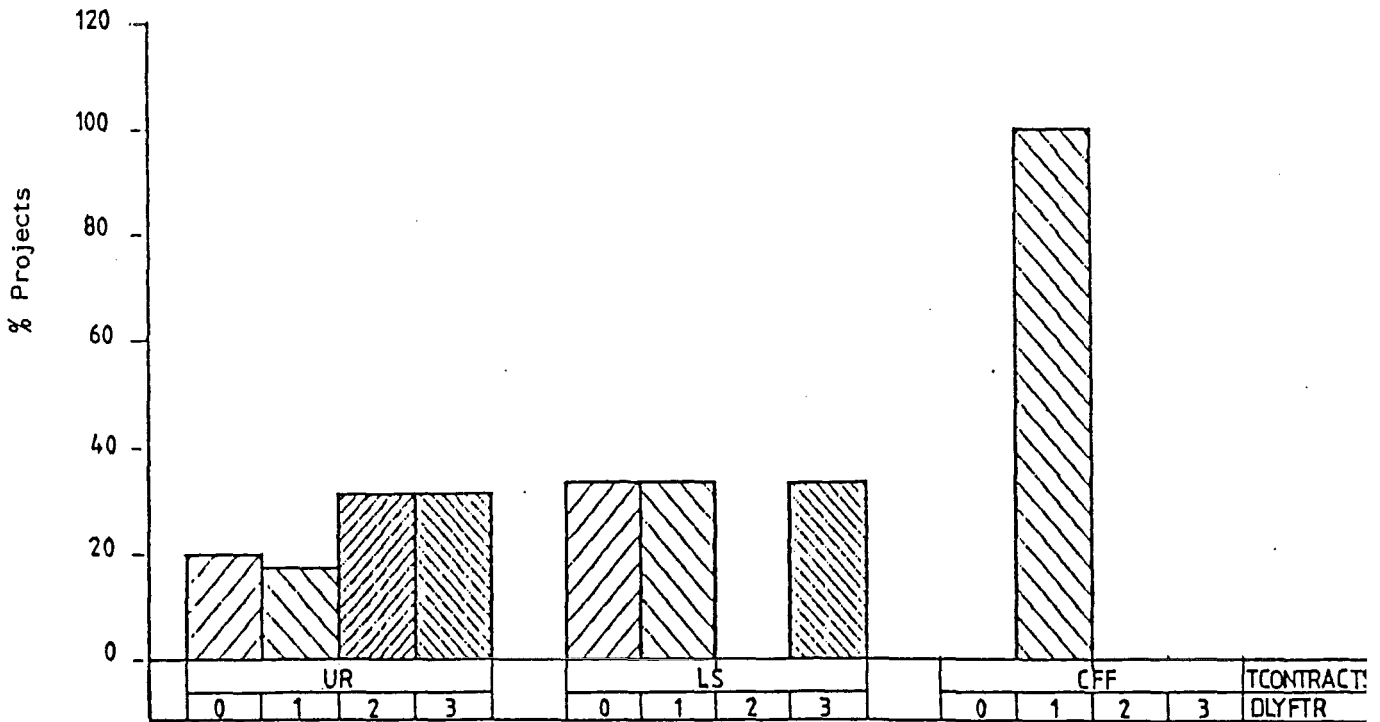


Table 10b Completed projects by contract types  
Delay factors vs No. of projects

CONTRACT TYPE	No. OF PROJECTS	% DISTRIB.	DELAY FACTORS			
			0	1	2	3
UNIT RATES	35	83.0	7	6	11	11
LUMP SUM	6	14.0	2	2	0	2
COST & F.FEE	1	3.0	0	1	0	0
TOTAL	42	100.0	9	9	11	13

Fig 6b Completed projects by contract types  
Delay factors vs projects

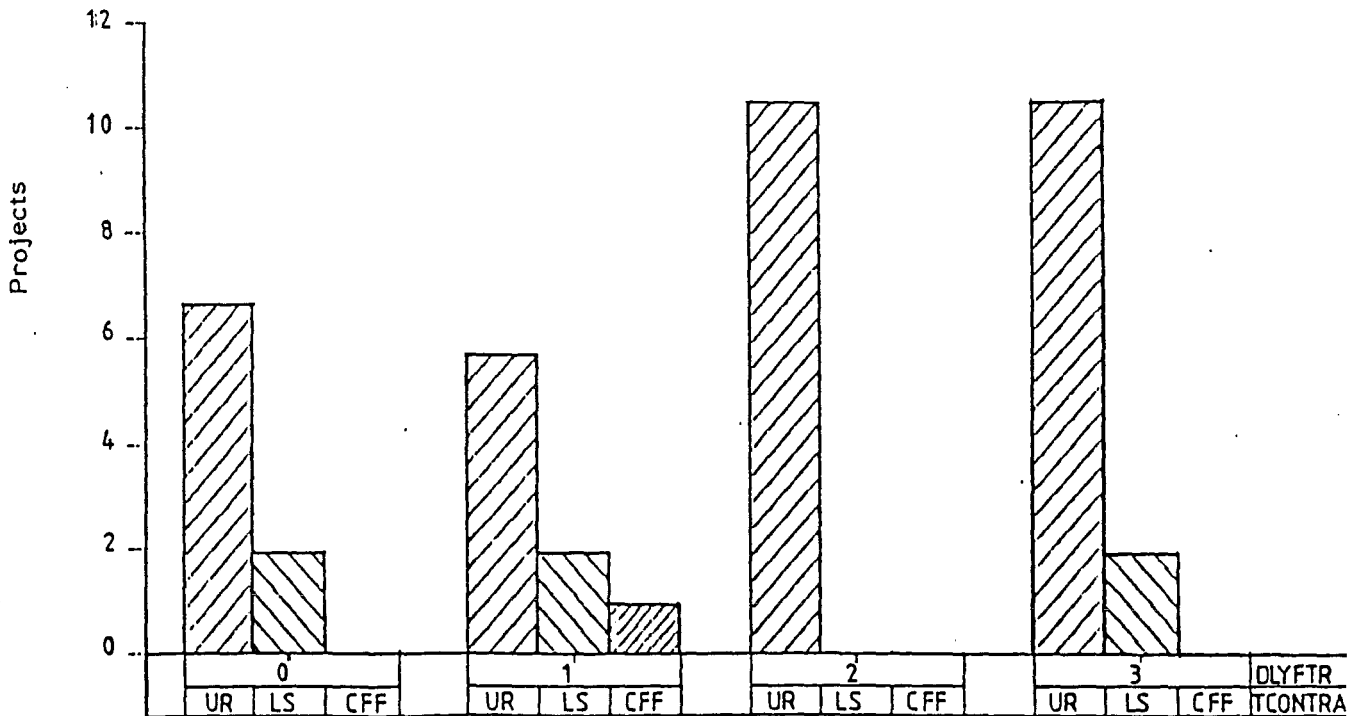


Table 11a: Completed projects by tender types  
 Delay factors vs % projects by respective tender types

TYPE TENDER	No. OF PROJECTS	TOTAL %	DELAY FACTORS			
			0	1	2	3
OPEN	20	100.0	15.0	15.0	35.0	35.0
SELECTED	16	100.0	31.2	18.8	18.8	31.2
NEGOTIATED	6	100.0	16.7	50.0	16.7	16.7

Fig 7a Completed projects by tender types  
 Delay factor vs % projects by respective tender types

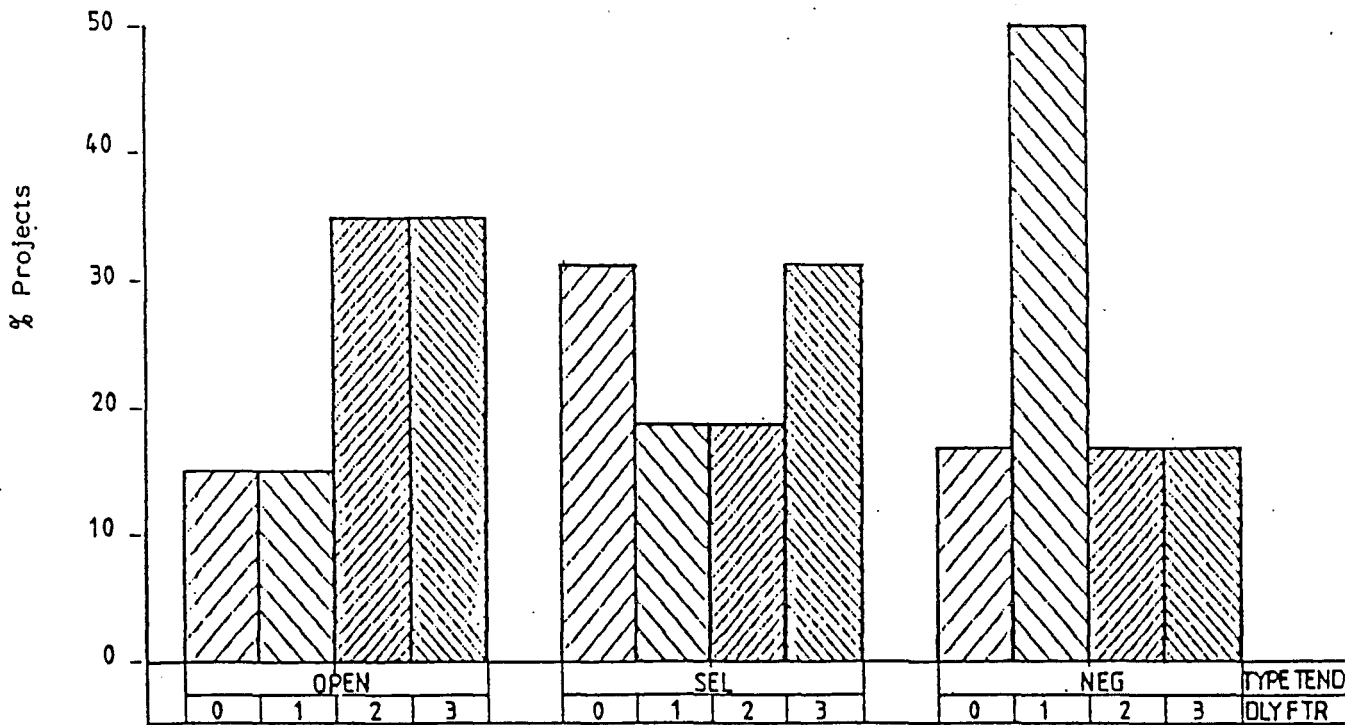


Table 11b: Completed projects by tender types  
Delay factors vs No. of projects

TYPE TENDER	No. OF PROJECTS	% DISTRIB.	DELAY FACTORS			
			0	1	2	3
OPEN	20	48.0	3	3	7	7
SELECTED	16	38.0	5	3	3	5
NEGOTIATED	6	14.0	1	3	1	1
TOTAL	42	100.0	9	9	11	13

Fig 7b Completed projects by tender types  
Delay factors vs projects

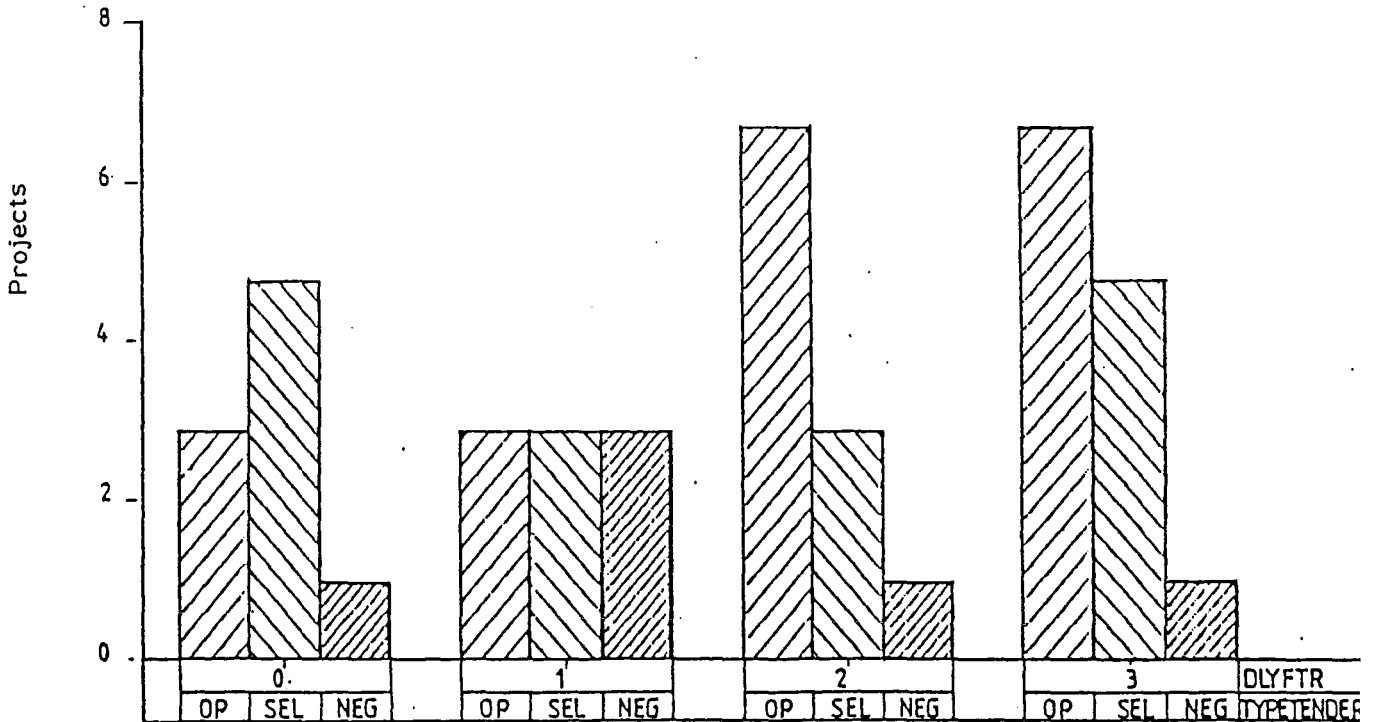


Table 12a: Completed projects by building contractors  
 Delay factors vs % projects by respective building contractors.

CONTRACTORS CLASSES	No. OF PROJECTS	TOTAL %	DELAY FACTORS			
			0	1	2	3
C1	27	100.0	18.5	22.3	29.6	29.6
C2	8	100.0	0.0	12.5	25.0	62.5
C3	7	100.0	57.1	28.6	14.3	0.0

C1 =Class ONE contractors  
 C2 =Class TWO contractors  
 C3 =Class THREE contractors

Fig 8a Completed projects by building contractors  
 Delay factors vs % projects by respective building contractors

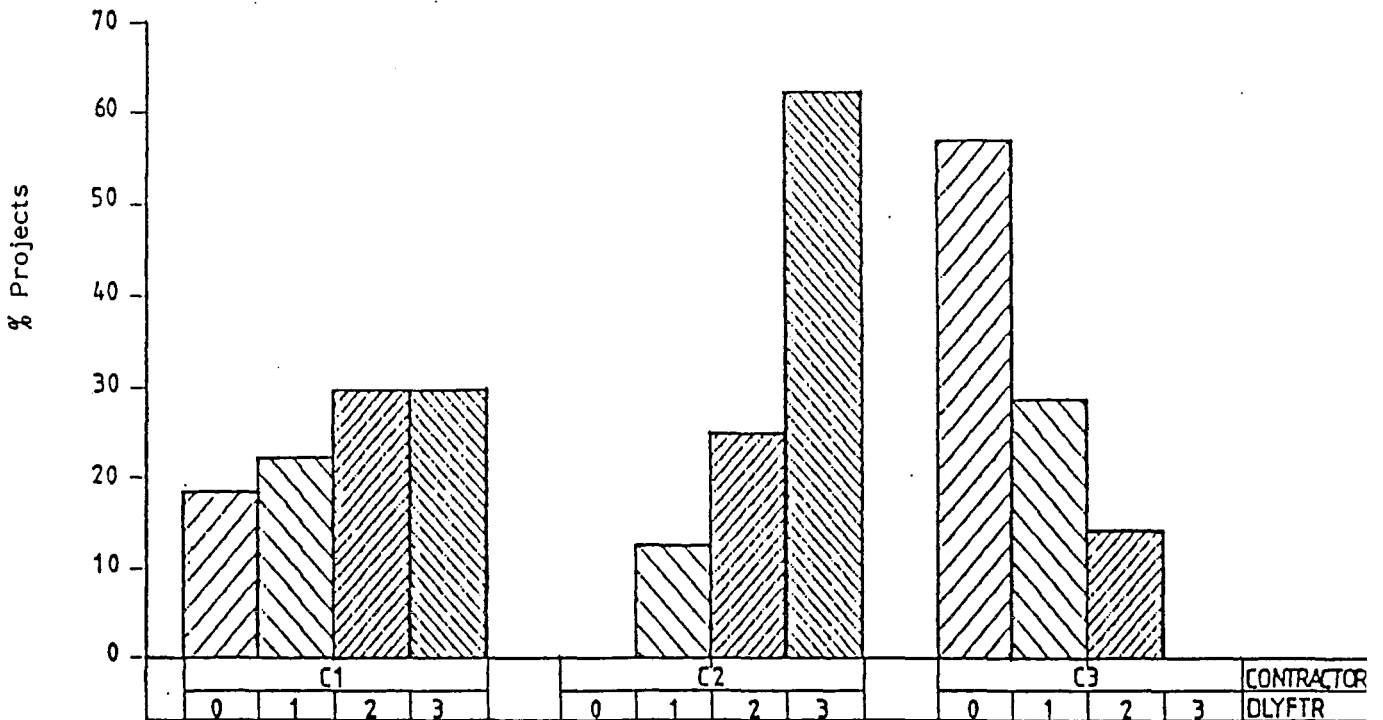




Table 12b: Completed projects by building contractors  
Delay factors vs No. of projects

CONTRACTOR CLASSES	No. OF PROJECTS	% DISTRIB.	DELAY FACTORS			
			0	1	2	3
C1	27	64.0	5	6	8	8
C2	8	19.0	0	1	2	5
C3	7	17.0	4	2	1	0
TOTAL	42	100.0	9	9	11	13

C1=Class ONE contractors  
C2=Class TWO contractors  
C3=Class THREE contractors

Fig 8b Completed projects by building contractors  
Delay factor vs projects

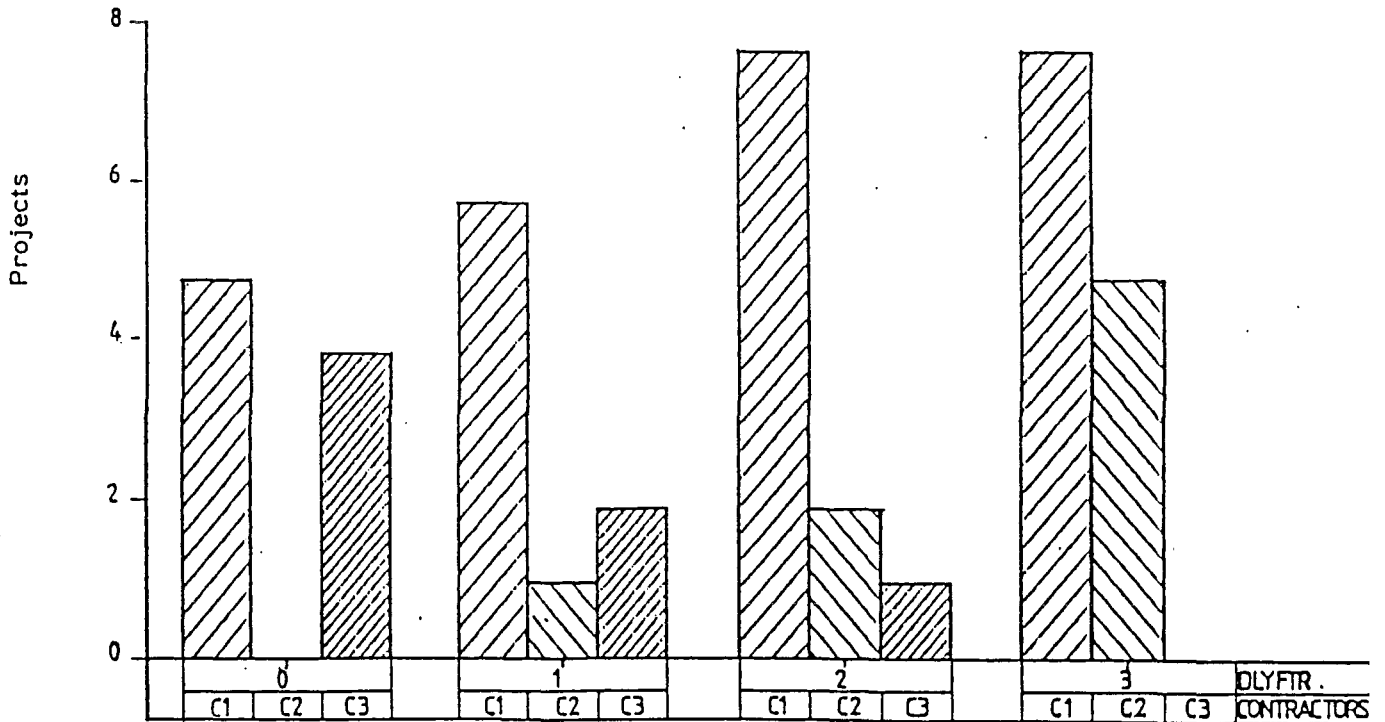


Table 13a Completed projects by building categories  
 Delay factors vs % projects by respective building categories.

BUILDING CATEGORIES	No. OF PROJECTS	TOTAL %	DELAY FACTORS			
			0	1	2	3
O	11	100.0	0.0	45.5	27.3	27.3
I	13	100.0	23.2	23.2	23.2	36.4
S	3	100.0	0.0	33.3	33.3	33.3
C	15	100.0	40.0	0.0	26.7	33.3

Fig 9a Completed projects by building categories  
 Delay factors vs % projects by respective building categories

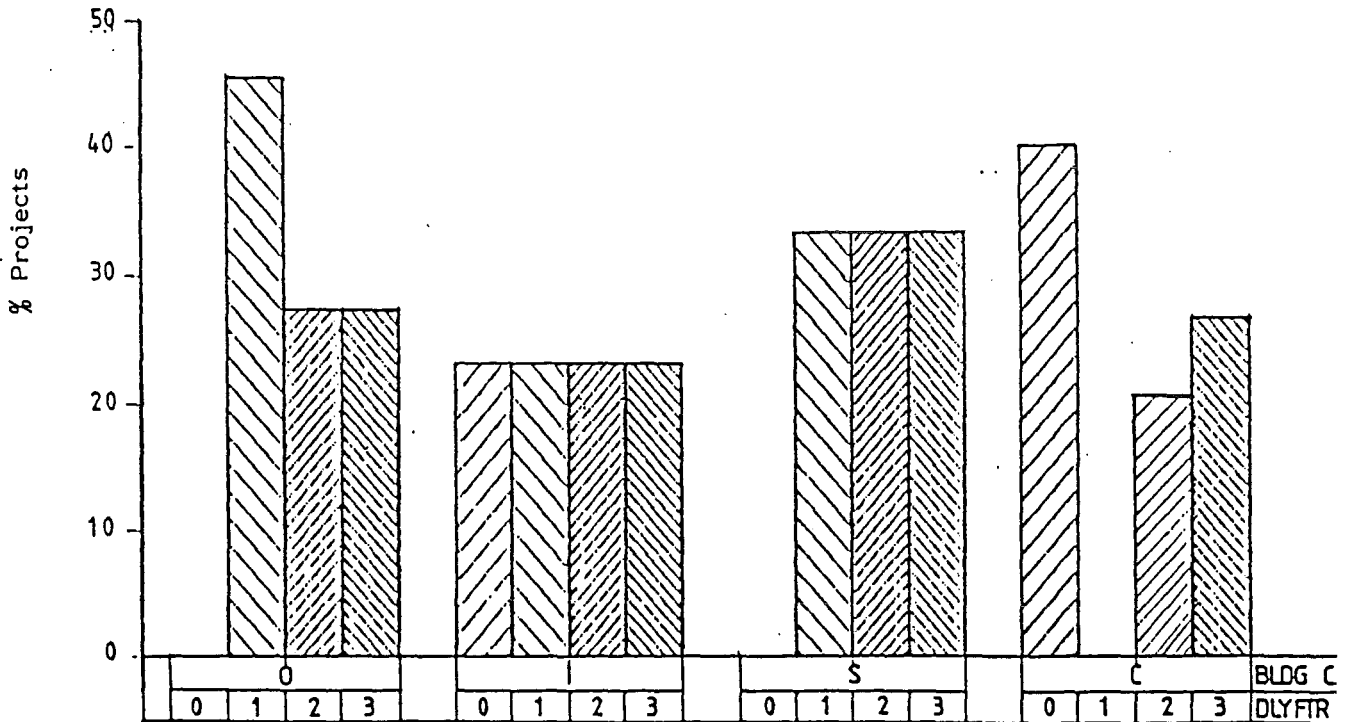
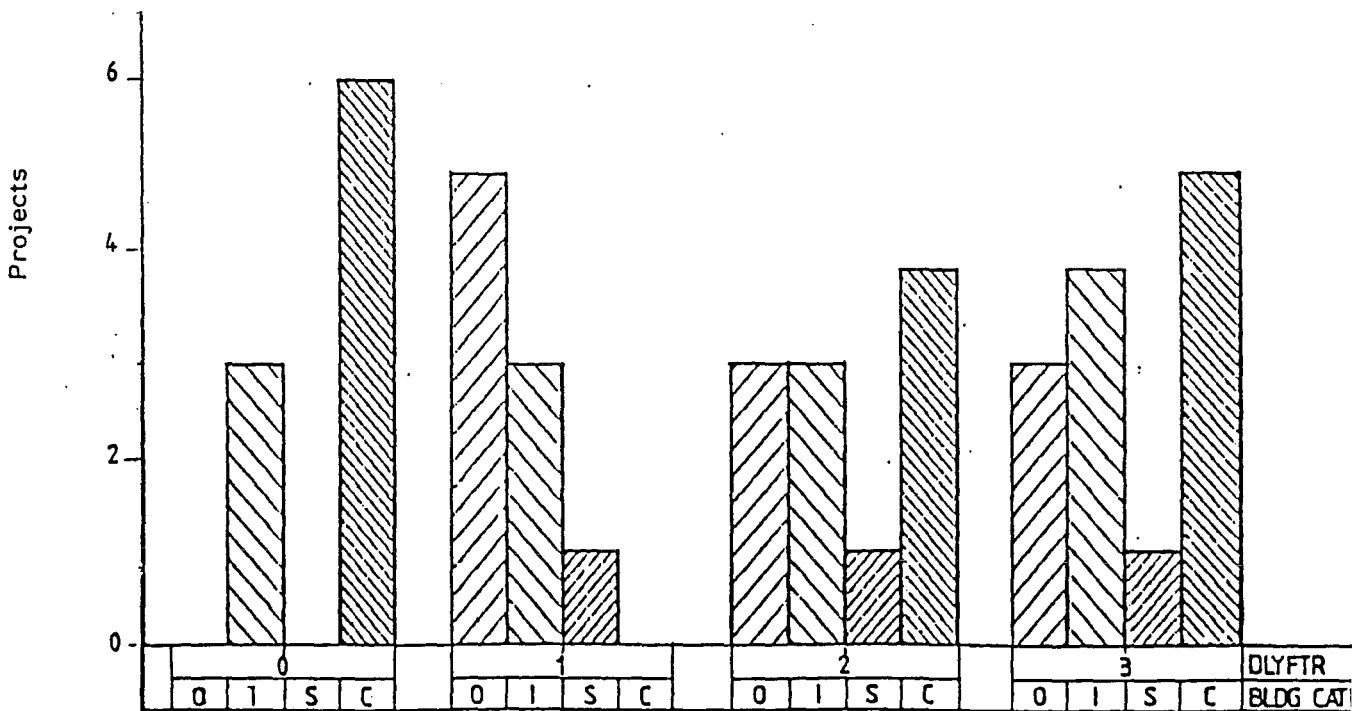


Table 13b: Completed projects by building categories  
Delay factors vs No. of projects

BUILDING CATEGORIES	No. OF PROJECTS	% DISTRIB.	DELAY FACTORS			
			0	1	2	3
O	11	26.0	0	5	3	3
I	13	31.0	3	3	3	4
S	3	7.0	0	1	1	1
C	15	36.0	6	0	4	5
TOTAL	42	100.0	9	9	11	13

Fig 9b Completed projects by building categories  
Delay factor vs projects



**Table 14a:** Completed projects by main building groups  
 Delay factors vs % projects by respective main building groups.

MAIN GROUPS	No. OF PROJECTS	TOTAL %	DELAY FACTORS			
			0	1	2	3
A	24	100.0	12.5	33.3	25.8	29.2
B	18	100.0	33.3	5.6	27.8	33.3

**Fig 10a** Completed projects by main building groups.  
 Delay factors vs % projects by respective main building groups

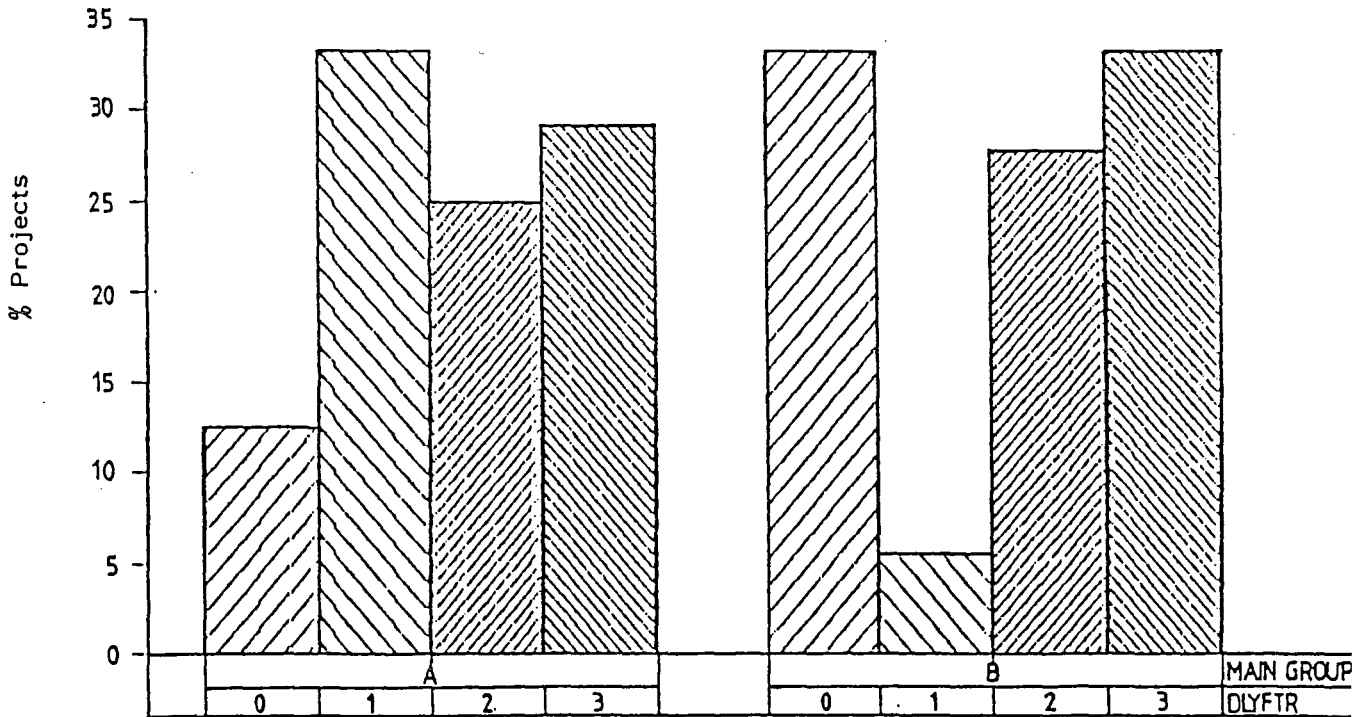


Table 14b: Completed projects by main building groups  
Delay factors vs No. of projects

MAIN GROUPS	No. OF PROJECTS	% DISTRIB.	DELAY FACTORS			
			0	1	2	3
A	24	57.8	3	8	6	7
B	18	43.8	6	1	5	6
TOTAL	42	100.8	9	9	11	13

Fig 10b Completed projects by main building groups.  
Delay factor vs projects

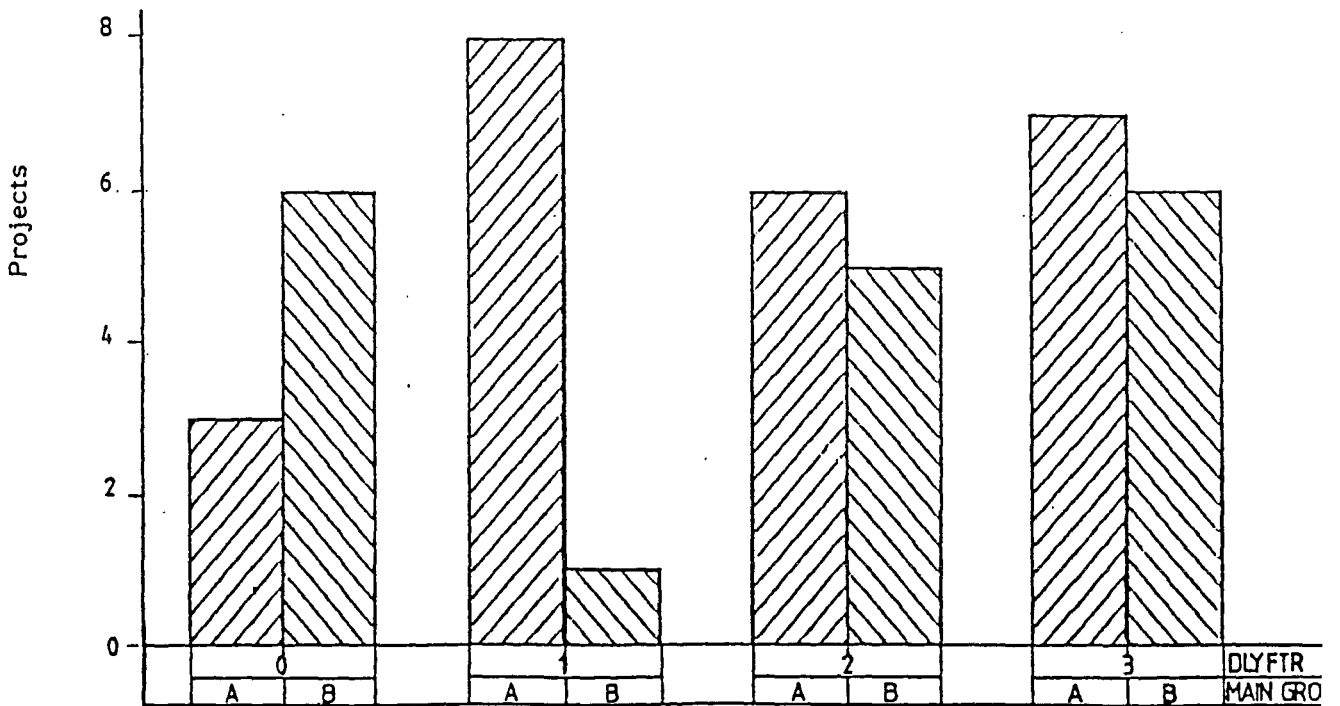


Table 15: Inter-Relationship; Clients/Tender types  
Clients vs % projects by tender types.

CLIENTS	TOTAL No. PROJECTS	TOTAL %	TYPES OF TENDER (%)		
			OPEN	SEL.	NEG.
GOVT.	6	100.0	83.0	17.0	0.0
PARA	26	100.0	54.0	42.0	4.0
PRIV.	18	100.0	10.0	40.0	50.0

Fig 11 Inter-relationship  
Clients vs % projects by tender types.

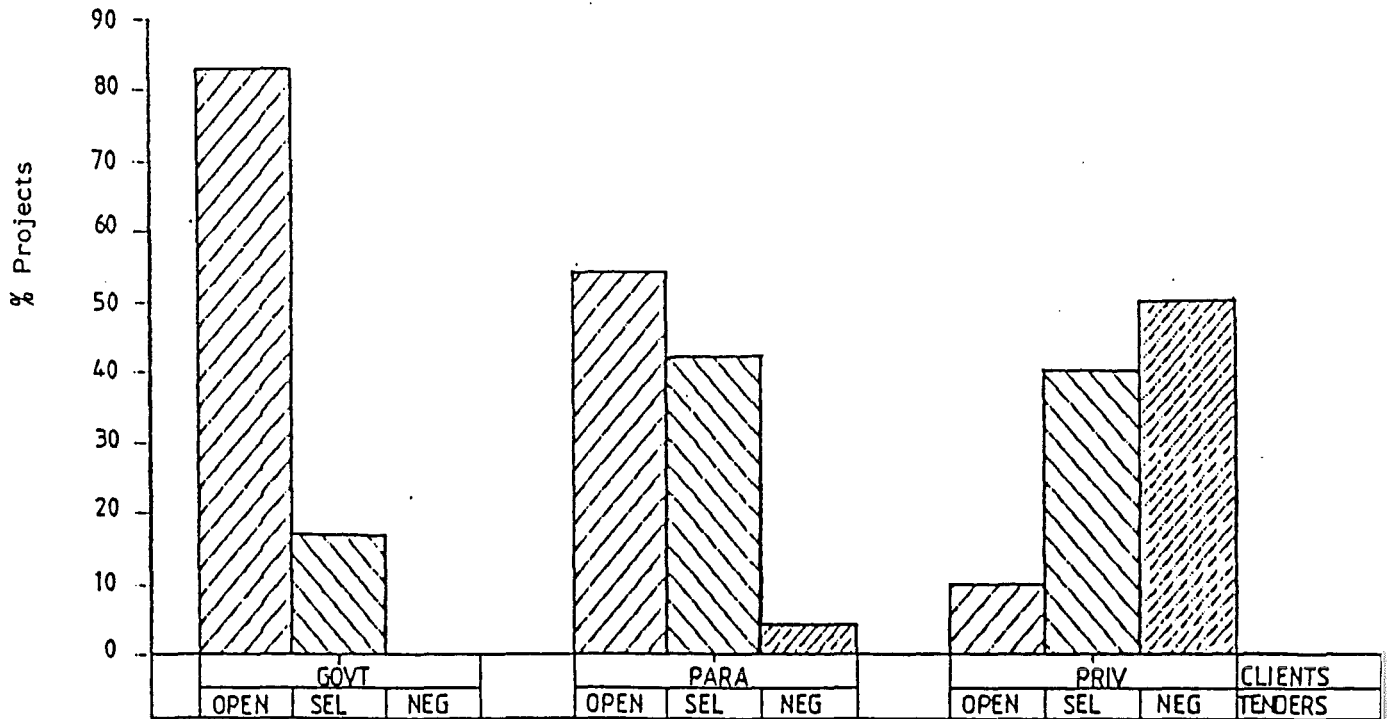


Table 16: Inter-Relationship; Clients/Contract types  
Clients vs % projects by contract types

CLIENTS	TOTAL No. PROJECTS	TOTAL %	TYPES OF CONTRACTS (%)		
			UR	LS	CFF
GOVT.	6	100.0	100.0	0.0	0.0
PARA	26	100.0	85.0	12.0	3.0
PRIV.	10	100.0	70.0	30.0	0.0

Fig 12 Inter-relationship  
Clients vs % projects by contract types

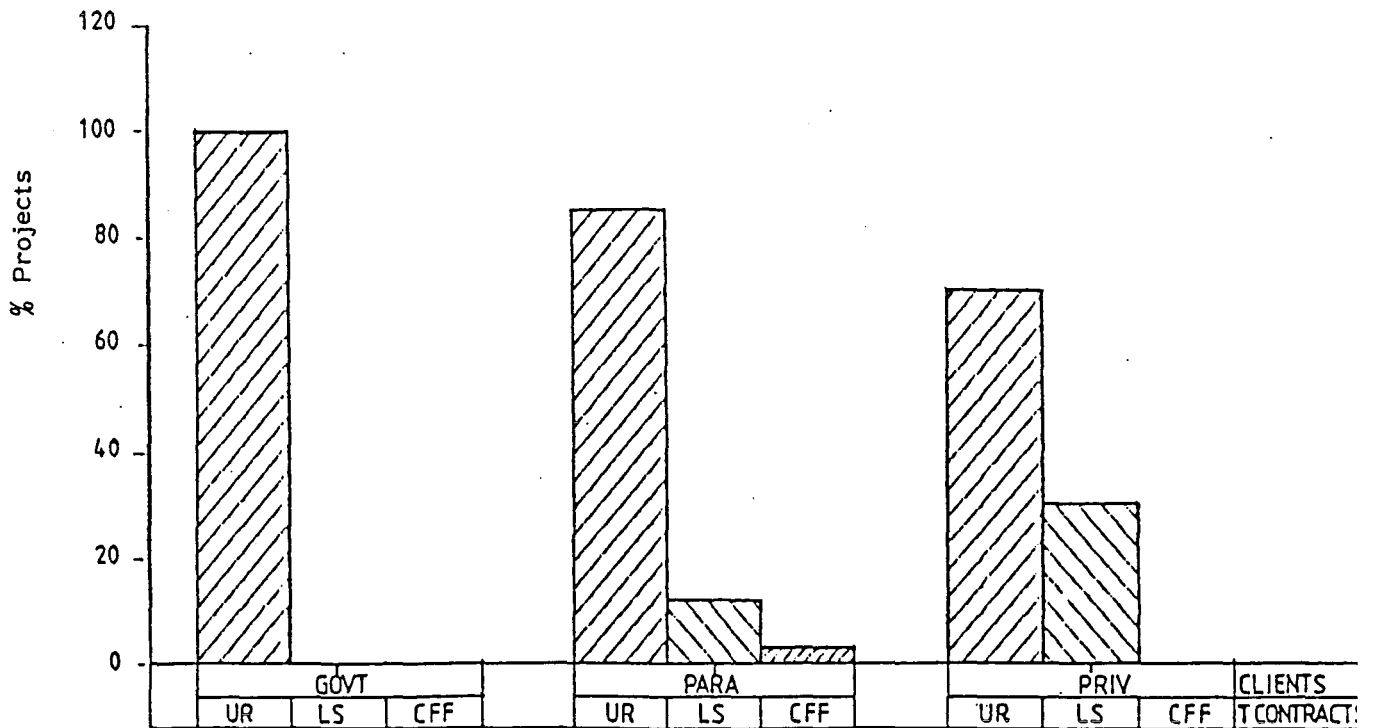


Table 17: Inter-Relationship; Contract types/Tender types  
Contract types vs % projects by tender types

TYPES OF CONTRACTS	TOTAL No. PROJECTS	TOTAL %	TYPES OF TENDER (%)		
			OPEN	SEL.	NEG.
UR	35	100.0	57.0	34.0	9.0
LS	6	100.0	0.0	67.0	34.0
CFF	1	100.0	0.0	0.0	100.0

Fig 13 Inter-relationship  
Contract types vs % projects by tender types

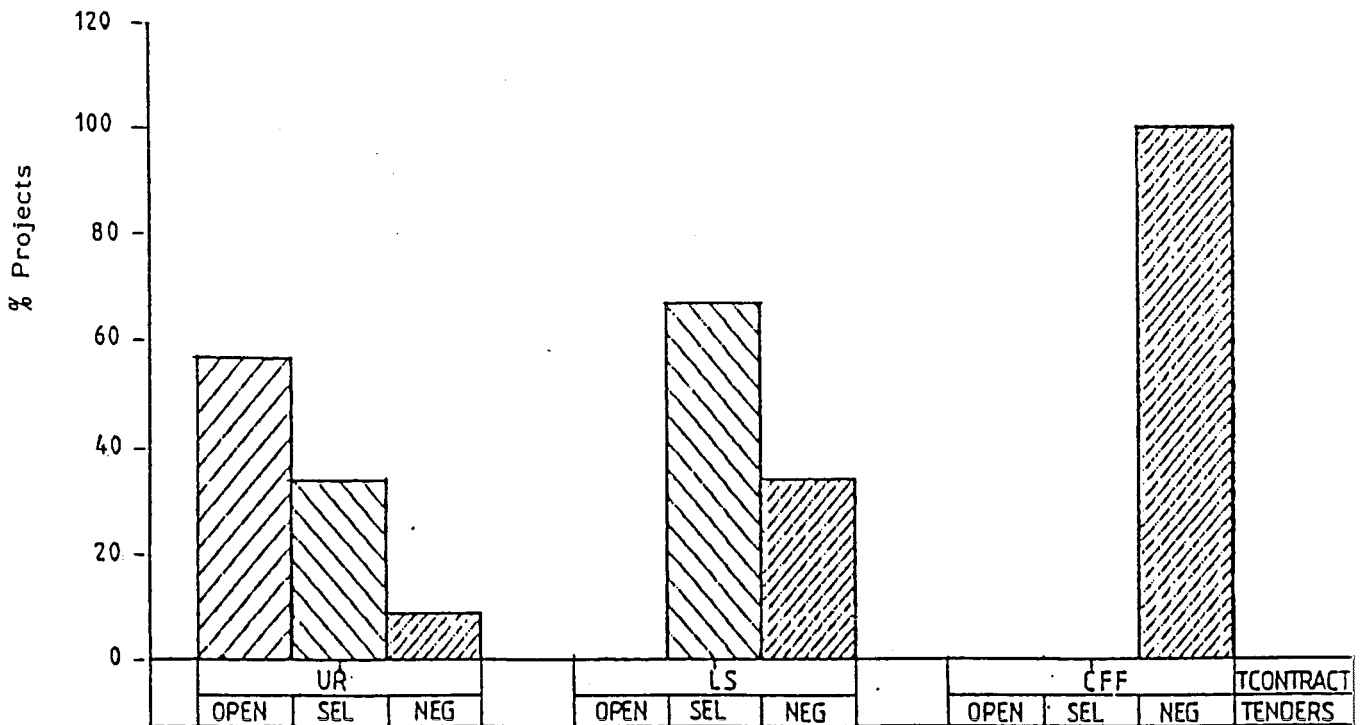




Table 18: Completed projects  
Contributing factors to delays

No.	PROJECT NAME	DLYFTR	ZDELAY	DLYMATRS	CLTFUND	CEQUIPT	TRANSP	WEATHER	SCINCOMP	DESIGN	MISCLT	MCONSULT	MCINCOMP	MCBANKRT	LABOUR
1	Office Block for NPF	3	ERR	Y	N	N	N	N	N	Y	N	N	N	N	N
2	Berger Fire Godown	3	125	N	Y	N	N	Y	Y	N	N	N	N	N	N
3	Housing Estate -TIB	3	117	Y	N	N	N	N	N	N	N	N	N	N	N
4	Star.Godown for TAT.	3	113	Y	N	N	Y	Y	N	N	N	N	N	N	Y
5	KIA Hangar	3	100	Y	Y	N	Y	N	N	N	N	N	N	N	N
6	Acheles Factory Ext.	3	103	N	N	N	N	N	N	N	N	N	N	N	N
7	NDC Housing Estate	3	100	Y	Y	N	Y	Y	N	N	N	N	N	N	Y
8	Off.Acc.Sch.Complex	3	100	Y	Y	N	N	N	N	N	N	N	N	N	N
9	NIC Staff Flats	3	100	Y	N	N	Y	N	N	N	N	N	Y	N	Y
10	Vocat.Training Ctr	3	100	Y	Y	N	Y	N	Y	N	N	N	N	N	Y
11	Godown,Office bldg.	3	100	Y	N	N	N	Y	N	N	N	N	N	N	N
12	Block of Flats	3	100	Y	N	N	N	N	N	N	N	N	Y	N	N
13	Bank Flats and M/Hse.	3	80	Y	N	N	Y	Y	N	N	N	N	N	N	N
14	AMREF R/Hqs.	2	67	N	N	N	N	N	N	N	N	N	N	N	N
15	Office Accoa.Schene	2	54	Y	N	N	N	N	N	Y	N	N	N	N	L
16	THA Training School	2	50	Y	N	N	N	N	N	Y	N	Y	N	N	N
17	Diesel Locom.Depot	2	50	Y	Y	N	Y	N	N	Y	N	N	N	N	N
18	Tourist Hotel	2	50	Y	Y	N	N	N	Y	Y	N	N	N	N	N
19	Train.Ctr-Orthopaedic	2	40	Y	N	N	N	N	N	Y	N	N	N	N	N
20	Off/Accoa.Tiwb.Struct.	2	46	N	N	N	N	N	N	Y	N	N	N	N	N
21	Lab,Foundry,Godown	2	44	Y	Y	N	Y	Y	N	N	N	N	N	N	N
22	Godown,Offices	2	43	Y	N	N	Y	Y	N	N	N	N	N	N	N
23	Staff Housing	2	38	Y	N	N	N	N	N	N	N	N	N	N	N
24	Int.Sch;Hall Complex	2	35	Y	N	Y	Y	Y	N	N	N	N	N	N	Y
25	Grain Stores:Irg,Song.	1	34	Y	N	N	N	N	N	Y	N	Y	N	N	N
26	Mech.Eng.Laboratory	1	33	N	N	N	N	N	N	N	N	N	N	N	N
27	Coconut Creaming Fact.	1	33	N	Y	N	N	N	N	N	N	N	N	N	N
28	Workshop,Off.Block-BML	1	33	Y	N	N	N	N	N	N	N	N	N	N	Y
29	CCM H/Q.Extension	1	29	Y	N	N	Y	N	N	N	N	N	N	N	N
30	NIC Office Blocks	1	22	N	Y	N	N	N	N	N	N	N	N	N	N
31	Vocat. Training Ctr.	1	13	Y	N	Y	Y	N	N	Y	N	N	N	N	N
32	Bank of Tanzania Bldg.	1	13	Y	N	N	Y	Y	N	N	Y	N	N	N	N
33	Bank of Tanzania Bldg.	1	11	Y	N	N	N	N	N	N	N	N	N	N	N
34	DAFCD Godown	0	0	N	N	N	N	N	N	N	N	N	N	N	N
35	Bank Flats & Houses	0	0	Y	N	Y	Y	N	N	N	N	N	Y	N	Y
36	Housing Estate - TRDB	0	0	Y	N	N	N	N	N	N	N	N	N	N	Y
37	Res. Houses	0	0	N	N	N	N	N	N	N	N	N	N	N	N
38	M.V.Assembly Plant	0	0	Y	N	Y	N	N	N	N	N	N	N	N	Y
39	Res.Houses 6.Nos.	0	0	Y	N	Y	N	N	N	N	N	N	N	N	Y
40	Constr.4Nos.Houses	0	0	N	N	N	N	N	N	N	N	N	N	N	N
41	Warehouse - CRDB	0	0	N	N	N	N	N	N	N	N	N	N	N	N
42	Res.Houses 13.Nos.	0	0	Y	N	Y	Y	N	N	N	N	N	Y	N	Y

Table 19: Contributing factors to delays  
Frequency distribution of projects by each factor

CONTRIBUTING FACTORS TO DELAYS	FREQUENCY OUT-42 PROJS	% DISTRIBUT.
1. Lack of building materials	31	73.8
2. Lack of funds from clients	10	23.8
3. Lack of construction equipment	5	11.9
4. Transport problems	15	35.7
5. Weather problems	9	21.4
6. Incompetence of sub-contractor	3	7.1
7. Design problems	9	21.4
8. Misunderstand.contractor/client	1	2.4
9. Misunderstand.contractor/consult	2	4.8
10. Incompetence of main contractor	4	9.5
11. Main contractor bankrupt	0	0.0
12. Labour problems	11	26.2

Table 20: Major contributing factors to delays  
 Delay factor vs % projects by individual contributing factors

CONTRIBUTING FACTORS TO DELAYS	% DISTR 42 Proj.	DLYFTR-0		DLYFTR-1		DLYFTR-2		DLYFTR-3	
		freq.	%	freq.	%	freq.	%	freq.	%
		9 proj.	distr.	9 proj.	distr.	11 proj.	distr.	13 proj.	distr.
1. Bldg. materials	73.8	5	55.6	6	66.7	9	81.8	11	84.6
2. Transport	35.7	2	22.2	3	33.3	4	36.4	6	46.2
3. Labour	26.2	5	55.6	1	11.1	1	9.1	4	30.8
4. Funds-client	23.8	0	0.0	2	22.2	3	27.3	5	38.5
5. Design	21.4	0	0.0	2	22.2	6	54.5	1	7.7
6. Weather	21.4	0	0.0	1	11.1	3	27.3	5	38.5

Fig 14 Major contributing factors to delays  
 Delay factors vs % projects by respective major factors.

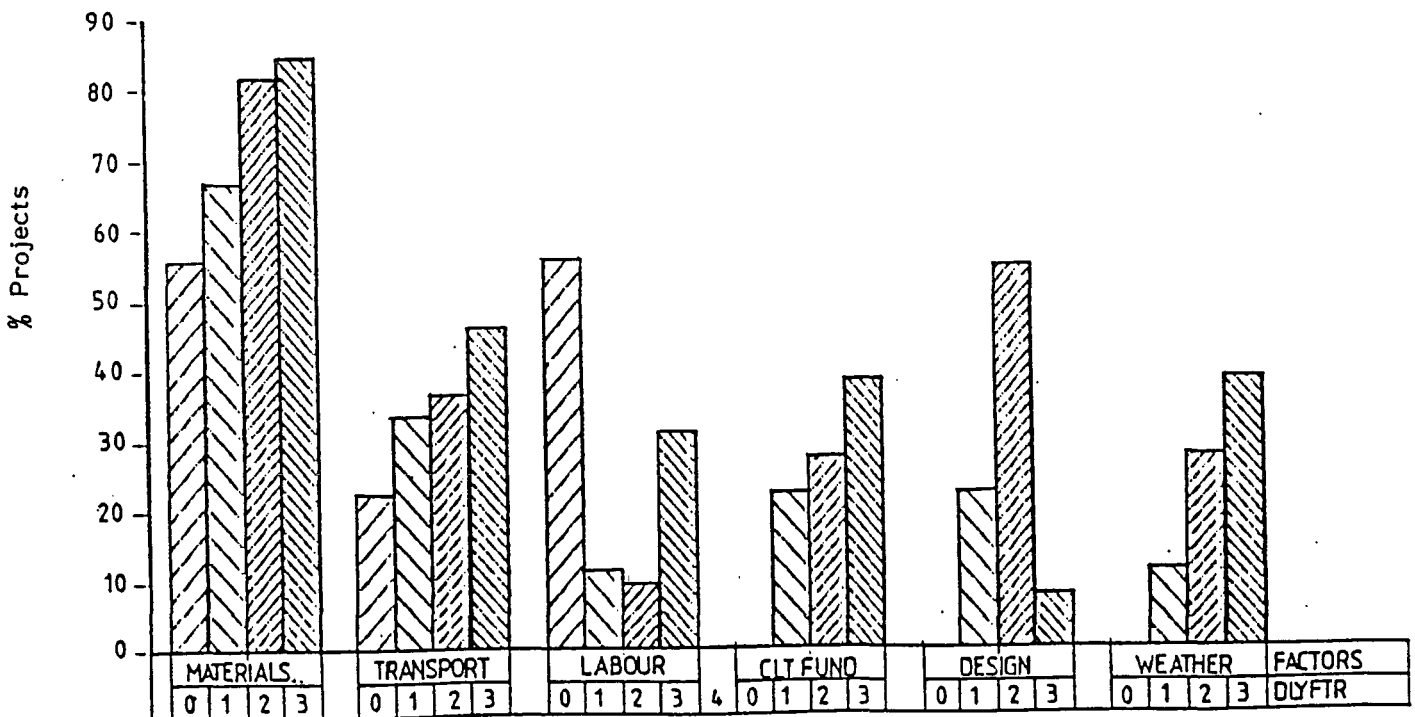


Fig 15: Completed projects  
Cost-Overrun (%) vs Projects

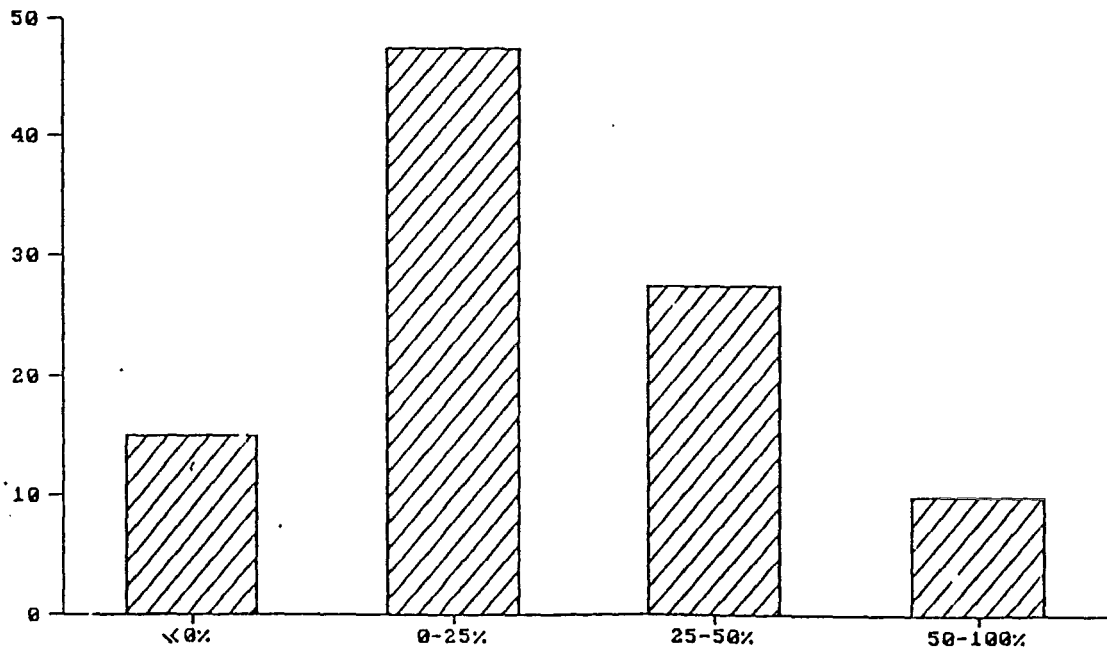


Table 27: Completed projects (%)  
Cost-Overrun (%) vs Delay Factors

Cost-Overrun	No. of Projects	% Distrib.	Delay Factors			
			0	1	2	3
≤0%	6	100%	66.7	0.0	33.3	0.0
0-25%	19	100%	21.1	15.8	26.3	36.8
25-50%	11	100%	9.0	27.3	36.4	27.3
50-100%	4	100%	0.0	25.0	0.0	75.0

Fig 16: Completed projects (%)  
Cost-Overrun (%) vs Delay Factors

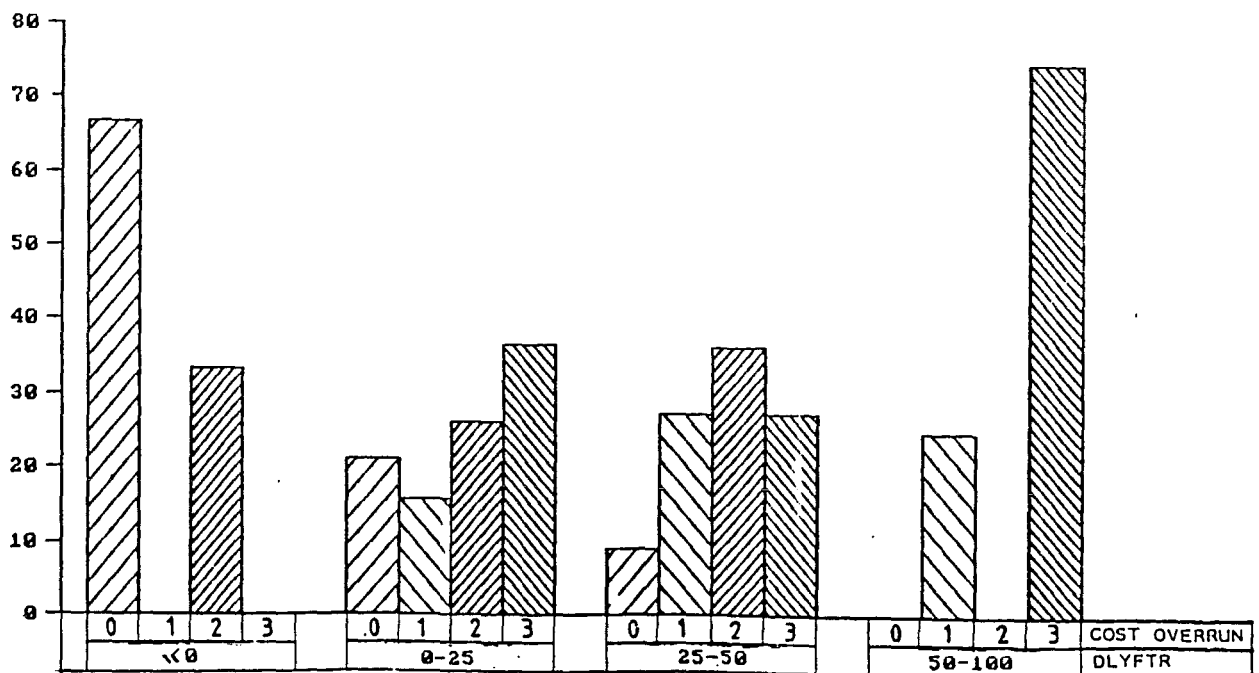


Table 28: Completed projects (%)  
Cost-Overrun (%) vs Clients

Clients	No. of Projects	% Distrib.	% Cost-Overrun			
			<0%	0-25%	25-50%	50-100%
Govt	6	100%	0.0	50.0	33.3	16.7
Para	26	100%	11.5	50.0	27.0	11.5
Priv	9	100%	37.5	37.5	25.0	0.0

Fig 17: Completed projects (%)  
Cost-Overrun (%) vs Clients

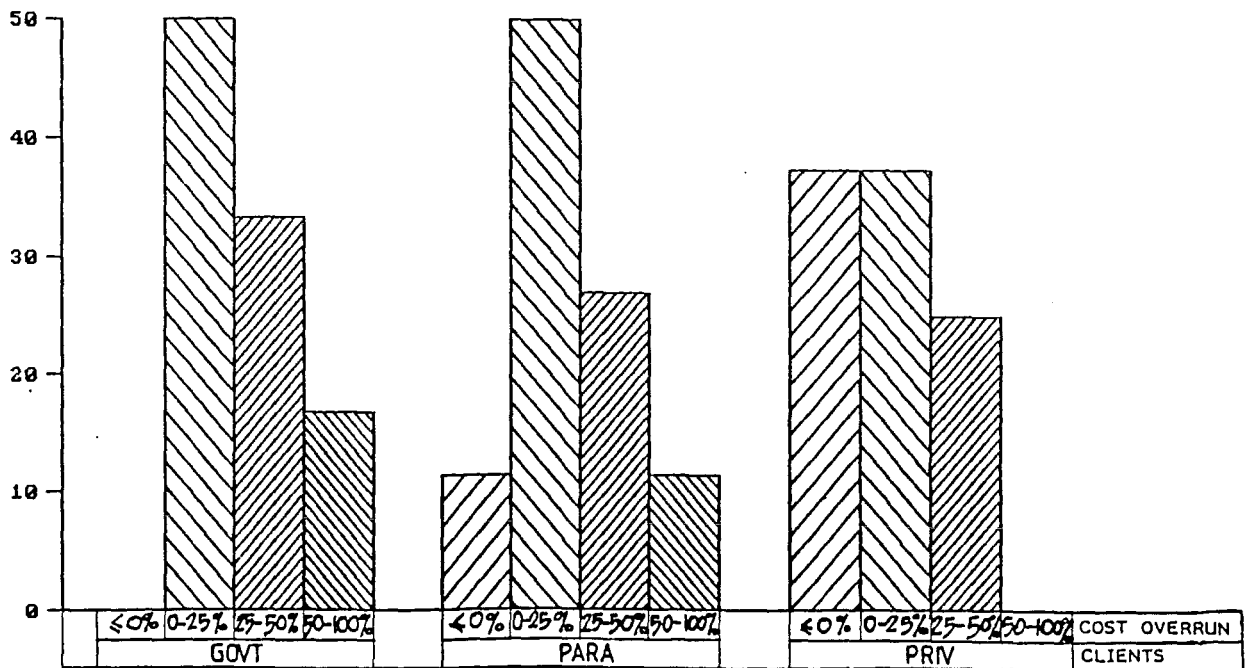


Table 29: Completed projects (%)  
Cost-Overrun (%) vs Contract Type

Type of Contract	No. of Projects	% Distrib.	% Cost-Overrun			
			≤0%	0-25%	25-50%	50-100%
Unit rates	34	100%	14.7	50.0	26.5	8.8
Lumpsum	5	100%	20.0	40.0	20.0	20.0
CFixed Fee	1	100%	0.0	0.0	100.0	0.0

NB: CFixed Fee = Cost and fixed fee

Fig 18: Completed projects (%)  
Cost-Overrun (%) vs Contract Type

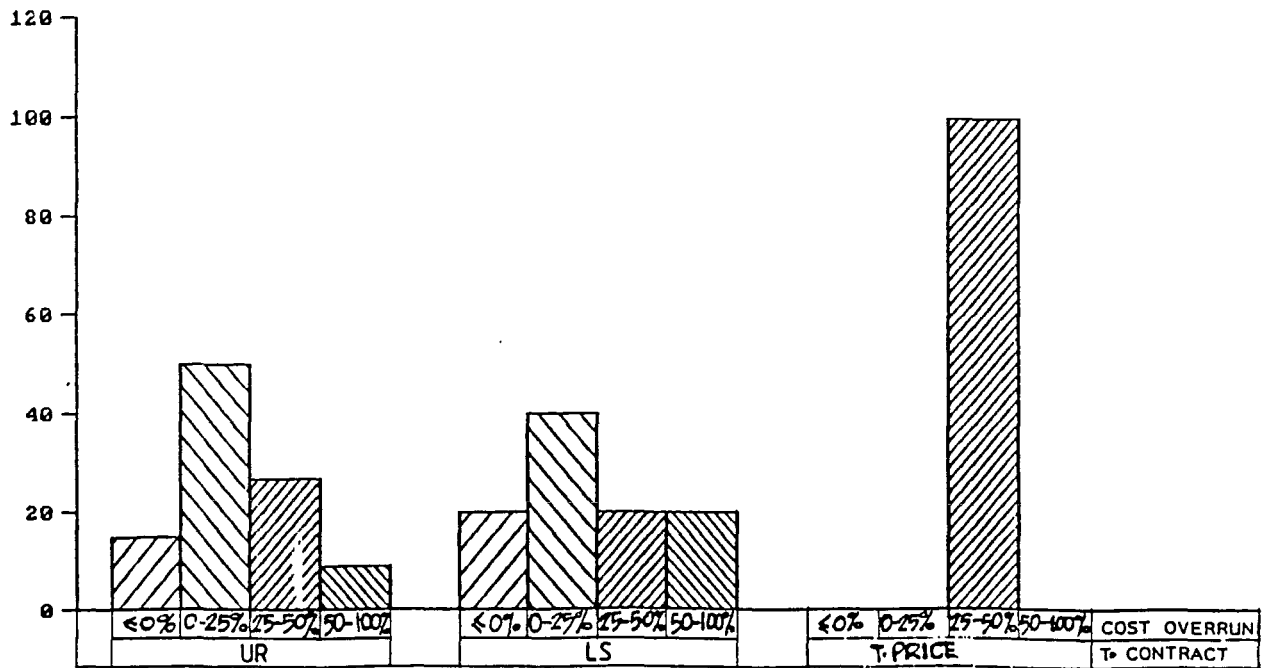


Table 30: Completed projects (%)  
Cost-Overrun (%) vs. Type of Tender

Type of Tender	No. of Projects	% Distrib.	% Cost-Overrun			
			≤0%	0-25%	25-50%	50-100%
Open	20	100%	10.0	45.0	35.0	10.0
Selected	16	100%	18.7	56.3	12.5	12.5
Negotiated	4	100%	25.0	25.0	50.0	0.0

Fig 19: Completed projects (%)  
Cost-Overrun (%) vs. Type of Tender

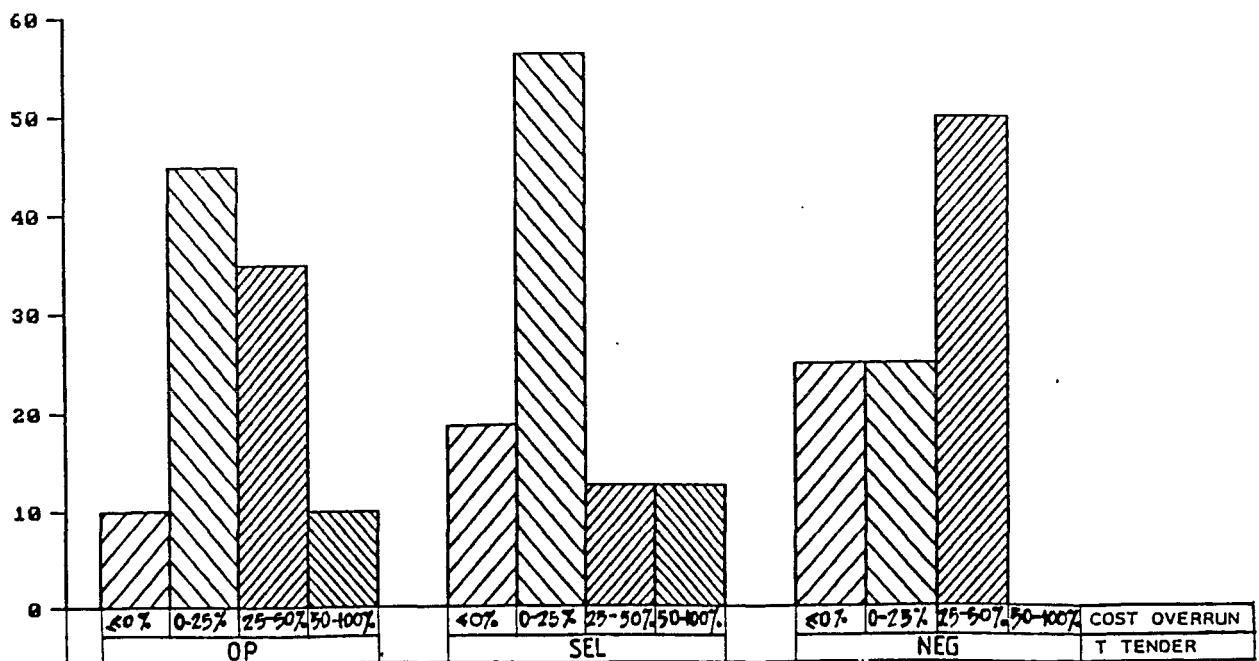
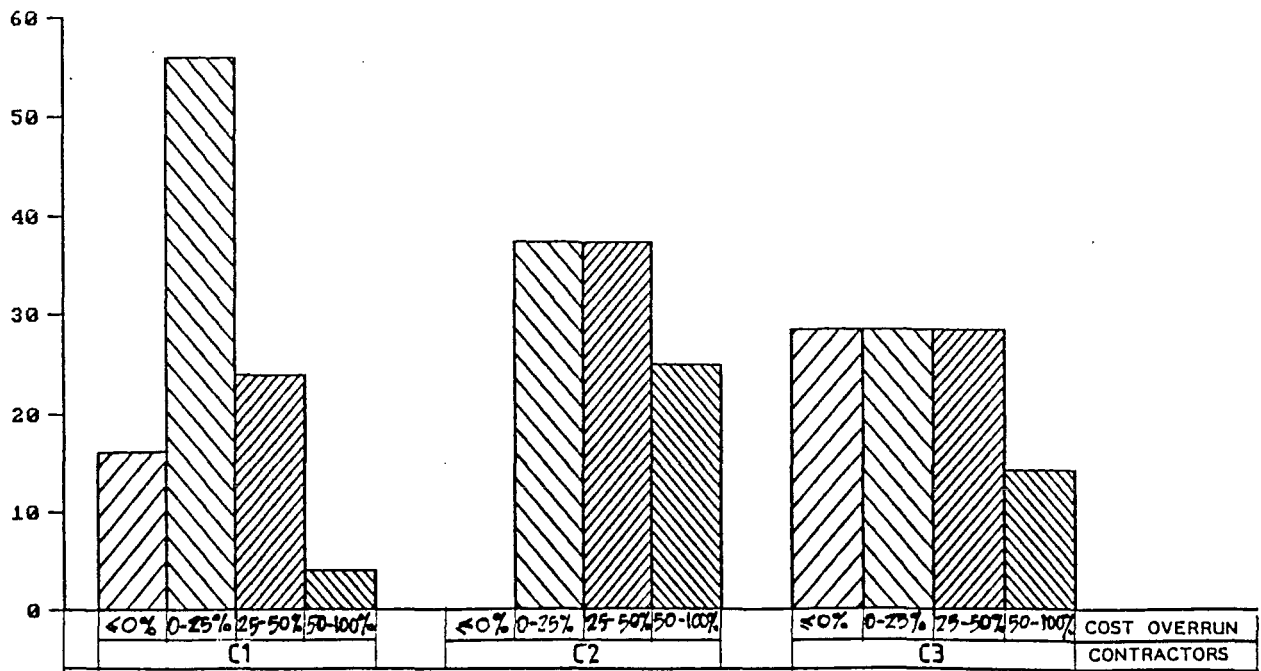




Table 31: Completed projects (%)  
Cost-Overrun (%) vs Building Contractors

Contractors	No. of Projects	% Distrib.	% Cost-Overrun			
			<0%	0-25%	25-50%	50-100%
C1	25	100%	16.0	56.0	24.0	4.0
C2	8	100%	0.0	37.5	37.5	25.0
C3	7	100%	28.6	28.6	28.6	14.2

Fig 20: Completed projects (%)  
Cost-Overrun (%) vs Building Contractors



**Table 32:** Completed projects (%)  
Cost-Overrun (%) vs Main Building Groups

Main Building Group	No. of Projects	% Distrib.	% Cost-Overrun			
			<0%	0-25%	25-50%	50-100%
A	22	100%	9.1	59.1	27.3	4.5
B	18	100%	22.2	33.3	27.8	16.7

NB: A = Commercial buildings  
B = Institutional buildings

**Fig 21:** Completed projects (%)  
Cost-Overrun (%) vs Main Building Groups

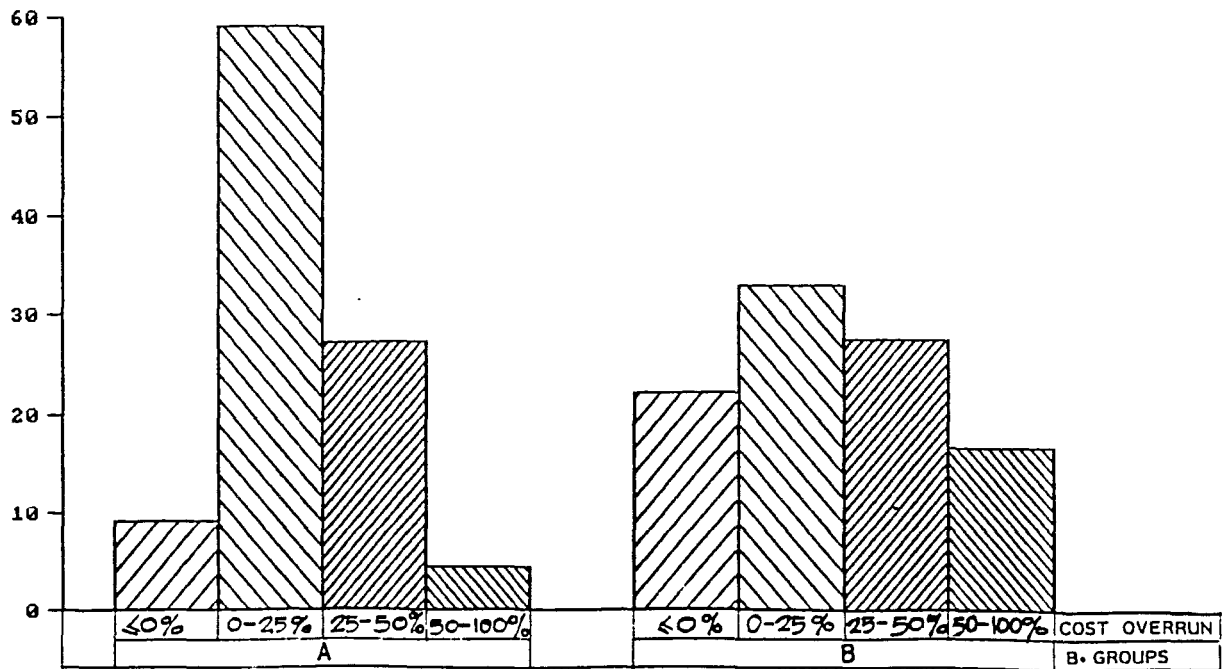


Fig 23: Completed projects  
Actual construction time vs final contract sum

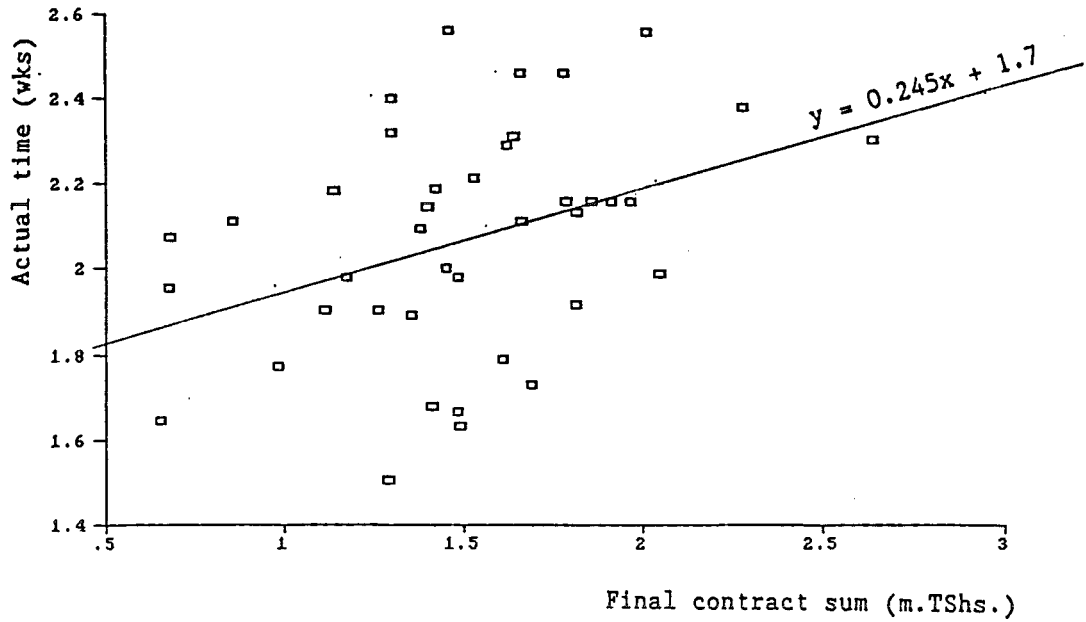
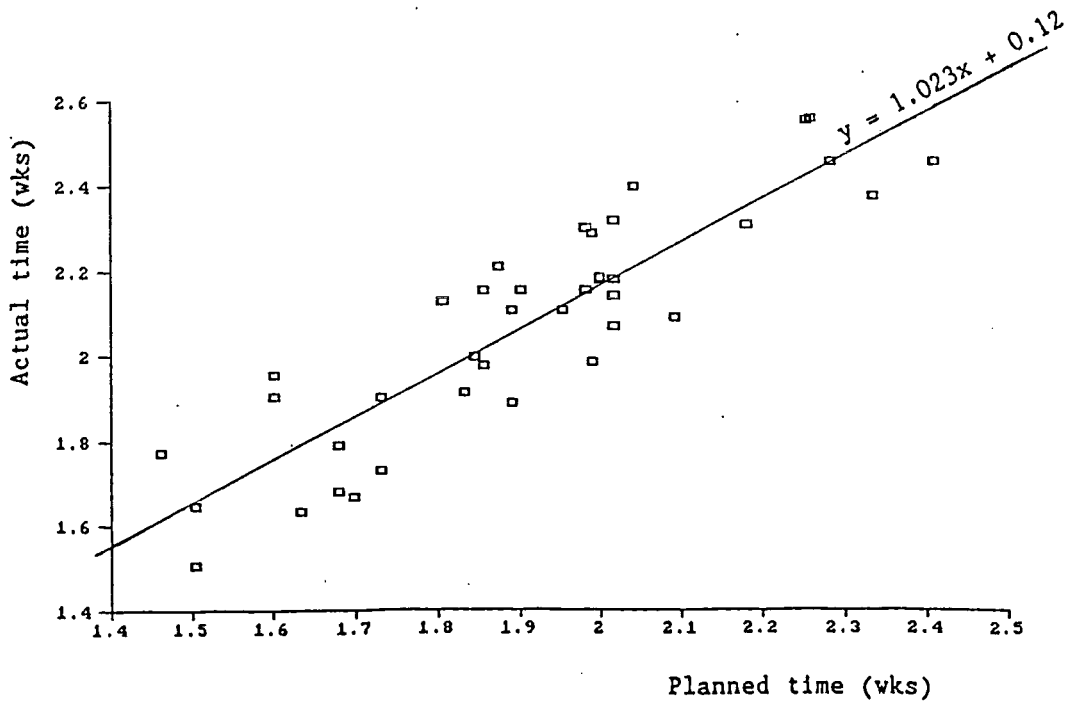


Fig 24: Completed projects  
Actual construction time vs planned time.



The Centennial of the School of Engineering



8-10 May 1987

25 June 1987

Ref. No.

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Dear Sir,

RE: A STUDY OF PROBLEMS OF THE CONSTRUCTION INDUSTRY IN TANZANIA

I have the pleasure to introduce myself to you as Mr Halid Y. Kijangwa, a graduate Civil Engineer (DSM University - 1980), employed by the Ministry of Communication and Works but currently pursuing an M.Sc. in Construction Management at Canterbury University.

One of my studies investigates the problems of the construction industry in Tanzania, especially in building projects. The purpose of the study is firstly to identify the variables that experience shows tend to influence construction times and costs, and secondly to determine which of these are the most significant factors. The study will also investigate possible solutions to these problems by comparison with the construction Industry in other countries.

Therefore we sincerely request your assistance in providing us with some of the data on which the study will be based. We ask you to fill in the attached questionnaires, providing us with as much information as you can, and return the completed questionnaires to the person who brought them to you. He will forward them to us before Monday 24 August 1987.

It is our hope that at the completion of this study we will be able to give guidance for the improvement of the construction industry in Tanzania. This will be possible only if we receive sufficient information from Tanzanian construction organizations.

In the sincere hope that you will help us, we thank you for your cooperation.

Yours faithfully,

**Halid Y. Kijangwa**  
Postgraduate Student  
Civil Engineering Department,  
University of Canterbury

**Dr David Scott (Supervisor)**  
Senior Lecturer  
Civil Engineering Department  
University of Canterbury

## INSTRUCTION SHEET

The following remarks have been set to make the filling of questionnaires a bit easier. Kindly read them carefully.

### 1.0 Colour of Questionnaire Sheets

- 1.1 White Sheet (Page 1) - Questionnaire No. 1
- 1.2 Blue Sheets (Page 2-7)  
(Continued) - Questionnaire No.1
- 1.3 Pink Sheets (Page 8-11) - General Questions

### 2.0 Other Remarks

- 2.1 Most of the questions are multi-choice, Please tick (✓) where applicable.
- 2.2 Where there are no boxes, write the information on the dotted line.
- 2.3 No names should be filled in on the Questionnaire.
- 2.4 You may write "N/A" for questions not applicable to your firm.
- 2.5 You may use Hand Writing to fill questionnaires.
- 2.6 Fill at least one Abandoned Project.
- 2.7 All information supplied will be treated in confidence and shall have not effects on the firm.

Thank you

QUESTIONNAIRE NO.1

[Please tick (✓) where appropriate]

1. NAME OF THE CONSULTING FIRM: .....

.....

.....

2. OFFICES:

3.1 HEAD OFFICE: .....

3.2 BRANCH OFFICE:.....

3.0 PERSONNEL [Not names please]

3.1

3.2

Directors/Partners	Qualifications
1. Director/Partner No.1	.....
2. " / " No.2	.....
3. " / " No.3	.....
4. " / " No.4	.....
5. Director/Partner No.5	.....

Other Qualified Personnel [But not Directors/Partners]	No.s
1. Civil/Structural Engineer	.....
2. Mechanical/Electrical Engineer	.....
3. Sanitary Engineer	.....
4. Quantity Surveyors	.....
5. Surveyors	.....
6. Planners	.....
7. ....	.....

## 4.0 LIST OF PROJECTS UNDERTAKEN BY YOUR FIRM [i.e. for last 10 years] AND SUCCESSFULLY AWARDED TO CONTRACTORS

[Value for each &gt; T.Shs. 10.0M]

Project 1.

Description of Project and Town	Project Cost [T.Shs.]	Other Consulting Firms involved	Name of Client	Contractor Executing Project	Date of Start and Duration	Extension of Time until Completion	Type of Contract	Type of Tender	Project Status	Reasons for delay [Tick all applicable] or if not delayed state
	1. Quoted value in the Tender ..... 2. Final Cost at Completion .....	1. Architect  2. Engineers  3. Quantity Surveyor  4. ....	1. Government <input type="checkbox"/>  2. Parastatal <input type="checkbox"/>  3. Private Organisation <input type="checkbox"/>	1. Class-I <input type="checkbox"/>  2. Class-II <input type="checkbox"/>  3. Class-III <input type="checkbox"/>  4. ....	1. Date of Start ..... 1979 2. Duration ..... .....	1. Authorised ..... 2. Overrun ..... .....	1. Unit Rates <input type="checkbox"/> 2. Lump sum <input type="checkbox"/> 3. Cost & Fixed fee <input type="checkbox"/> 4. Cost & Fixed % <input type="checkbox"/> 5. Target Price <input type="checkbox"/>	1. Open Tender <input type="checkbox"/> 2. Selected Tender <input type="checkbox"/> 3. Negotiated Tender <input type="checkbox"/> Tender was awarded by	1. Ongoing* <input type="checkbox"/> 2. Completed <input type="checkbox"/> 3. Abandoned* <input type="checkbox"/> * State % completion	1. Lack of building materials ..... <input type="checkbox"/> 2. Lack of funds from client ..... <input type="checkbox"/> 3. Lack of constr. equipment ..... <input type="checkbox"/> 4. Transport problems ..... <input type="checkbox"/> 5. Labour problems ..... <input type="checkbox"/> 6. Weather problems ..... <input type="checkbox"/> 7. Incompetence of sub-contractor ..... <input type="checkbox"/> 8. Design problems ..... <input type="checkbox"/> 9. Mis-understanding with client ..... <input type="checkbox"/> 10. Contractor's inexperience ..... <input type="checkbox"/> 11. Contractor became bankrupt ..... <input type="checkbox"/> 12. .... <input type="checkbox"/>

GENERAL QUESTIONS [Please tick (✓) where appropriate]

As observed there are a number of contributing factors as to projects not completed in time, abandoned and those completed in time.

5.0 Contractors' Experience

5.1 From your experience, are you pleased as to the way the projects are awarded to contractors taking into consideration of their class and past experience.

A. YES

B. NO

5.2 Then, what changes if any do you think could improve this trend?

i) .....

ii).....

5.3 Do you think that over commitment to projects\* is a significant factor in contractors not completing a project on time.

A. YES

B. NO

C. NOT ALWAYS

5.4 If yes, then what could be an optimum number of projects\* the following classes of contractors should have at any given time.

	Class I	Class II	Class III
A.	1 to 2 <input type="checkbox"/>	1 to 2 <input type="checkbox"/>	1 to 2 <input type="checkbox"/>
B.	1 to 3 <input type="checkbox"/>	1 to 3 <input type="checkbox"/>	1 to 3 <input type="checkbox"/>
C.	1 to 4 <input type="checkbox"/>	1 to 4 <input type="checkbox"/>	1 to 4 <input type="checkbox"/>
D.	1 to 5 <input type="checkbox"/>	1 to 5 <input type="checkbox"/>	1 to 5 <input type="checkbox"/>
E.	1 to 6 <input type="checkbox"/>	1 to 6 <input type="checkbox"/>	1 to 6 <input type="checkbox"/>
F.	ANY <input type="checkbox"/>	ANY <input type="checkbox"/>	ANY <input type="checkbox"/>

\* i.e. The number of projects within that class.



6.0

BUILDING MATERIALS:

6.1 Are delays due to non-availability of building materials taken into consideration when fixing duration for contracts?

- A. YES
- B. NO
- C. DIFFICULT
- D. NOT APPLICABLE

6.2 If no; then, do you think taking the above factor (item 6.1) into account could have produced a realist contract duration for projects?

- A. YES
- B. NO
- C. NEVER
- D. NOT APPLICABLE

7.0 CONTRACT TYPE

7.1 What form of contract conditions do you normally use?

- i) .....
- ii) .....

7.2 What method of contract documentation do you normally use?

- A. CONVENTIONAL CONTRACT (i.e. Bill of Rates Type Contract)
- B. COST PLUS \_\_\_\_\_
- C. OTHER (STATE) .....

7.3 What financial incentives do you normally use in contracts?

- A. BONUSES FOR EARLY COMPLETION \_\_\_\_\_
- B. LIQUIDATED DAMAGES \_\_\_\_\_
- C. OTHERS (State) .....

8.0 CONTRACT PERIOD

8.1 How is contract period normally determined?

- A. MINISTRY OF COMM. AND WORKS STANDARD SCHEDULES \_\_\_\_\_
- B. CLIENT REQUIREMENTS \_\_\_\_\_
- C. CONSULTANTS STANDARD SCHEDULE \_\_\_\_\_
- D. OTHER (State) .....

8.2 Who normally set the contract period for projects?

- A. ARCHITECT \_\_\_\_\_
- B. ENGINEER \_\_\_\_\_
- C. QUANTITY SURVEYOR \_\_\_\_\_
- D. PROJECT MANAGER \_\_\_\_\_
- E. CONTRACTOR \_\_\_\_\_
- F. OTHER (State) .....

9.0 METHOD OF CONSTRUCTION

9.1 Traditionally, Cast-in-situ method of a reinforced concrete construction is used in Tanzania. Do you think of any other method of construction not normally used in this country that could result in improvement in the construction industry in terms of cost and time.

Please give details

- i) .....
- .....
- ii) .....
- .....

10.0 ANY ADDITIONAL INFORMATION

QUESTIONNAIRE NO. 1

[Please tick ( ) where appropriate]

1. NAME OF COMPANY: .....

.....

2. HEAD OFFICE: ..... BRANCH OFFICE: .....

3. CLASS: REGISTERED CLASS?YEAR: ...../19...

PRESENT CLASS: ..... YEAR UPGRADED: .....

4. COMPANY'S TECHNICAL PERSONNEL [Not names please]

4.1

4.2

4.3

Directors/Partners		Qualifications	Other Qualified Personnel [Not Directors/Partners]		Qualified and Experienced technicians	
				No.s		No.s
1. Director/Partner No.1	.....	.....	1. Civil/Structural Engineers	.....	1. Civil/Structural	.....
2. " / " No.2	.....	.....	2. Mechanical/Electrical Engineers	.....	2. Mechanical	.....
3. " / " No.3	.....	.....	3. Sanitary Engineers	.....	3. Sanitary	.....
4. " / " No.4	.....	.....	4. Quantity Surveyors	.....	4. Plumbing	.....
5. " / " No.5	.....	.....	5. Surveyors	.....		
6. Director/Partner No.6	.....	.....	6. Accountants	.....		

5.0 LIST OF PROJECTS (INCLUDING CURRENT & ABANDONED) UNDERTAKEN BY YOUR FIRM FOR LAST 10 YEARS

[Value for each T.Shs. 10.0M]

PROJECT 1.

DESCRIPTION OF PROJECT AND TOWN	PROJECT COST [T.Shs]	NAME OF CONSULTANTS	NAME OF CLIENT	TYPE OF TENDER	DATE OF START & DURATION	EXTENSION TIME UNTIL COMPLETION	TYPE OF CONTRACT	PROJECT STATUS	REASON FOR DELAY [Tick all Applicable] or if not delayed state
	1. Quoted value in the Tender ..... 2. Final cost at completion .....	1. Architect 2. Engineers 3. Quantity Surveyors	1. Government 2. Parastatal 3. Private Organisation	1. Open Tender 2. Selected Tender 3. Negotiated Tender Tender was awarded by .....	1. Date of Start .....	1. Authorised .....	1. Unit rates 2. Lump Sum 3. Cost & Fixed Fee 4. Cost & Fixed % 5. Target Price	1. Ongoing* 2. Completed 3. Abandoned* *State % Completion	1. Lack of Building Materials 2. Lack of Funds from client 3. Lack of Const. Equipment 4. Transport problems 5. Labour problems 6. Weather problems 7. Incompetence of sub-contractor 8. Design problems 9. Mis-understanding with client 10. Mis-understanding with consultant 11..... 12.....

GENERAL QUESTIONS [ Tick (✓) where appropriate]6.0 BUILDING MATERIALS

6.1 How do you rate the adequacy of building materials in this country? [ie. Are they readily available whenever need arises]

A. EXCELLENT  B. FAIR  C. DIFFICULT  D. VERY DIFFICULT

6.2 Then, which of the following building materials have been a contributing factor to delays in a significant number of projects?

A. CEMENT  B. REINFORCING STEEL  C. TIMBER  D. AGGREGATES   
E. SAND  F. PAINTS  E. FITTINGS

6.3 Which of the following fittings have contributed much to delays of projects?

A. SANITARY FITTINGS  B. ELECTRICAL FITTINGS   
C. PLUMBING FITTINGS  D. GLASS  E. IRON MONGERY

6.4 Have the price rises in the above items (ie. 6.2 & 6.3) affected considerably the progress of the projects?

A. YES  B. NO

7.0 CONSTRUCTION EQUIPMENT

7.1 Do you consider the construction equipment you have as sufficient for the projects you executed?

A. YES  B. NO

7.2 What equipment could have improved the efficiency of all executed projects, but the company doesn't own?

1..... 2..... 3.....

7.3 Is this equipment available from dealers?

A. YES  2. NO

8.0 FUNDS

8.1 From your experience, which of the following clients have you experienced difficulties as regards to payments whenever your claims were submitted to him?

- A. GOVT.  B. PARASTATAL ORGANISATION  C. PRIVATE   
 D. NONE

9.0 TECHNICAL PERSONNEL

9.1 Do you think your company has adequate technical personnel? /

- A. YES B. NO

9.2 Had there been difficulties finding and retaining qualified and experienced personnel? (eg. Architects, Engineers, Quantity Surveyors etc.)

- A. YES B. NO

9.3 Which of the following personnel are you still in need of?  
 [Please tick and state the number beneath.]

- |   |   |  |
|---|---|--|
| A. ENGINEERING<br>No.s .....                          | B. Q.S <input type="checkbox"/><br>No.s ..... | C. ARCHITECTS <input type="checkbox"/><br>No.s ..... |
| D. TECHNICIANS <input type="checkbox"/><br>No.s ..... | E. <input type="checkbox"/><br>No.s .....     | No.s .....   |

10.0 TRANSPORT

10.1 Which of the following means of transport do you always use?

- A. ROADS  B. RAILWAYS  C. LAKE  D. SEA

10.2 Which of these have contributed much delay regarding the supply of building materials to the sites?

- A. ROADS  B. RAILWAYS  C. LAKE  D. SEA

10.3 Taking roads into consideration, how do you usually supply materials to sites?

- A. COMPANY'S TRUCKS  B. HIRED TRUCKS  C. BOTH

LABOUR

11.1 Do you frequently face labour shortages?

A. YES  B. NO

11.2 If yes, which parts of the country?

.....

12.0 WEATHER

12.1 Do you find weather a contributing factor to delays in most of your projects?

A. YES  B. NO

12.2 If so, then which seasons were critical?

.....

13.0 LOCATION

13.1 Given chance, which of the following areas would be most favourable for you to execute projects? (you may tick the towns.)

A. COASTAL AREAS  
(Tanga, Morogoro, DSM)

B. NORTHERN AREA   
(Arusha, Moshi)

C. LAKE ZONE  
(Mwanza, Shinyanga,  
Musoma, Bukoba)

D. CENTRAL AREA   
(Dodoma, Tabora,  
Rukwa, Kigoma)

E. SOUTHERN AREA   
(Mtwara, Lindi, Songea)

F. SOUTHERN HIGHLANDS   
(Mbeya, Iringa)

14.0 SUB-CONTRACTORS

14.1 Have you ever worked with subcontractors?

A. YES  B. NO

14.2 Have you ever experienced significant delays in working with subcontractors?

A. YES  B. NO

14.3 What type of sub-contractors were you involved with?

i) .....

CLIENTS

15.1 From your experience, how do you consider the client (ie. Govt, Parastatal, Private) can contribute to the successful completion of project on time?

.....

16.0 ANY ADDITIONAL INFORMATION.



## Appendix-ii

### CALCULATION OF COST INDEX

Adjustment of the final cost of the projects (using Tanzanian inflation rates) to 1987 values were done using the cost index as tabulated below:

YEAR	INFLATION RATE (%)	COST INDEX
1979	28.0	1000
1980	27.2	1280
1981	25.3	1628
1982	29.2	2040
1983	31.9	2636
1984	34.4	3477
1985	33.7	4673
1986	30.4	6248
1987	32.4	8144

Base year of comparison

An arbitrary cost index of 1000 was fixed for year 1979 and the consecutive cost index for year 1980-1987 were determined by the formula;

$$\text{Cost index at year } n = I_n \times (1 + I_{n-1})$$

where  $I_n$  = inflation rate at year  $n$

$I_{n-1}$  = inflation rate at year  $n-1$

To convert say, TShs 1,000,000.00 in year 1984 to 1987 value we have:

$$\begin{aligned} & \text{1984 cost index} \quad \text{1986 cost} \times \frac{\text{1987 cost index}}{\text{1984 cost index}} \\ & = 1,000,000 \times \frac{8144}{3477} \\ & = 2,342,250 \text{ TShs.} \end{aligned}$$

### INFLATION STATISTICS:

SOURCE:- IMF - International Financial Statistics - 1980  
International Publication Services - Africa South of Sahara  
1981 - 1982  
Bank of Tanzania - Annual Economic and Operation Report  
1981 - 1987

DETERMINATION OF REGRESSION LINE, CORRELATION COEFFICIENT AND  
COEFFICIENT OF DETERMINATION

LINEAR REGRESSION LINE

One way of using linear theory in non-linear case is to transform the variables in such a way that a linear relationship results (Chatfield-1970). For example the formula:

$$y = a_0 x^{a_1} \text{ can be transformed into: } \log y = \log a_0 + a_1 \log x$$

If  $\log y$  is plotted against  $\log x$ , the points will lie in a straight line. This line is linear regression line of the form;

$$y = a_0 + a_1 x \quad \dots\dots(i)$$

This line passes through the centroid of data  $(x,y)$ , with slope  $a_1$ . The constants  $a_0$  and  $a_1$  are determined by methods of least squares. Thus equation (i) can easily be calculated using this equation;

$$(y-\bar{y}) = a_1 (x-\bar{x}) \quad \dots\dots(ii)$$

$$\text{where } a_1 = \frac{[\sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{N}]}{\sum x_i^2 - \frac{(\sum x)^2}{N}}$$

$\bar{x}, \bar{y}$  = mean value of  $x$  and  $y$  respectively.

CORRELATION COEFFICIENT

This product measures the degree of association of the two variables and is determined by the following formula;

$$r = \frac{\sum x_i y_i - (\sum x_i)(\sum y_i)}{\sqrt{\left[ \left( \sum x_i^2 - \frac{(\sum x_i)^2}{N} \right) \left( \sum y_i^2 - \frac{(\sum y_i)^2}{N} \right) \right]}}$$

## COEFFICIENT OF DETERMINATION (R)

The total variation of the regression line can be partitioned into two components (Moroney, 1970).

Total Variation = Variation due to + Variation not  
                          regression                          explained by  
                          (explained                          regression.

The Ratio of the explained variation to the total Variation measures how well the straight-line fits the data. This ratio is called the "coefficient of determination" (R), and must be between nought and one. (Chartfield 1970).

When  $R=1$ , all observed points lie exactly on a straight line  
 $R=0$ , the slope of the line = 0

Therefore the closer the coefficient is to one, the closer the points lie to an exact straight line.

The coefficient of determination for linear regression is the square of a quantity called correlation coefficient (r).

Appendix- iv

TABLE SHOWING LOG.VALUES OF COST, PLANNED AND ACTUAL TIME

Adjusted final costs(C)-1987 (m.TShs.)	Planned time(To) (wks)	Actual Time(Ta) (wks)	Log.values		
			Log C	Log To	Log TA
4.78	40	90	0.68	1.60	1.95
33.89	75	163	1.53	1.87	2.21
65.31	64	136	1.81	1.81	2.13
432.53	96	200	2.64	1.98	2.30
9.59	29	59	0.98	1.46	1.77
20.00	104	208	1.30	2.02	2.32
102.82	180	360	2.01	2.25	2.56
28.68	182	364	1.46	2.26	2.56
13.03	40	80	1.11	1.60	1.90
41.69	98	196	1.62	1.99	2.29
81.98	72	144	1.91	1.86	2.16
71.86	80	144	1.86	1.90	2.16
7.20	78	130	0.86	1.89	2.11
26.30	100	154	1.42	2.00	2.19
92.69	96	144	1.97	1.98	2.16
45.62	192	288	1.66	2.28	2.46
61.00	96	144	1.78	1.98	2.16
18.29	54	80	1.26	1.73	1.90
13.80	104	152	1.14	2.02	2.18
45.62	90	130	1.66	1.95	2.11
28.11	70	100	1.45	1.84	2.00
4.50	32	44	0.65	1.50	1.64
25.00	104	140	1.40	2.02	2.15
43.53	152	204	1.64	2.18	2.31
15.00	72	96	1.18	1.86	1.98
30.50	72	96	1.48	1.86	1.98
40.68	48	62	1.61	1.68	1.79
65.17	68	83	1.81	1.83	1.92
4.80	104	118	0.68	2.02	2.07
59.96	256	288	1.78	2.41	2.46
191.62	216	240	2.28	2.33	2.38
31.00	43	43	1.46	1.63	1.63
22.60	78	78	1.35	1.89	1.89
25.55	48	48	1.41	1.68	1.68
48.51	54	54	1.69	1.73	1.73
24.00	124	124	1.38	2.09	2.09
20.00	110	110	1.30	2.04	2.04
19.55	32	32	1.29	1.50	1.50
111.75	98	98	2.05	1.99	1.99
30.45	50	50	1.48	1.67	1.67
mean values			1.502	2.072	1.906

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