SITE MANAGEMENT CONTROL, EFFICIENCY AND PRODUCTIVITY: CASE STUDY OF CONTRUCTION SITES WITHIN NAIROBI, KENYA.

BY

KITUTU MARTHA MERIKOL

BO3/0291/99

A research project submitted in part fulfillment for the award of bachelor of arts degree in building economics and management department of building economics and management
University of Nairobi.

JUNE 2003.

DECLARATION.

This project paper is my original work and has not been presented in any other University.

Sign.....

KITUTU MARTHA MERIKOL

BO3/0291/99

Date..... 27/6/2003

This research project has been submitted for examination with my approval as a University supervisor.

Sign.....

SYLVESTER MUNGUTI MASU

B.A (Bldg. Econ) Hons., M.A. (Bldg. Mngt.), M.A.A.K. (Reg. Q.S), A.C.I Arb, F.I.Q.S.K.

Date..... 27/6/2003.

ACKNOWLEGMENT.

I wish to acknowledge the assistance of several people without whose goodwill; interest and co-operation, preparation of work of this nature would not have been possible.

Am greatly indebted to all my lecturers and staff in the department of Building Economics (University of Nairobi) for their tireless efforts and dedication to educate me this far.

I particularly wish to express my sincere gratitude to my supervisor, Mr. Sylvester M. Masu for his constructive critism, guidance and advice that he gave me during the course of the study.

Gratitude also go to all those who kindly gave me the information I needed especially The Nairobi City Council - City Development Planning section and the Ministry of Public Works.

Thanks to all those who kindly responded to the questionnaires of this study.

My friends, Betsy, Rufus and all my classmates for encouragement.

Last but not least, I wish to thank the Almighty God for the gift of life and all the blessings – WITHOUT WHOM NOTHING IS POSSIBLE!!

DEDICATION.

This work is dedicated to my dear parents Sammy and Joyce for your love, care and support thus far. I love you so!

ABSTRACT.

Measurements on a dozen sites have indicated that the degree of management control has a strong positive effect on productivity. (Lansley P.R. et al., 1987).

The central focus of this study is efficiency and productivity of construction sites, as a function of Site Management Control. Measures of progress and efficiency are discussed, since this can help managers to decide how to use the time and man-hours that remain to be spent on a project.

The basic idea of the research was to come up with the characteristics of an 'ideal site'. Ideal means the optimum set up of construction site facilities taking in to consideration all of the surrounding constraints, physical and managerial and the methods of site management control aiming at increasing productivity on site.

This was done by an examination of twenty construction sites. The target population in the study comprises all the professionally designed and managed building projects executed in Nairobi, during the time of study. The projects covered in the study were at various stages, their contract values ranged from 5.6 million to 300 millions.

Chapter four contains the collection and analysis of the raw data from the field. This is arranged according to objectives. The data was collected from site managers using questionnaires and was analyzed using descriptive statistics. The questionnaires contained sixteen questions related to the various methods of control and were used during the site visits. The questions covered the following topics: management of labour, progress, preparation of various reports and their frequency, preparation of cost reports, quality control and the management of safety, health and welfare on sites.

Management of construction projects is still being done in a traditional manner. Key managers do not exercise tight control of site operations; reports such as progress, cost, labour, materials, and equipment are prepared at monthly intervals. Most sites are very badly organized, have poor materials management and give little responsibility to site personnel. Although most industries in the country have benefited from the computer revolution, the construction industry remains, as contractors were unable to take full advantage of the potential benefits of computer applications.

The style of management is a very important determinant of the level of productivity and efficiency of construction activities. The findings of the research lead to the belief that control is exercised from head offices of firms as opposed to site control.

It was recommended that project personnel must have specialized skills and knowledge required for management, system should allow for delegation of the necessary authority to site staff and control be exercised from site as opposed to head office in order to provide tight control.

TABLE OF CONTENTS.

APPENDICES:

LIST OF FIGURES.

LIST OF TABLES.

LIST OF CHARTS.

CHAPTER ONE

1 .0 Background to the study.

A construction project is a dynamic entity that is carried out in an environment of ceaseless change. To be completed successfully and well, it must respond to changing conditions and must be monitored through a system that generates feedback for necessary corrective action. (Lansley P.R., 1988).

The construction process in most cases is a complex one involving many activities and people, external as well as internal to the project, that interact to realize the project objectives. It is possible to appreciate construction projects as complex when they are defined as systems (Cleland and King 1985, New Combe, Langford and Fellow 1990).

The activities may require diverse specialties, which means that many business entities have to be represented on site at any one time. It may also require a whole range of plant and machinery necessary to perform some of the activities with speed and ease. A substantial amount of materials may also be in use. There is therefore need for proper control of all this. It has been recognized that construction projects create risks. Toakley (1990) asserts that risk is an inherent characteristic of the construction process and therefore should be expected in every project.

Control is a management function that ensures that efforts in the organization are directed towards goals and ensures objectives of the organization are realized. Control is concerned with the detection of deviations of the actual from the planned performance and correction of such variations so that they correspond to the initial plans. (Lansley P.R., 1988).

Control is needed regardless of the size of organization; size of project and selection of a control system depends in part on the size and complexity of the contract but more on the management i.e. top management.

Because projects are unique-one off undertakings, there are problems in defining work, organization, allocation responsibility, budgeting, control, communication and co-ordination.

Finally the temporary, complex and often loose nature of the relationships and authority patterns involved in project work, combined with the number of different departments and companies involved in any project whose objective and

management styles may differ, leads to human behaviour problems and the tendency for conflict between groups and individuals. (Harrison F.L., 1985).

The basic idea of the research is to come up with characteristics of an 'ideal site'. Ideal means the optimum set up of the construction site facilities taking in consideration all of the surrounding constraints, physical and managerial and the methods of the methods of field management control aiming at increasing efficiency of the construction activities and hence increasing productivity on sites.

1.1 PROBLEM STATEMENT.

Productivity is fundamental to the economies of construction. An increase in productivity of the construction sector should not only raise the earnings and profits of those working in that sector but also contribute to an improvement of productivity in other sectors thereby improving general standards of living.

In the last fifty years construction projects have advanced to higher levels of complexity. For instance, recently, quite complex projects have been initiated in Kenya.

Complexity is defined by size, cost, time and intricacy of construction when these attributes seem to be larger than usual. (Sidwell 1990, Gidado 1996).

The huge and challenging projects notwithstanding, the construction industry in Kenya has not kept pace with this advancement to be able to effectively handle complex problems.

Although effective control of a project is vital to its efficient completion, unfortunately in many projects, control is ineffective with corrective action being too weak and too late. (Harrison F.L., 1985).

Over recent years, clients of building and civil engineering works have all too often experienced difficulties in obtaining projects finished on time, to budget, of acceptance, quality and serviceability. (Butterworths, 1985).

Projects delays are a manifestation of inefficiency in the construction industry and this makes it difficult to finance projects either through aids or loans as foreign investors are sensitive to and attracted by efficient infrastructures that support profitability for their investments. (Talukhaba, 1999).

Usually, project work involves large capital expenditures and the financial management and control of projects is thus extremely important to minimize the overall cost of the project. (Harrison F.L.,1985).

Greater emphasis must therefore be given to project work to planning and control of activities, to avoid delays and over-expenditure.

One of the factors common to poor performing organization and individuals is lack of an effective control and information system and a baseline performance to compare their own with. Control is essential to enable project managers to maintain a grasp of it, that is, to effectively manage it. (Harrison F.L., 1985).

Once a project is launched, control is project management and without effective control the project manager has little influence over the project. It will meander to

completion but it will inevitably take longer and cost more than would have been the case without effective control. (Harrison F.L., 1985, pg 56).

Measurements on a dozen sites have indicated that the degree of management control has a strong positive effect on productivity. (Lansley P.R., et al, 1987). Properly interpreted, productivity studies can inform management, provide insight and point the way to better use of resources. (Mathenge M.J., 1986).

In practice, the task of planning and controlling work on site is considerably more difficult than might be envisaged. Therefore the central problem of site management is not planning and programming but control because on site one 'force majeure' follows another. (Mathenge M.J., 1986).

The study by David Aird (1963) on 'Labour Productivity' observed that labourers and carpenters were idle for no apparent reason for about 17.5% of their total workday. The study conclusions, however, placed almost the entire blame for this inefficiency with construction management. Generally, the conclusions were that there was lack of good management and that this resulted to inefficiency, poor utilization of labour and 'involuntary idleness' on the part of workers.

Often in project work, the only formal control function or system in is the hands of project accountants and to some people; project control and cost control are thought to be synonymous with one another.

This is clearly depicted by cases of inefficiency at the workplace in the following:

- Increased cost of materials because of wastage due to bad storage, lack of care in use and poor supervision.
- Increased cost of labour because of low productivity and poor workmanship, resulting in the need for rectification.
- Wastage of time between jobs because of inadequate planning of the flow operations.
- Increased cost of subcontractors because of poor planning may mean they cannot start on time.
- Increased cost of plant because of low utilization and improper maintenance (Peter, R. et al., 1988).
- Unsound coordination of trades.
- Conflicting responsibilities.
- Lack of clarity on what is expected of an operative by his supervisor.

It is therefore the proposition of this study that the problem of poor performance of projects relates to lack of proper management control of the various project operations and resources.

1.3 RESEARCH HYPOTHESIS.

The hypotheses adopted for the studies are as follows: -

- The management of various construction firms do not incorporate adequate control of the operations on site in order to achieve optimum efficiency and productivity (formal control processes).
- Lack of proper management control is responsible for poor projects implementation.

1.2 OBJECTIVES OF THE STUDY

To focus on the problem clearly and to facilitate an in-depth investigation of the same, it is necessary to derive the objectives of the study.

- To evaluate construction site management control practices of Kenyan firms.
- To investigate the machinery or instruments necessary in the formal control on construction sites.
- Suggest practical means of adopting formal site control.

1.4 SIGNIFICANCE OF THE STUDY.

This study is about the management control of the construction projects within Nairobi.

The study seeks to focus on examination of Site management control in a view of finding out ways of improving productivity and efficiency within the construction sites. It will identify areas of weakness in the management and controlling of construction sites and give recommendations for making site management control more effective.

The researcher hopes that the management within construction sites will recognize the key factors identified and adopt or modify the findings of this study as a means of ensuring efficiency in the construction industry.

The researcher also feels that the study will challenge other researchers in carrying out further studies on productivity especially for the Kenyan construction industry.

Appreciation of the facts mentioned above, and the diligent application of the principles of formal control knowledge, which are presented in this report, would raise the level of performance (efficiency and productivity) by contractors of projects.

1.5 SCOPE AND JUSTIFICATION OF THE STUDY.

1.5.1 Physical scope.

The study is to be carried out in Nairobi. The choice of Nairobi is because; a quick observation reveals that many construction projects are on going i.e. of all types – commercial, residential and also varied in the size complexity and type.

Nairobi is a favorable area for the study as the construction sites are within a close range and therefore will be convenient as study involves physical visits to site.

1.5.2 Conceptual scope.

The study is about site management control, efficiency and productivity of construction site operations. The study considers management control during the construction phase only, it does not look at control before or after construction.

1.6 RESEARCH ASSUMPTIONS.

- The number of sites chosen randomly for the study is a good and fair representation of the construction projects going on in the study area.
- The construction project work can be divided into a finite number of operations that can each be effectively controlled to attain efficiency.

1. 7 DEFINITION OF TERMS.

Controlling- Controlling is the process of making events conform to plans; coordinating the actions of all parts of the organization according to the plan established for obtaining the objective. (Strong E.P et al, 1968).

Efficiency- The measure of the speed and effectiveness with which a resource delivers a particular skill.

Productivity- The actual rate of output or production per unit of time worked.

Schedule – A time sequence of activities and events that represent an operating timetable. The schedule specifies the relative beginning and ending times of activities and the occurrence time of events. (Lansley P.R. et al, 1988)

Quality control- Involves the examination and checking of products produced by the project. The quality review, end-stage and mid-stage assessments and the testing of the products realize it.

Progress report- Report showing the current status usually in relation to planned status. Progress reporting refers to the collection of information of work done compared to the work planned to be done. (Harris .F., 1989)

Cost control- Any system of keeping costs within the bounds of budgets or standards based upon work actually performed. (Hill .S., 1989).

Communications- The effective transmission of information so that the recipient understands clearly what the receiver intends. Communication media may take various forms; oral, written, textural, numerical, graphic, body language, paper, electronic and physical. (Koontz et al, 1984).

Contractor- A person or organization that undertakes that takes responsibility of the performance of a contract.

REFERENCES:

1. Cleland D.I & King, W.R., **Systems Analysis And Project Management**, New York, McGraw Hill, (1985).
2. Harrison F.L., **Advanced Project Management** 2nd ed., (1985)
3. Lansley P.R. & Harlow. P.A. Managing Construction Worldwide. **Construction and Organization in perspective**. Vol.3. London E & F.N. Spon Ltd. (1988).
4. Lansley P.R. & Harlow. P.A. **Managing Construction Worldwide**. Vol.2. London E & F.N. Spon Ltd. (1987).
5. Sidwell, A.C., **Project Management Dynamics and Performance**, Construction Management & Economics, Vol.8, (1990).
6. Strong, E.P. & Smith, R.D. **Management Control Models**, New York, Rinehart and Winston, (1968).
7. Toakley, R.A., **The Nature of Risk and Uncertainty in Building Procurement Process,** Australian Institute of Building papers Vol.4, (1990).
8. Mathenge M.J., **Variability of Productivity of Labour in Construction**, Undergraduate project. University of Nairobi, Unpublished. (1986).
9. Talukhaba A.A., **An Investigation into factors Causing Construction Project Delays in Kenya** – Case study of high rise building projects in Nairobi, PHD thesis. University of Nairobi. Unpublished. (1999).

CHAPTER TWO

LITERATURE REVIEW OF RELATED STUDIES ON SITE MANAGEMENT CONTROL, EFFICIENCY AND PRODUCTIVITY.

2.1 INTRODUCTION.

Management refers to methods that facilitate the production of goods and services for sale. Functions of management include:

- Planning
- Organizing
- Staffing
- Directing
- Co-coordinating
- Controlling.

(Maalu, 2000)

2.2 CONTROL.

As soon as a project is launched, control becomes the dominant function for the remaining 80% of the project lifecycle.

The control function monitors the system, keeps things in line and facilitates the integration of activities. (Kast et al, 1970)

Control is important as it performs the 2 critical functions:

2.2.1 Motivating and monitoring performance.

The traditional, essential accounting, view of control is that without an effective control system to monitor performance, an organization, and the people in it, will become slack and inefficient. Time and cost to completion of a project will always be greater if no real objective measurement of performance and control.

In project work, planning and control can be combined to be a strong motivator to achieve higher performance, by showing people what they have to do to achieve higher performance and giving them feedback on how they are performing.

2.2.2 Managerial function of control.

The supplying of information to enable project and not just simply to administer it, is another critical function of control.

The project control and information system must tell the management quickly how all parts of the project are progressing, highlight the problem areas and bring

to his attention deviations from plan so that he, or she, can take action to minimize delays and costs before they get out of hand i.e. trouble shooting.

Control is another name for the ongoing management of the project, and commitment to effective control must become part of the managerial philosophy of a site manager. (Harrison F.L. 1985).

2.3 PRODUCTIVITY.

Productivity has become a matter of increasing concern to the construction industry. A construction Industry Cost Effectiveness (CICE) project report on "Measuring Productivity in construction" claimed that the decrease in productivity in the industry over the last decade was 20%.

The decline of productivity in the construction industry has led to the recognition that better ways of measuring construction productivity are prerequisite to improving it. (Lansley P.R. et al, 1987).

Higher productivity in the construction industry, as in many other industries is a derived goal but it is not an end in itself. (Mathenge M.J, 1986).

Productivity is used to denote the relationship between output and the associated inputs used in the production process. Most quantitative definition of productivity is:

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$ (Ndegwa.M, 2002)

Fig. 1:Production process.

(Nyangito .H, 1998).

Inputs consist of: -

Money

Materials

Human resources

Machines and other assets.

Technology and information.

Activity may include design, construction, manufacturing, servicing, maintenance e.t.c. Output is simply the result and activity i.e. ends product. (Ndegwa M. 2002).

Shadded and Pitcher (1984), have defined productivity as the magnitude of productiveness. The amount of output produced by a unit of productive factor per unit of various inputs, with all other factors of production considered as variables, where one or more of these factors are held constant, it will be stated.

Productivity is essentially variable and the variables may exist in; the workers, the workers surroundings, plant and equipment, communication, in the budgeted cost versus the real incurred costs, management's efficiency in controlling and allocating resources.

Productivity can also be taken as the optimum use of resources to obtain an acceptable goal. (Mathenge M.J. 1986).

Therefore, productivity is not simply efficiency but rather it is more concerned with effectiveness. Productivity is concerned with profitability, which can be achieved by increasing the ratio of output/ input. This can be achieved by increasing the output, reducing the input or permitting changes in both such that the rate of increase in output is greater than that for input. (Lansley P.R, 1987).

Ross (1982) proposes the increase as follows:

i) Reduced cost $= \dfrac{\text{Output at the same level}}{\text{Input increasing}} = \text{Improved Productivity}$

ii) Managed growth $= \dfrac{\text{Output Increasing}}{\text{Input increasing (but at a slowerrate)}} = \text{Improved Productivity}$

iii) With smarter workers $= \dfrac{\text{Output increasing}}{\text{Input constant}} = \text{Improved Productvity}$

iv) Paring down $= \dfrac{\text{Output down}}{\text{Input down (but at faster rate)}} = \text{Improved productivity}$

v) Work effectively $= \dfrac{\text{Output increase}}{\text{Input Increase}} = \text{Improved productivity}$

In (i) above, people are perceived as a direct expense and costs can be reduced by cuts in expenses, services, training and advertisement and a reduction in research and development.

In (ii) management of growth is by investment which yields a greater return than cost of investment and this can be in the form of capital, technological improvement and training.

In (iii) increased productivity may be achieved through reduced production costs by design, recycling and recovery.

In (iv) paring down seeks to remove unproductive employees, facilities and products.

In (v) it involves a combination of changes that increase productivity.

Total productivity = Total value of work

Labour cost+ materials + machine cost + money cost +

Management + technology cost. (Ndegwa .M, 2002).

Productivity = Actual value of work done to date.

Planned value of work to be done by this date.

Where the 'value' of work is a percentage (%) of the work in a project or stage of the project.

Efficiency can be expressed as, = Actual cost

Planned cost of work done.

2.3.1 Need for corrective action.

This can be highlighted by comparing: -

- Productivity so far, against the productivity required completing outstanding work within the remaining time.
- Efficiency of a team so far, against efficiency required to complete the job within planned man-hours.

$$Eficiency = \frac{\text{Money remaining to complete}}{\text{Planned Cost of outstanding work.}}$$

If the prevailing efficiency is poor, for example 1.1, the efficiency needed to complete construction work will be less than unity; say 0.9. In this case, the required change in efficiency is 1.1/ 0.9 = 1.22 i.e. a 22% higher output.

Practical responses to this might include closer supervision, unpaid overtime or putting more productive individuals in the same team. (Harlow P.A, 1987).

2.3.2 Productivity on site.

Tactics to improve productivity of design and construction may be divided into two groups: -

- The first is composed of the tactics to improve management control and utilization of resources and control of timing.

- The second comprises those intended to improve the efficiency of tasks in as much as these are independent of their external world.

Management control is the largest component capable of directly influencing productivity in the industry besides materials manufacturers, designers, contractors and subcontractors who all contribute to the productivity of the industry. (Mathenge M.J, 1986).

2.4 Management on sites.

Work on sites may be divided into a number of operations, each operation corresponding to work that can be done by a man, or by a gang or by one or more gangs, without interruption by the work of other men / equipment. (Harris.F, 1989).

The problem is to maintain a flow of work through the site so as to strike a balance between the rate of construction on one hand and non-productive time on the other. Non-productive time may arise in four 4 ways: -

- When a site is working below full capacity example, when work is delayed by unexpected soil conditions or by major changes in client's requirements.
- Consequence of unbalanced resources.
- Related to individuals example, walking time on dispersed sites, avoidable idle time such as late starts and early finishes, casual conversations e.t.c.
- When a gang is delayed because work is not available or whilst awaiting service by other gangs / mechanized. (Mathenge M.J., 1986).

2.4.1 Responsibility for control.

Control of work in progress, money, changes to design specification, procurement of bought in-items and a host of other factors is much more difficult than the control of technical factors.

Site managers must have a managerial philosophy of the project, which involves knowing what is required of them, by when, and personally controlling their own progress. (Harrison F.L. 1985).

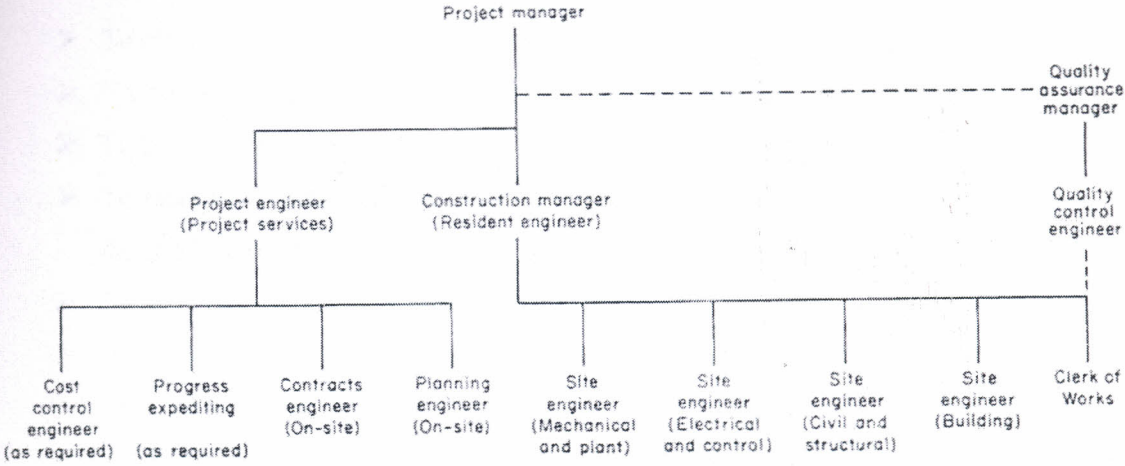
Site management office may comprise of some or all of: -

- A construction manager appointed and authorized by the project manager as his deputy on site.
- Engineers and quality inspectors to watch the grades of materials being used, the standard of workmanship, and the technical accuracy of the work

being produced. Each is attached for work to a contract manager; technically they come under the project manager.

- A group of contract managers appointed by the project manager seconded to work under the local control of the construction manager.
- Quantity Surveyors (QS) deployed from the main office of the Quantity Surveyors firm employed for the project.
- A representative of the contracts engineers from the project manager's head office to deal with day-to-day matters of legal or contractual importance.
- A small design/drawing office to up-date drawings following changes, variations or measurements. Every change, however small must be designed officially and recorded. Technically the office comes under the project engineer at the project manager's head office.
- A planning engineer for the site approval and co-ordination of contractors detailed work programmes.
- Administration, clerical assistance, telephones, telexes, fax, computer-as required.

Figure 2: Composition of site management.



Source: (Hill S, 1989).

The duties of site management must include: -

- The interfaces with 'neighboring' contracts
- Progress as compared with the project programme derived there from. Contractors staffing levels, usage of plant.
- The layout of work on site, its construction to specification, its inspection during execution, its quality and accuracy. Its reliability and workmanship.

- Periodic measurement of work accomplished, made in conjunction with the contractor. Evaluation and calculation of sums due for payment. Application of remeasurement and contract price adjustment
- Contractor's adherence to site regulations; contract obligations (insurances, bond, guarantees e.t.c) parking and storages, disposal.
- Documentation and administration. Reporting to the Project manager. Application of regulations from safety and health at work e.t.c. Act. Approval of contractor's temporary works.
- Routine estimation with QS of cost committed, cost to completion. Effect on budget for contract.
- Contractor's claims for extra payment Application of contract price adjustment to them. Site diary to record bad weather conditions, accidents, wasted time, delays, shortages of materials from subcontractor's, delays due to lack of information or other causes by employer or project manager.
- Quality inspection of all materials bought on site by a contractor.
- Liaison during final certification, final accounting, settlement of outstanding claims, post completion inspection. (Horgan.M. 1988).

Purposes of control on construction sites.

- To create historical data for future bidding.
- To check actual against estimated and planned (cost and work).
- To stimulate the desire for lower costs.
- To place the responsibility and credit where it belongs.
- To enable corrective action during the progress of the work and not after the job has lost money.
- To form a basis for work simplification and cost reduction studies.
- As a foundation for time / cost determinations in scheduling.

(Peter R.L. et al, 1987).

- To be efficient, the control system must therefore meet the following standards:
- The data used must be reliable.
- It should be an integrated system covering both progress & cost.
- It should communicate the information produced to all those involved and not just senior management.
- Should promote time & cost consciousness on all those involved.

(Harrison F.L, 1985).

- Be economical – the less effort needed to gain control, the better.
- Be meaningful – events to be measured have to be meaningful.
- Be appropriate to the nature and phenomena measured.
- Measurements have to be congruent with events measured.
- Be timely.
- Be simple as not to confuse user.
- Be operational- must reach person capable of taking controlling action.

(Peter R.L. et al,1987).

2.4.3 Types of control.

Three approaches.

I. Internal market controls - Uses the price mechanism to regulate activity. Best used where such market mechanisms can be identified.

II. Clan control – Depend on shared values and trust. Works best in small units where markets do not apply. In order to apply the clan controls you need to have efficient systems of inculcating values and social activities.

III. Formal control - The use establishes standards, measurements and corrective actions in the sequence. Appropriate where the tasks are relatively determined and where people can work independently of the others. (Maalu, 2000)

2.4.4 Control process.

Three critical general dimensions, which are used in assessing the progress of projects regardless of their nature and specific content, are cost, time and performance (quality).

Cost control is usually regarded as the effort directed to ensuring completion at a predetermined cost; time control aims at completing a project within a set period while quality aims at realizing the performance standards envisaged during the design. (Strong E.P., 1968).

Control process involves.

- Identifying problem area.
- Taking decisions to tackle the problem.
- Organizing resources required.
- Measuring the results of the decisions.
- Reviewing and monitoring operations.
- Taking decisions to correct any variances. (Mbaya, 2002).

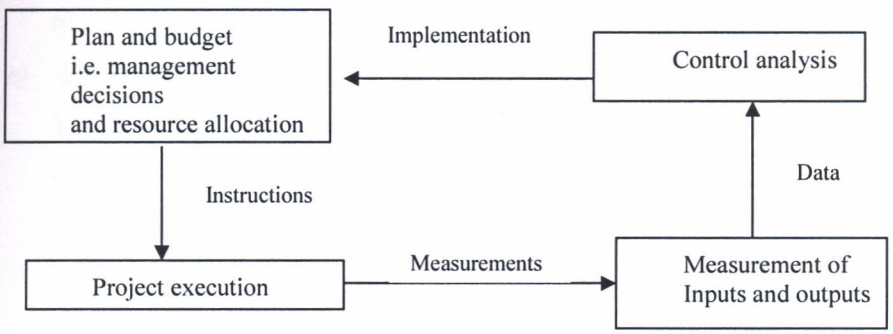
The basic control process consists of 3 activities;

- ❖ Establishment of standards
- ❖ Measurement of performance
- ❖ Correction of deviations. (Strong E.P. et al, 1968).

These form the control cycle. The control cycle is an endless sequence of establishing standards, observing performance, comparing performance with standards and taking corrective action to increase the likelihood of achieving performance, which 'measures up' in the light of actual performance.

(Walker, A. 1984).

Fig. 3: Control cycle



2.4.5. Control mechanisms.

- ➢ **Budget.**

Used to allocate amount of funds that managers use to undertake the activities. Should be done in a way that they are flexible to allow one to vary depending on achievement.

- ➢ **Use of policies and procedures.**

May be used to control behaviour of people during task performance e.g. when to work, how to wear how to address customers. Measurement of this may be done through direct supervision of performance in relation to the policies and procedures.

- ➢ **Output standards.**

In form of targets or quarters and specifically being able to meet goals. To measure performance –a system must be used that produces the statistics and reports given by people. (Maalu, 2000).

Construction mechanisms that may be considered in a construction situation include: -

a) **Visual and personal checks.**

Undertaken by a supervisor or site manager. The regular visits to a project by the manager of a small organization are a means of applying control to a project.

b) **Reporting procedures.**

The submission of regular reports during a project provides control information to management. This applies to weekly site reports on progress and monthly cost / value reports on the profitability position.

Monthly reports on progress and cash funding also aid management decision-making.

c) **Control by exception.**

This is a well-established management principle. It enables management to consider only reporting on various deviations otherwise it is assumed that performance is up to standard.

Senior management must establish control policy and the establishment of the necessary information in order to control the business

Management must lay down policy statements in order to establish standards for controlling finance, time and quality. Control systems may be established for reporting on project performance and profitability and require strict monitoring and enforcement in order to succeed.

This is essential control procedure in both the medium and large contracting organizations. (Brian.C et al, 1998 pg.60).

2.5. PROJECT CONTROL.

Controlling construction project is about ensuring that project objectives (especially time), cost and quality are met. (Mbaya, 2002).

All contractors have different ideas on degree of control necessary for projects that they undertake. Many factors need to be considered including the size and organization of the firm and the scale and complexity of the projects in hand.

In order to monitor a contractor's performance, information needs to be collected within a structured reporting system so that appropriate action can be taken if and when things start to go wrong.

Matters of control that may be considered essential are: -

- Control of time.
- Control of money.

- Control of resources i.e. materials, personnel, plant & equipment.

(Brian.C. et al, 1998 pg.207).

Whatever the system to be used in control, it has to be detailed enough and structured in a way as not to create problems, but more, as a means of monitoring and control. No matter how perfect in reporting deviation, a control system has no value unless it produces action. (Peter R.L. et al, 1987 pg.661).

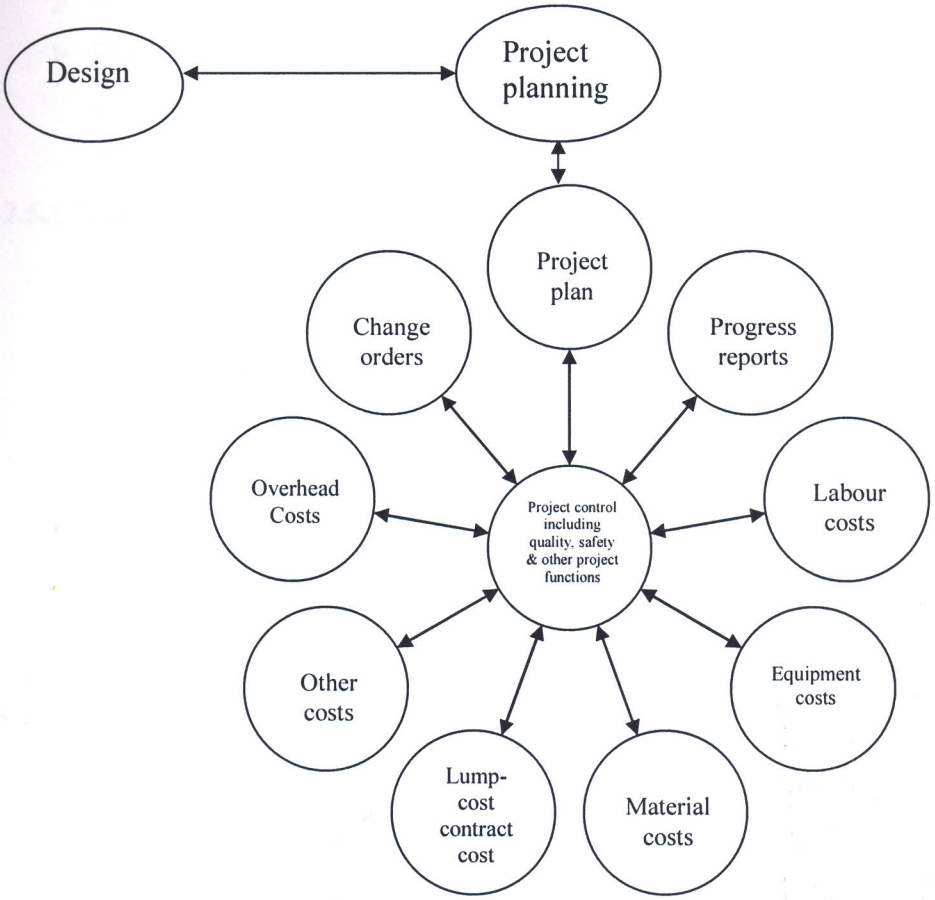


Fig 4: Relationship of various project elements.

Source: (Ahuja H.N., 1976)

2.5.1. Factors to be considered in choosing a control system.

- Output and behavior standards.

Controls that measure people's behavior differ substantially from those that measure output. The output measures stress ends while behavior measures stress means.

- Span of control.

Number of subordinates reporting to a single supervisor. This is a structural dimension of an organization that also affects the control process. (Maalu, 2000).

It is essential that site staff be prepared to delegate responsibility coupled with some authority, to subordinates (Frank 1983 pg.162).

The span of control delineates the number of subordinates that a supervisor can effectively supervise or handle. Practice has shown that a supervisor can directly supervise 5-8 subordinates. (Broughton,1965).

- Size of the organization –determines the kind of control to be put in place.
- Number of controls – restricts people innovation and creativity.
- Frequency of monitoring and feedback – in built in the system. Infrequent monitoring may lead to loss in control. When tasks are uncertain there may be need for more frequent monitoring. (Maalu, 2000).

2.5.2 Principles of control.

- Method of control must be suitable for the activity it seeks to regulate and should be minimum required to achieve the desired results.
- Controls installed should not cost more than they will save.
- Type of industry or activity concerned must determine the kind of controls that are needed.
- Feedback information must be available to the controller in time for corrective action to be taken before matters have gone too far.
- The corrective action to be taken promptly and consistently when required and that such action must be seen to be taken.
- The exception principle should be applied whenever possible.
- The areas of responsibility and accountability must be clearly defined so that there's no doubt where the responsibility lies. (Maalu, 2000).

2.5.3 Basic elements of a control system.

- Frame of reference i.e. measurable and controllable characteristic standards are known e.g. volumes, cost budgets lengths and widths.
- Means of measuring the characteristic.
- There must be a means of comparing actual or projected results with known standards and evaluating any differences.
- A means of remedial action i.e. making correction.

2.5.4. Requirements of a good control system.

- Should draw immediate attention to significant deviations from what is planned.
- Must have true and meaningful comparison for it to be effective.

- There must be a means of comparing actual and projected results with known standards and evaluating any differences.
- The information should indicate what corrective action is necessary and who should take the action.
- Effective control should be expressed in a simple form so that it is readily understood by those making use of it. (Mbaya, 2002).

2.5.5 Visual aids to management and control.

Effective project control must be based on an instant appreciation and ready assimilation of a large number of facts and trends, and these can only come from a visual representation of them. The different types of visual presentation used in project control are: -

- The common graph.

This is the oft-used and well-known curve showing the relationship between two variable parameters (x-axis and y-axis). These latter spot relationships are calculated/ measured and graph joins them up.

- The histogram.

This is a form of graph in which values of y are shown by narrow rectangles, rising from x-axis. These are frequently coloured or cross- hatched to distinguish them from their neighbours. The main use of a histogram is statistical: such as comparing manpower, month by month, or stocks of cement week by week. (Horgan, M. et al, 1988).

- The Bar Chart.

The bar chart is quite the best form to show progress to a site management team compared with what was planned for the same period. The x-axis is usually divided into equal periods (days, weeks or months; to cover contract or project period). Changes can be more easily introduced; and it is easier to read off elapsed periods independent of when the work was actually started. (Talukhaba A, 1999).

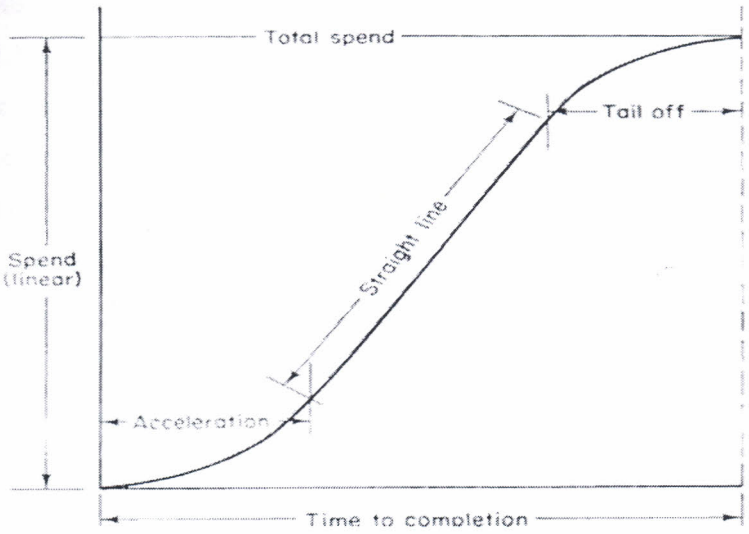
- The Activity Networks.

The activity networks need to be interpreted by an engineer versed in their details. They are more use when planning a project yielding an orderly and economic development, smooth working and optimum time to completion.

- The S-curve.

The s-curve is designed to allow a project manager to keep a general review, during the period of a project, on how it is progressing. (Horgan, M. et al, 1988).

Fig 5: S-curve.



Source: Horgan, M. et al, 1988).

2.6. MATTERS OF SUPERVISION AND CONTROL.

The objectives of the site management should be to produce the agreed project by the programmed date and with no unexpected increases in cost to the employer. Site manager should therefore ensure control in the following areas.
(Horgan, M. 1988 pg 169).

2.6.1 Labour/ manpower/personnel control.

Labour productivity is the most significant part of the total productivity in the construction industry. Various studies have concluded that the prime need of industry is to improve effectiveness and efficiency of its labour crew. (Lansley P. R et al, 1987).

Labour management decisions need a particular attention for a variety of reasons. Management of Labour is the management of people, with all the complexity, variety and rewards that these imply. Direct and indirect labour costs form a substantial proportion of the total cost of any business organization; typically some 70% of the total costs are attributable to labour.

Unlike other inputs, owner of the inputs must accompany the use of that input. Productivity of labour is a variable depending on working conditions, the amount and quality of training and education and the form of payment system adopted. (Hill, S. 1989).

Two types of labour.

2.6.1.1 Directly employed labour.

On large projects, the contractor is more concerned with keeping the overall labour expenditure within the estimated allowance.

- Time keeping.

Can be organized by a number of ways;

Either by operatives clocking on signing in or merely shouting their work numbers through the timekeepers office window.

- Personal records.

Records may be kept on site regarding each operative on such matters as extra payment allowed warning for misconduct, absences from work and any other relative information that will assist management to maintain control.

- Bonus

Realistic targets should be agreed with the operatives or their union representatives to enable a fair return for their conscious laborers.

- Non-productive time

A site manager should determine when to stop work temporarily because during inclement weather.

2.6.1.2 Indirect / Sub contract labour.

Arrangements should be made to ensure continuity of work for subcontractors. Adequate facilities must exist for the subcontractor's representatives to meet and discuss any problems that inevitably occur, this should be by a direct approach to the site manager and at site meeting. (Forster, G. 1986 Pg.275).

2.6.2 Material control.

Expenditure on materials will often constitute a large proportion of total project costs. Efficient materials planning, purchasing and handling ensuring that excesses, losses and damages are minimized are all essential in achieving a satisfactory outcome for the project. (Kim.G. 1987).

Material expenditure represents a major proportion of the contract value. Therefore the control of purchasing, scheduling, delivery and handling of materials on site is an essential part of the control process. There is need to control wastes of materials at site level.

Four distinct categories of wastes are: -

- Design waste.
- Take off / specification waste.
- Delivery waste
- Site waste. (Brian C. & Peter.W. 1998 pg 224).

A good definitive estimate and bill of materials provide excellent control documents by which material cost can be controlled on a project. (Ahuja, H.N. 1976).

2.6.2.1 Objectives of material control system:

- To assess material requirements so as to allow for periods of manufacture, distribution and delivery appropriate to the construction situation.
- To facilitate forward planning thus enabling material supplies and prices to be fully evaluated.
- To enable checks to be made on material utilization with the objectives of controlling or reducing wastage.
- To enable key materials which affect the construction progress to be incorporated in the contract programme.
- To take advantage of favorable trading conditions, and where applicable, bulk buying facilities.
- To incorporate material requirements into the planning process.
- To enable site management to assess the influence of materials on planning procedures and site layout.
- To keep management aware of the control aspects arising from aspects of materials demand and supply. (Cooke B. 1981 pg 238).

2.6.2.2 Record and administration procedures of material

All aspects need to be coordinated, from the original contract or authorization to proceed, the material planning, purchasing, the receipt of the goods, and on to their issue and installation. (Dennis.L, 1987).

Company policy must clearly indicate responsibility for materials control and purchasing procedures. Centralized purchasing is the usual policy within large construction firms. The buying department may be responsible for placing material orders. Material quantities prior to ordering should be checked from the contract drawings or based on bills of quantities and later confirmed prior to delivery. (Cooke .B, 1981).

2.6.2.3 Storage.

Besides the physical conditions, all stores must have good records and clear procedures. Stock records are required which show the location and quantity of all the materials. Many existing stores stock records will be kept on a computer, but the disciplines are the same as for any manual system.

By carefully logging in and out, the stores staff should always know exactly how much materials are being held and the location. Both expensive and cheap items need protection. (Dennis, L. 1987).

2.6.2.4 **Receiving materials**.

For control to be exercised at the appropriate time, it is essential that a record of purchases be maintained by the organization. The foreman usually reports materials received on site on a form. (Ahuja H.N. 1976).

Accurate records are vital in any stores operation to ensure that all materials can be quickly and easily accounted for. Record starts with receipt of goods, then storekeeping staff must check the materials being delivered against both the original purchase order and the supplier's documents.

- Is the quantity correct?
- Is the description of the goods correct/ does it matches what has actually been delivered?
- Are any items damaged?
- Is the packaging damaged / stained with moisture?
- Is any supporting documentation required such as the certificate of conformity?

Any discrepancies must be marked on the supplier's documentation, goods separated, safely stored in a clearly identifiable place for easy subsequent location; to ensure that supplier is not paid until delivery has been completed satisfactorily. Internal records need to be updated, showing the description and part number of the goods, quantity received and supplied, date received and supplied, stores location, document reference numbers.

Besides maintenance of good records, consideration has to be given to the physical handling arrangements for unloading and moving materials on receipt. Site stores received area; it must be secure, and provide for the safe unloading and examination of materials being delivered. (Dennis.L. 1987).

Table 2.1:Materials record.

Work item	Performing agency	Material	Units	Qty used.	Rate	Amount
BA 03300	76,115	Concrete	Cu. Yd.	600	35	21,000.00

Source: Ahuja H.N. 1976.

2.6.2.5 Issuing materials.

There's need to maintain up-to-date records, Failure to, need requirements will lead to project delays and higher costs as replacement materials may have to be obtained. (Dennis.L. 1987).

Other considerations when controlling materials on site are: -

- Chasing orders- Site managers to phone suppliers few days prior to delivery. In case of any problems at suppliers' then arrangements are made for alternatives.
- Daily or weekly material returns – To assist head office in reconciling material delivered to site with those ordered, those used and those still left.

Continuous checks can then be made of the material costs throughout a project period. (Forster.G. 1986 pg. 274).

2.6.3 Plant & equipment control.

Technology assures every industry of one challenge; the high rate of equipment obsolescence. Firms have to choose when to buy and when to hire, at least to cut down on equipment loses. (Construction Review Journal, June 2001).

Generally, a construction company has two options in acquiring plant. It may either own its machinery and equipment or hire it. In recent years; the growth of the independent plant hire sector of the construction industry has greatly facilitated this latter option and approximately 50-60 % of the plant presently used on projects is hired.

The main objectives for employing plant and equipment are: -

- To increase production.
- To reduce costs
- To reduce or eliminate the heavy manual labour. (Broughton, 1965)

When examining the need to own plant the following points must be considered:

- Will the item of plant generate sufficient turnover to provide an adequate rate of return of the capital employed?

- Is ownership of the plant, rather than obtaining it by some other method absolutely necessary for the business?
- Is outright purchase the only way of acquiring the plant?

To obtain maximum utilization of the plant on site, it is essential particularly in mechanical handling that the number of men working on any operation should be correctly related to the output of the mechanical plant serving them. This avoids idle plant on site. (Masu.S.M, 2003).

2.6.3.1 **Plant utilization sheets.**

Head office requires to be checking on the usage of all plant on-site. Active time, idle time, breakdown time and maintenance time should be recorded. (Forster.G, 1986).

The purpose of noting down any plant that is idle is, so that later should the contractor make claim for plant brought to site and left standing idle because he was prevented from using it, the extent of the lost time and the reasons for it may be checked from diary records. In this manner any gross overstatement of the claim may be detected. (Twort.A.C. 1995).

To reduce costs, site managers should be encouraged to return plant that remains idle, and discourage from hoarding on the off chance that plant may be required later. (Forster.G. 1986).

2.6.3.2. **Maintenance.**

Maintenance is all the work undertaken to keep, retain or restore a facility to acceptable standards (BS 3811).

A contractor that owns plant must be prepared to provide maintenance and servicing of the equipment if economic levels of utilization are to be obtained. Effective maintenance is expensive and requires depot facilities, workshops, experienced staff e.t.c. Most firms have tried to avoid these costs by providing minimum maintenance and the result has often been unexpected breakdowns, lost production and insufficient machinery. (Harris.F.1989 pg. 118).

Alternatively the contractor can implement a system of planned maintenance that can broadly be divided into either preventive or corrective options.

(a) Planned preventive maintenance.

System requires the implementation of planned regular procedures aimed at reducing wear, maintaining the plant in good working condition and preventing unforeseen stoppages. The maintenance actions are as follows: -

- Daily servicing and superficial inspection performed roughly half an hour before and after working hours.
- Regular full maintenance and inspection, including periodic overhaul.
- Replacement or repair of competent parts within a working period based on the expected duties and conditions.

(b) Planned corrective maintenance.

Providing the minimum of maintenance to enable the plant to operate while on site. Work is then undertaken to restore it to an acceptable level after completing its duties on site through sudden failure. Method favored by construction plant operators as the necessary workshop facilities to perform major overhauls are more likely to be available at the central depot and not on individual construction sites. (Harris.F. 1989 pg. 118)

For maintenance policy to be executed efficiently; it is necessary to instill a recording and costing system that shall include: -

2.6.3.3. Usage.

Site manager should ensure maximum and equal by each trade.

- Plant transfer sheets.

Copy of this form sent to head office and to site where plant is being transferred. (Forster.G. 1986 pg. 274).

Operations control. Work on site may be divided to a number of operations; each operation corresponding to work that can be done by a man, or by a gang or by plant perhaps served by one or more gangs, without interruption by the work of other men or equipment. (Mathenge.M.J. 1986).

- Contract programme- should form basis of controlling all operations on site. The programme gives visual instructions of when operations begin and end. It warns the Site manager about which operatives will shortly be required and in what numbers.
- Method statement- If this document has been thoroughly prepared it will explain method and sequence of construction, and will outline the plant, equipment and labour required at each stage of work.(Forster,G.1986 pg. 272).

2.6.4 Communications control.

An effective system for passing on information and instructions, and for receiving feedback, is essential for management control. In construction, this system must work both within and among the many firms –consultants, contractors, subcontractors, suppliers and client – who contribute to the design and production of the finished structure. (Barry, F. 1996).

Communication is defined as the transfer of information to the receiver with the information being understood by the receiver; (Koontz et al, 1984) or the exchange of information and the transmission of meaning. (Katz D. et al, 1987).

2.6.4.1 Functions of communication.

- Information function – Passing on of information between the consultants and operatives.
- Social relationships function – Maintain relationships between individuals.
- Expression function – Enables people to express feelings e.g. an argument during site meeting.
- Attitude change function – Managers may need to change employee's attitudes to get the best work from them.
- Role related /Ritual function – Managers often expected to give speeches.
- Instrumental function – In construction, most of the targets are available in drawings, programmes and specifications, but the manager needs skill to communicate them clearly.

A network directs information through specific channels. Channels are:

- A leadership or line hierarchy, linking people who decide policies with those who implement them.
- Functional and lateral relationships, linking people in different sections, some of whom contribute specialist knowledge and skills.
- Procedures through which managers and workers can consult and negotiate with one another to resolve conflict and increase commitment and co-operation. (Barry.F. 1996).

2.6.4.2 Flow of information in organization classification.

It is essential that problems be communicated quickly for correction, to avoid loss of output.

i. Downward communication.

Flows from people at higher levels to those at lower levels in the organizational hierarchy. This includes i.e. types of oral communication such as, speeches, meetings, use of telephones, loudspeakers, even the grapevine.

Examples of written downward communication.

Memos, letters, handbooks, pamphlets, company newspaper, periodicals, bulletin boards, policy statements and procedures.

Basic types of communication from superiors to subordinates: -

- Directions for handling tasks.
- Information for understanding relationships of the task.
- Procedures and enterprise –practice information.
- Information about enterprise goals.
- Feedback about performance of subordinates.

ii. Upward communication.

Travels from subordinates to superiors and continues up the organizational hierarchy. Since the organizational climate is greatly influenced by upper management, then responsibility for creating a free flow of upward communication rests a great extent – although not exclusively with superiors. (Mwangi.C.M. 2001).

Objective of transmission of information is essential for control purposes since upper management needs to know specifically about production performance, marketing information, and financial data, what lower level employees are thinking. Typical means for upward communication besides chain of communication:

- Suggestion systems
- Appeal and grievances procedures.
- Complaint system
- Joint setting of objectives
- The grapevine
- Group meetings
- Counseling sessions.
- Joint setting of objectives in an effective management by objectives. (MBO).

- Morale questionnaires
- Exit interview and the ombudsperson.

iii. Crosswise communication.

Includes the horizontal flow of information with people on the same or similar organizational levels and diagonal flow, with persons at different organizational levels who have no direct reporting relationships with each other. (Mwangi.C.M. 2001).

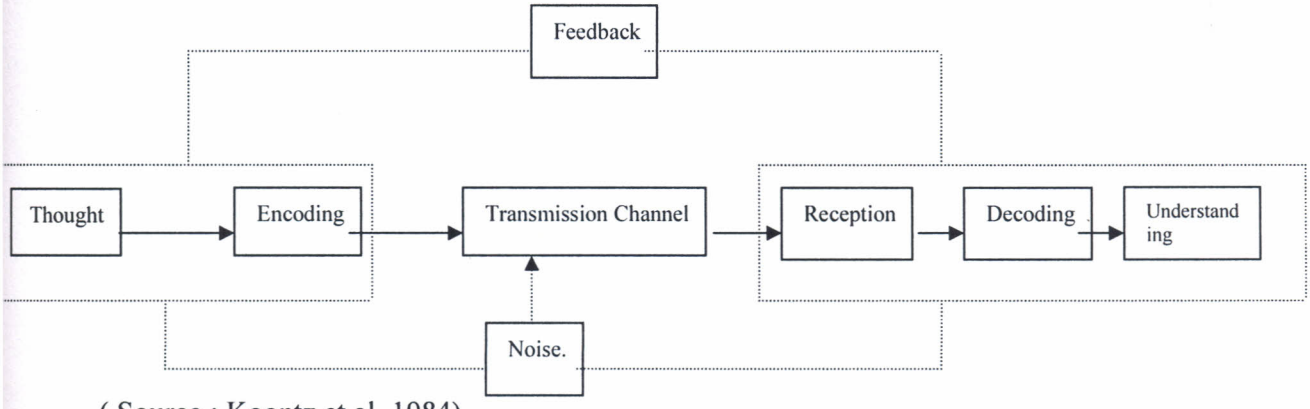
This speeds information flow, improves understanding and coordinates efforts for achievement of organizational objectives. (Bucha, 1992).

Communication with subordinates demands special attention. Subcontract site personnel have responsibilities both to their own company and to main contractor, so that lateral and downward communication 'compete' for priority. (Barry.F, 1996).

2.6.4.3 Modes of communication:

- Oral /Verbal - Could be a prearranged discussion, causal talk or telephone calls. However, could lead to loss of time in unsuccessful meetings, can be inaccurate or simply misunderstood.
- Written -This provides records that act as a future reference e.g. instructions, thus giving a clear indication of the requirements and clarity.
- Non verbal – What is said can be reinforced or even contradicted by non-verbal or visual aids such as figures, drawings, pictures, samples, models, and body gestures. (Ndaire, 1987), (Muli, 1998).

Fig 6 : Communications Process model.



(Source : Koontz et al, 1984)

2.6.4.4. Reasons for communication failures.

- Poor expression- Communicator does not encode message clearly.
- Overloading- Managers often give and receive too much information at once.
- Poor choice of method to suit communication.
- Distance limits face to-face communication and non-verbal signals like facial expressions, which help the communicator and receiver to judge each other's responses.
- Disjunction and distortion – sender and receiver may not share the same language, dialect and concepts.
- Status differences – People in junior positions may find it difficult to communicate with those of senior positions.
- Feelings may overshadow message.

To produce reliable information, firms need procedures for recording and storing data systematically and retrieving it in various forms to suit different needs. For instance, some of the data needed by contract managers, estimators and planners are similar, but they want the information for different reasons and in a different form: - (Mwangi C.M. 2001).

Mail – The receipt and dispersal of the mail could be one of the administrative staff's responsibilities i.e. time keeper or clerk; and general headed mail should be opened and passed to the appropriate person,(usually site manager) and personal mail forwarded unopened. When correspondence has been dealt with, it should be filed correctly.

Drawings registers - should be prepared at the beginning of the contract and need to be kept up to date, particularly when drawings are amended or superceded. Separate files should be kept for each drawing received from the following:

a) Engineer
b) Architect
c) Services engineer.

Filing – Emphasis should be given to careful filing of correspondence, documents and drawings. Suggested filing could be alphabetically, with folders clearly marked with either name / title of supplier, manufacturer or individual. Documents could be safety records and documents and personal records.

Telephone – All important calls should be recorded, particularly if instructions are received and action needs to be taken. Private personal calls should only be made with prior permission from site manager. (Forster. G 1986 pg. 272).

2.6.5. Quality inspection and control.

All work on site should be quality controlled. All this requires not only the most meticulous supervision but also proper administration of the related documentation, so that if necessary it can be later demonstrated that all is in order. (Dennis.L. 1996).

Setting quality standards involves having a clear specification of what the end product of the task should be including whatever quality factors may be appropriate.

Quality factors include: -

- Reliability Durability Accuracy.
- Clarity Functionality

Key elements of a quality system are:

- Policies
- Systems description
- Procedures. (Mbaya, 2002).

By referring to contract documents, particularly specifications, the quality of work expected by Architect and client can be determined.

Trade foremen and gangers are responsible in the first instance to ensure that subordinates maintain required standards and it is then up to the site manager to check periodically that standards are reasonable. (Forster.G. 1986).

One of the major factors inhibiting the effective control of projects in many organizations is the poor quality of their control and information system. Major attributes of quality control and information system are: -

- Timeliness of control system
- Level of detail
- Data versus information and data.
- Reliability of information
- Objectiveness of data and information.

Control could be exercised through: -

2.6.5.1 Receipt of materials on site.

Verification of compliance with specifications commences when materials or supplies are received at the site. The criteria for compliance are usually defined in the specifications; together with appropriate sampling and testing regimes.

Also random sampling and spot checks are s satisfactory form of verification.

The extent to which materials should be inspected on receipt should be carefully planned bearing in mind the costs of inspection and the possible penalties, which may arise from building subtle items into the works.

2.6.5.1 Special processes.

Each of these needs to be controlled if the final results are to be satisfactory. Special processes are processes, the results of which cannot be fully verified by subsequent inspection and testing of the product and where processing deficiency may become only apparent after the product is in use.

Examples of processes that should continuously monitored as they depend on operator skill and care.

- Placement and compaction of concrete.
- Welding.
- Tunnel grouting and painting.

2.6.5.3 Surveillance.

Monitoring to verify whether an item or activity conforms to specified requirements. (Ashford.J.L. 1989).

2.6.6 Progress control.

Controlling the timescale must be top priority for any project manager. Careful attention to timescale planning and progress control is essential if a project is to stand any chance of success. (Dennis .L, 1987).

Feedback on progress must be relayed to management through activity status sheets completed during the reporting period, as well as the activities that should be, and the activities in progress.

Table 2.2:Activity status sheets.

Activity	Duration	Expected/ Actual date.	Float total	% Complete	Remaining duration
8-9	12	24 May1976	0	0.0	15
8-14	0	9 May 1976	42	67.0	2

Table: Source: (Ahuja H.N, 1976).

While reporting the status of activities, it is important to think in terms of effective completion rather than total completion. (Ahuja H.N, 1976).

If operations in the programme are broken down into finer details, it can be used more effectively as a control document. In breaking down each operation into further activities, additional programmes to the outline or contract programme

can be drawn by the Site Manager assisted by the programming officer. These programmes are known as:

- Stage programmes
- Weekly programmes
- Daily programmes (Forster .G, 1986).

Considerations when preparing short term programme.

- Continuity of work between gangs
- Subcontract work should be arranged to be completed in the least number of visits as possible.
- Continuous employment of plant may be achieved by careful planning of related point operations.
- Overlap between related operations must be considered. (Cooke .B, 1981).

2.6.6.1 Recording progress.

Progress recording highlights operations either behind or ahead of the schedule. This indicates to the site manager critical operations, which require attention in the immediate short-term period. (Cooke B, 1981).

Various techniques are used to show the level of progress, for example; colouring the percentage completed spaces, and highlighting those operations in arrears.

Meetings – domestic site meetings.

- Project meetings.

During these meetings, queries relating to work are raised. (Forster, G. 1986).

- Site meetings.

Site meetings will do a great deal towards resolving difficulties before they generate friction and lead to misunderstanding between the various parties.

- Weekly plan of work.

Weekly planning procedures include co-ordination of trades foremen, subcontractor's representatives, site planning engineer and the construction manager.

- Weekly site reports and progress reports.

An important part of the site manager's responsibility is the keeping of site records and the submission to the contractor's head office of weekly reports.

2.6.6.2. Objectives of weekly reports.

- To keep the contracts department informed of the current contract position regarding progress.
- To provide detailed record of contract resources including labour, plant and material utilization.
- To report problem areas relating to labour, material and plant requirements which are likely to affect future progress.
- To monitor key dates relating to the receipt of information at site management level.
- To report on progress of subcontractors with particular reference to subcontractors' co-ordination and requirements.
- To summarize major instructions received from the architect in the form of verbal or written instructions.

Information to be included in weekly reports.

- Contract information – Name of the project and site manager, date, current week number, contract commencement and completion dates.
- Current progress
- Future progress- review of operations to be undertaken.
- Labour summary
- Subcontractors progress
- Plant currently in use on site. (Cooke. B, 1981).

2.6.7. Safety, Health and welfare control.

Regular safety meetings, training and thorough inspection are essential. Works (sub) contractors' proposals must meet specified requirements laid down by the managing firm. (Harris .F, 1989).

To ensure adequate controls within these areas, the site manager's main responsibilities are divided into.

- Inspections
- Records
- Notifications. (Forster, G. 1986).

An improvement in the quality of human resources as productive agents is an important factor in raising productivity levels and fostering economic growth. A safe and healthy work environment is a prerequisite for a productive worker. (Mwangi C.M., 1989).

2.6.8. Cost control.

Cost control is the gathering of cost data, the relating of actual costs to estimated costs and the reporting to management on the current cost status. Since the objectives of construction firms are to maximize their profits and or the survival among tight competition, it follows that cost control is the most important type of control required on construction sites. (Lansley P.R. et al, 1987).

The purpose of cost control is to contain costs with the level of expenditure that has been authorized (the project budget). (Lock D. 1987).

Cost control starts with careful definition of the scope of work for which funds are to be controlled. For all, but the smallest venture, this is followed by division of the whole project into a number of more easily manageable parts (Known universally as the work breakdown process). Each part becomes a work package to be estimated, budgeted and (subsequently) cost controlled. (Harris, F. 1989).

A cost control system should enable a manager to observe current cost levels, compare them with a standard plan or norm, and institute corrective action to keep cost within acceptable bounds.

2.6.8.1 Systems in current use.

The following systems and variants of them are in use in the construction industry. The selection of a system depends in part on the size and complexity of the contract, but more on the attitudes and the level of sophistication of top management.

- By overall profit or loss.

The contractor waits until the contract is complete and then the sums of money that have been paid with the monies incurred in purchasing materials, payments for labour, subcontractors, plant and overheads.

- Profit or loss on each contract at valuation dates.

The total costs to date are compared with valuations gross of retentions. This system suffers from the disadvantage that there is no breakdown of the profit figure between types of work; it therefore provides guidance only on which contract requires management attention.

- Unit costing.

In this system costs of various types of work, such as mixing and pricing concrete, are recorded separately. The costs, both cumulatively and on a period basis are divided by the quantity of work of each type that has been done, the unit costs are then compared with those in the tender. (Harris.F, 1989).

2.6.9. Events and site diaries.

A brief, but accurately worded diary of daily events, with references and photographs, should be maintained by the site manager and periodically counter-signed by the project manager. This can be indispensable for various unforeseen future problems and claims. Its contents might include: works done, payments made and received, subcontract activities, weather conditions, decisions taken, meetings held and other events. Photographs should be captioned and maintained in the accompanying album. (Raina V.K., 1988).

2.7. COMPUTERS.

Computers are routinely used today in most construction enterprises for accounting, office work and various clerical tasks involved in the administration of contracted and subcontracted work. More recently, they have been used for cost estimating, the control of cost schedules, and preparation of tender documentation, evaluation of bid proposals, storage and processing of data of past performance. (Warszawski.A, 1988).

The following is a review of the uses of computers.

- Planning by preparing a schedule of activities.
- Adding resources to the basic plan and preparing a resource plan.
- Monitoring progress in terms of time and resources and updating the plan.
- Costing the resources to produce estimates. Including revenues on each activity, producing cost and revenue forecasts and cash flows.
- Experimenting with activity schedule and resource allocation to determine likely outcomes to assumed scenarios in terms of time, resources and costs.

(Harris. F, 1989).

2.8 CONCLUSION.

Productivity refers to the measured rate of carrying out a certain construction operation. Productivity is essentially variable and the variables may exist in the workers, the workers surroundings, plant and equipment, communication, in the budgeted cost versus the real incurred cost, management's efficiency in controlling and allocation of resources.

The essential attitude to control is that the site manager actively works at being aware of what is happening on all parts of the project at all times. It includes a constant comparison of progress and performance against the base lines set by planning, a search for trouble spots, and a commitment to do something about deviations from plan and planned performance. This involves formal control.

Every Site manager has to ensure that his project is efficiently and sensibly planned and scheduled from the start to the end.

Office records are essential for the control of any kind of contract, and they must be both accurate and extensive. They should be kept up to date.

CHAPTER THREE

RESEARCH METHODOLOGY.

3.1 Research Design.

The research strategy used to accomplish the study objectives conformed to the ethical standards and legal safeguards for research participants. Construction projects involve a wide spectrum of firms. Information relating to control particularly labour control (whether unionized or not, availability of safety, health and welfare facilities on site) is usually very sensitive and therefore it was necessary to assure the respondents that the information given was to be treated with a lot of confidentiality.

The research design adopted for this study is a survey design. Survey research seeks to obtain information that describes phenomena by asking people about their perceptions, attitudes, behaviours or values (Mugenda and Mugenda, 1999).

In this research, information was obtained from managers of various sites using questionnaires.

3.1.1 Reasons for choice of the research design.

Data collection was done using questionnaires. The questionnaire was the most suitable method of data collection because of the nature of data; Gall, et al 1996 recommends the questionnaire as a convenient and most suitable instrument for data collection in survey as well as statistical research especially regarding social issues. This is because of: -

- Reduction in bias; questionnaires lead to unbiased data being given.
- Respondents have more time to think about their answers leading to better information being given to researcher.
- Method is cost effective.

3.2 Study Area.

The location of the study area is Nairobi. It is in South Central of Kenya, and is located south of the equator. Nairobi is the capital city of the country and the principle social, cultural and economic center.

The city of Nairobi covers an area of about 680 square kilometers at an average height of 1675 (549 ft) above sea level. The city center and the area to its North and East is relatively a flat plain, while the area to the South and West is hilly.

The structure of the city is concentric, with the city center that serves as the administrative and business center being surrounded or ringed by residential areas.

Nairobi was chosen as the study area as it is the capital city of Kenya, and compared to any other part of the country, Nairobi has the highest concentration of projects of all types- commercial, residential, institutional and also varied in size, complexity and type.

3.3 The population.

The population for the study comprised the number of construction sites in Nairobi, operational at the time of commencing the study. Evidence shows that construction industry activities in developing countries are concentrated in capital cities, and most firms involved in construction activities locate in the capital cities (Habitat, 1982: p iv-31).

The population of projects was within the geographical boundaries of the city of Nairobi. The NCC has a jurisdiction over all development projects within the city boundaries; hence a natural starting point for identifying projects to be used in the study. For purposes of administration of projects going on in the city and controlling physical developments, the Nairobi City Council has divided the city into 3 divisions:

Western division.

Parklands, Westlands, Lower Kabete, Spring Valley, Kyuna, Loresho, Karen, Lang'ata, Kileleshwa, Riverside, Golf course, Kibera, Jamhuri

Lavington, ThompsonEstate, Woodley, Gigiri, Runda, Nyari, Rossylene, New Muthaiga,

Old Muthaiga, Kitisuru, Dagoretti, Kangemi, Uthiru, Waithaka, Ruthimitu, Kawangware.

Central division.

Central Business District (CBD), Gikomba, Hill area, Westlands commercial zone, Industrial area.

Eastleigh, Park Road, Kariokor, Pumwani, Ngara East & West.

Buru Buru, Pioneer Harambee, Uhuru Estate, Madaraka.

Shauri Moyo, Bahati, Kimathi, Mbotela, Jericho, Landhies Rd.

Eastern division.

Nairobi West, South C & B, Mombasa Rd., Industrial area.

Embakasi, Jomo Kenyatta International Airport (JKIA) Tassia, Tena, Donholm, Umoja I &II, Inner core.

Kariobangi south & north, light- industry, Huruma, Mathare South & North, Pangani.

Ruaraka, Baba dogo, Korogocho

Kayole, komorocks, Njiru, Saikwa, Ruai, Dandora.

Thome, Thika road, Ridge ways, Marurui, Garden Estate, Kigwa, Kiambu road.

Kamiti, Kahawa west, Githurai, Kenyatta University.

Development control functions are under the city planning and architecture department of the city commission. In this department, a specialized unit known as the development control section is in charge of overseeing all developments coming up in the city and that no unauthorized development come up. All project plans are supposed to approved by NCC to ensure that they conform to the byelaws. This is regardless of whether they are developed by the government, public or private organization.

For purposes of effective control the three divisions are further divided in to smaller geographical sections. Each section is under the jurisdiction of an inspector. When construction works commences, he inspects and approves the construction in regard to issues as plot ratio and plot coverage, foundations and reinforcements, etc to ensure that standards are met.

The sample frame was therefore obtained from the NCC project approval records. A perusal of these records revealed that there were 278 projects approved since Nov 2002-March 2003, which were ongoing at the time the researcher obtained the information from the inspectors.

The distribution in the three divisions was as follows:

Western 99

Central 64

Eastern 115.

Table 3.1: Distribution of projects within the study area.

	Residential	Commercial	Institutional	TOTAL
Eastern	32	67	16	115
Western	52	29	18	99
central	11	32	21	64

Source: Own field study, 2003.

3.4 Sample procedure.

The researcher chose a 95% confidence level that the response achieved will be within + or - 5% of the true state of affairs in the construction industry. Therefore, the most conservative sample size is obtained by:

$$n = \frac{Z^2 P.q.N}{e^2(N-1) + Z^2 p.q)}$$

Where,

N- size of the population

n- size of sample

P- sample proportion.

q- 1-P

e- acceptable error

Z- value of the standard variate at a give confidence level worked out from the table showing area under normal curve.

e- 0.05 since the estimate should be within 5% of the true value.

$$n = \frac{(1.96)^2(0.05)(1-0.05)278}{(0.05)^2(278-1) + (1.96)^2(1-0.05)} = 57$$

Using the proportionate sampling technique the researcher targeted:

$$\frac{D}{T} \times 57$$

D- Number of sites in the division.

T- Total number of sites (i.e. 278)

$$Eastern = \frac{115}{278} \times 57 = 23$$

$$\text{Central} = \frac{64}{278} \times 57 = 14$$

$$\text{Western} = \frac{99}{278} \times 57 = 20$$

For each region, the researcher divided equitably to small, medium and large construction firms.

3.5 Questionnaire design

The questionnaire was designed in such a way that the stratification of the data was easy for analysis. The questions were both closed ended and open ended. The open-ended questions were for purposes of harnessing the variables that may have been missed out. They were helpful in cases where there was need for further clarification about variables.

3.6 Pilot testing of the questionnaire.

The first draft of the questionnaire was given to the supervisor for comments. The comments were then incorporated into the second draft, which was pre-tested on 2 respondents involved in managing projects. The aim was to scrutinize and detect the expected response to the questions. The final version of the questionnaire was prepared by taking into account the comments of the pretest questionnaire.

3.7 Administration of the questionnaire and data collection.

This involved physical visits to construction sites during which the researcher interviewed the site managers / site agents and foremen on the systems of control. Primary data was collected from the field using structured questionnaires administered to site managers.

Secondary data was obtained from works done by others in the area of site management. These works include:

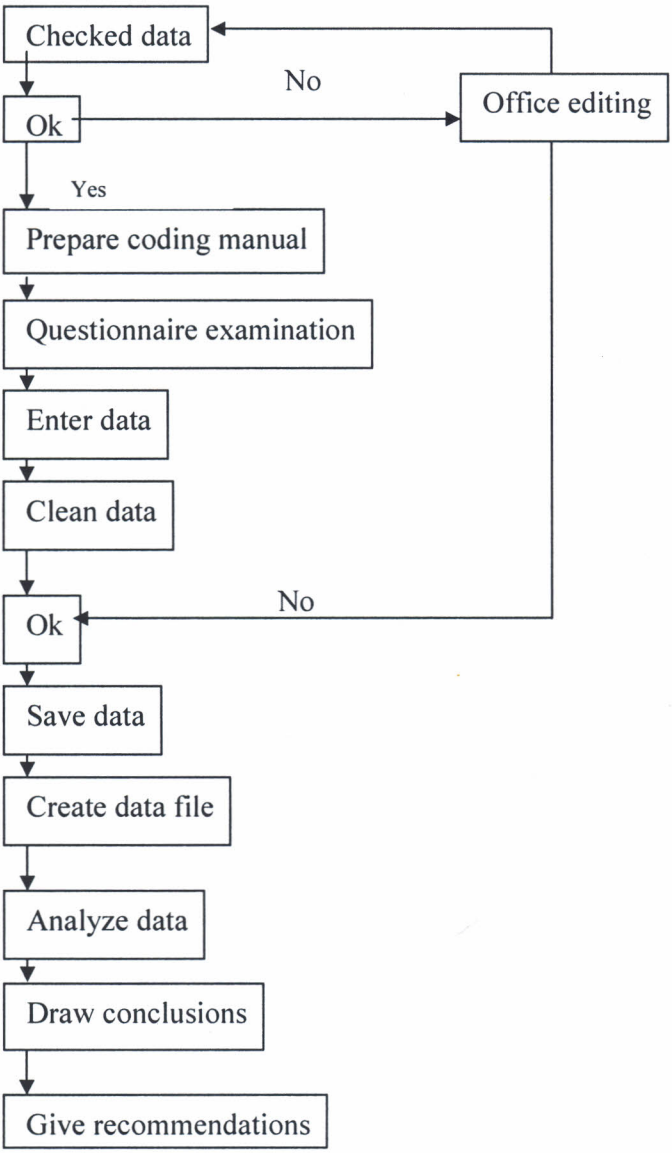
- Text books
- Internet
- Journals
- Research projects and thesis.

3.8 Credibility of the data collected.

To ensure that the data collected from the field leads to reliable conclusions, the researcher took it through the processes described by the figure below. Data collected in the field was checked for errors and found to be all right. A coding manual was prepared and questionnaires examined to ensure that the format of the coding manual corresponded with the variables in the questionnaires. Data was

then entered in the coding manual and cleaned for any typing errors. Data was then analyzed; the researcher drew conclusions and gave recommendations.

Fig. 7: Data analysis procedure.



(Watuka J., 2003)

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS.

4.1 Introduction.

This focus of this study is site management control as a function of efficiency and productivity of site operations.

The study objectives are:

- To evaluate construction site management control practices of Kenyan firms.
- To investigate the machinery or instruments necessary in the formal control on construction sites
- To suggest practical means of adopting formal site management.

This chapter sets out to present the raw data collected from the field on the systems of control practiced by various firms.

Data is presented in form of charts, tables and graphs. The structure of the questionnaire was used to present data.

Out of 57 sites sampled, 13 (22.80%) projects did not meet the criteria i.e. they were not professionally designed and managed. This left 44 sites - (71.19%).

The 44 construction sites further reduced to 29 as the researcher was denied access to 7 sites to meet the site managers, 8 other construction sites could not be traced despite the researcher having noted down the plot numbers to ease tracing of the sites.

The questionnaires were then distributed to the 29 construction sites, for the site managers to fill. 9 questionnaires were given out to big firms, 10 to medium size firms and 10 to small firms all of which were equitably distributed in the three divisions of the study area i.e. Eastern, Central and western divisions.

Response to questionnaires.

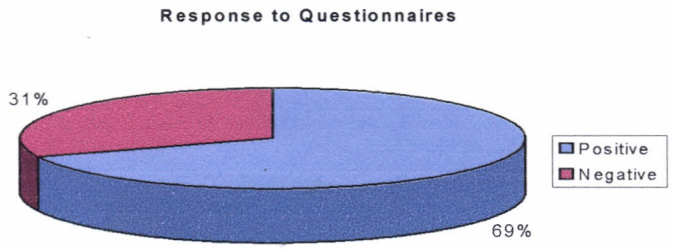
Out of 29 questionnaires distributed, 20 (69%) were received back having a positive response while 9 (31%) had a negative response. 4 (44.4%) of the 9 questionnaires were returned blank, 5 (55.5%) had not been filled by 15th May, 2003 and therefore could not be considered for the study as that was late.

Table 4.1: Response to questionnaires.

Firm category	Large	Medium	Small	Total
Distributed questionnaires	9	10	10	29
Positive response	7	6	7	20
Negative response	2	4	3	9

Source: Own field study, 2003.

Chart 1:



Source: Own field study, 2003.

20 questionnaires were therefore analyzed for the study, which were considere adequate.

However, researchers on Construction projects have in many cases worked wi relatively small sample sizes for various reasons. For example Nkado (199 investigated 'Information systems for the building industry with a sample of 29 case Ogunlana; et al (1996) investigated the causes of delay in projects in Thailand basi the research on a sample of 12 projects. Uher (1996) investigate the cost estimati practices in Australian construction Industry using a sample of ten (10) projects.

4.2 Data Presentation And Analysis.

As mentioned earlier, the data was collected according to a structured and detailed l on the various systems of control. Data collection entailed actual visits to the vario construction sites to take the questionnaires and interview the site managers.

Information relevant to the study yet not anticipated at time of developing the research list was recorded and taken into account during the analysis stage. The raw data was coded using a coding manual that made it easy to analyze.

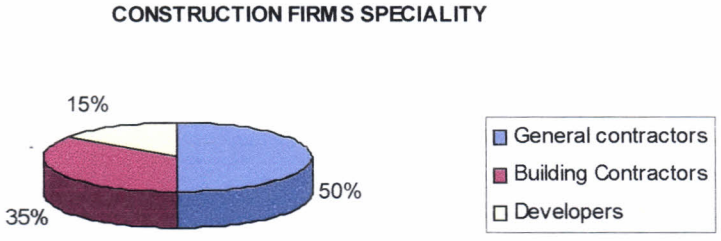
The construction firms in the study consisted of general construction firms, building contractors and developers.

Table 4.2: Construction firms' specialty.

Specialty	Total	Percent (%)
General	10	50
Building	7	35
Developers	3	15
	20	**100**

Source: Own field study, 2003.

Chart 2



Source: Own field study, 2003.

From the above study, the most popular form of specialty adopted by many firms is that one of general construction.

20 construction sites were covered during the period of study. The projects were in different stages of construction, and their contract values ranged from 5.6 to 300 million shillings.

Refer to appendix D for a summary of the general performance characteristics of contractors.

Matters of control and supervision.

1. **Labour control.**

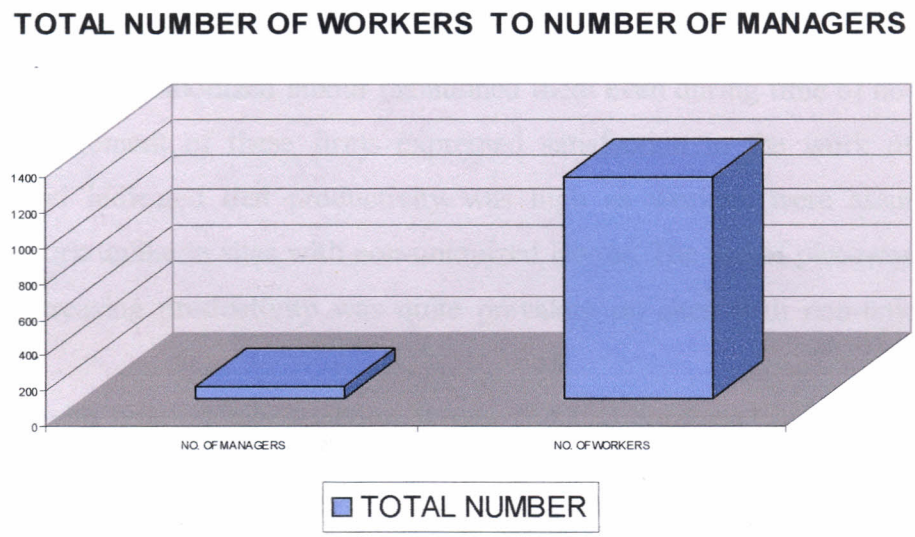
The question of the number of operatives on site and the number of managers was aimed at establishing the span of control. This was done in order to try and establish the relationship between the number of managers to workers and extent to which they are able to effectively control and supervise the work of the operatives on site.

Table 4.3: Number of managers to workers.

	Total number	Percentage (%)
Managers	69	5.27
Workers	1241	94.73
TOTAL	**1310**	**100**

Source: Own field study, 2003.

Chart 3



Source: Own field study, 2003.

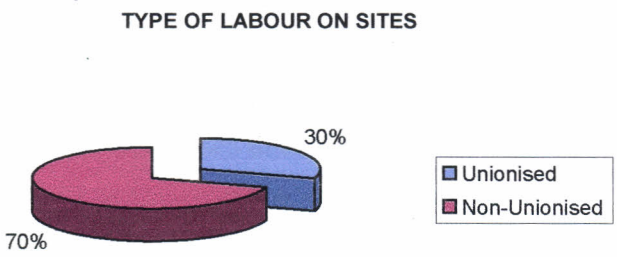
From the study, the number of operatives ranged from 11 to 208 who were supervised by managers in range of 1 - 9. Majority of the worker son construction sites studied are non-unionized, 6 construction sites (30%) out of the 20 sites had unionized labourers while the rest 14 (70%) were non-unionized. These operatives are casual and therefore do not have security of work.

Table 4.4: unionized and non-unionized labour.

Type of labour	Number of sites	Percentage (%)
Unionized	6	30
Non-unionized	14	70
	20	**100**

Source: Own field study, 2003.

Chart 4.

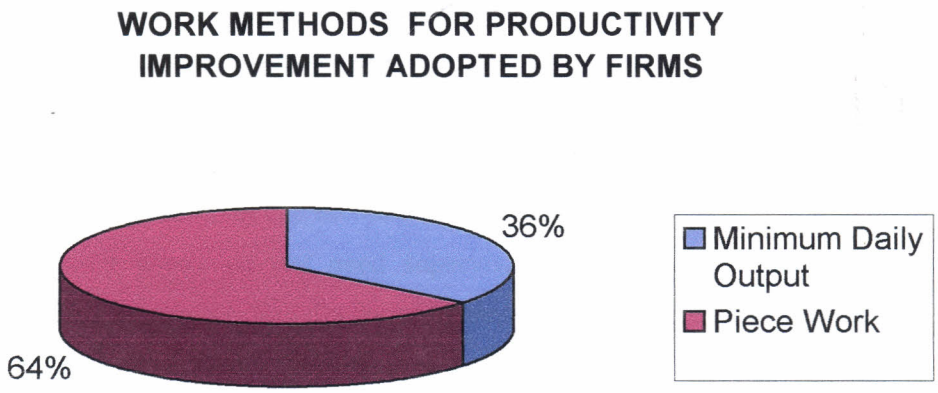


Source: Own field study, 2003.

The firms that had unionized labour maintained them even during time of no work. The site management of these firms expressed satisfaction in the work of their operatives and indicated that productivity was high as workers were assured of security of work unlike in sites with non-unionized labour. The use of piecework as a means of increasing productivity was quite prevalent on sites with non-unionized labour.

On 14 sites with non-unionized labour, 9 sites (64.3%) confessed using piecework (where a worker is paid as a function of amount of work he performs) to improve the productivity, while the remaining 5 sites (35.7%) of the sites set up a minimum daily output expected from the workers.

Chart 5: Methods adopted by firms to improve productivity.



Source: Own field study, 2003.

Of the 6 construction sites with unionized labour, 3 sites (50%) used piecework and the other 3 (50%) set minimum daily output expected from the workers.

For large firms the site management team consisted of general foremen, site managers, site agents, construction managers, purchasing managers, site superintendents and general foremen.

On small firms, the site management consisted of the general foremen and the storemen who liased directly with the Directors of the firms.

Table 4.5: Composition of site management.

	Large		Medium		Small		TOTAL
	No.	(%)	No.	(%)	No.	(%)	(%)
Construction managers	4	57.14	3	42.86	-	00.00	**100**
Site manager	3	50.00	3	50.00	-	00.00	**100**
Site engineer	4	40.00	3	30.00	3	30.00	**100**
Purchaser	3	75.00	1	25.00	-	00.00	**100**
Site agents	4	33.33	5	41.67	3	25.00	**100**
Foremen	8	38.10	6	28.57	7	33.33	**100**
Storemen	3	33.33	2	22.22	4	44.45	**100**
TOTAL	**29**		**23**		**17**		**69**

Source: Own field study, 2003.

2. **Subcontractors.**

The subcontractors' work according to results found were supervised by the main contractor and specialist consultants as found on 50% sites, 15% had subcontractors work supervised by general foremen and the other 35% had it supervised by the subcontractors foremen.

The subcontractors' operatives on most construction sites were supervised by their own foremen and not the main contractor foremen.

Foremen on some of the medium and small size firms were of the opinion that subcontract works do not need supervision as specialist subcontractors were assumed to be experts and did the work well.

Table 4.6: Frequency of subcontractor site meetings held on sites by site management.

Firm	Daily	Weekly	Monthly	Occasional	Never	Total
Large	-	3	4	-	-	7
Medium	-	2	3	1	-	6
Small	1	-	3	1	2	7

Source: Own field study, 2003.

Main contractor should hold meetings with subcontractors to discuss progress of work. 50% of the construction firms studied held subcontractor meetings in which they discussed progress of works, problems facing subcontractor and material and labour requirements of subcontractors. 10% of the firms, which was part of the small firms, did not hold any meetings with subcontractors.

The records kept by various firms about subcontractors were labour records, payment records, progress of works, material storage records, programme of works, name of subcontractors foremen, records showing performance, problems faced by subcontractors, changes or amendments, quotation records.

30% of the firms studied did not keep any records about anything concerning subcontract works, despite subcontractors working on site. Some claimed that the subcontractors kept all records concerning their works and therefore kept no records.

The sites studied had various subcontractors at work, for instance plumbing, electrical installations, structured cabling, roofing, tiling e.t.c. One site (5%) carried out all the subcontract works.

3. Materials control.

The magnitude of materials in the total value of the building structure ranges between 68-76% (Habitat p. iv-43 - 44).

Of the studied (30%), the directors of the firms were responsible for materials purchasing, scheduling and ensuring that they are delivered on site in time. In 50% firms, the site manager / agent were responsible and on 10% of the sites, the storemen were responsible.

The control of materials on sites was mainly the responsibility of the site management as per 75% of the firms. On 3 sites (15%), the head office was

responsible for the control of materials on site and 10% of the firms had materials departments, which were entirely responsible of all issues regarding materials.

Besides good conditions, all stores must have good records and clear procedures. Stock records are required which show the location and quantity of all the materials.

On most construction sites, simple records such as materials received, materials delivery notes, stock cards and materials cost records. On some sites, the personnel in the head office kept the materials records.

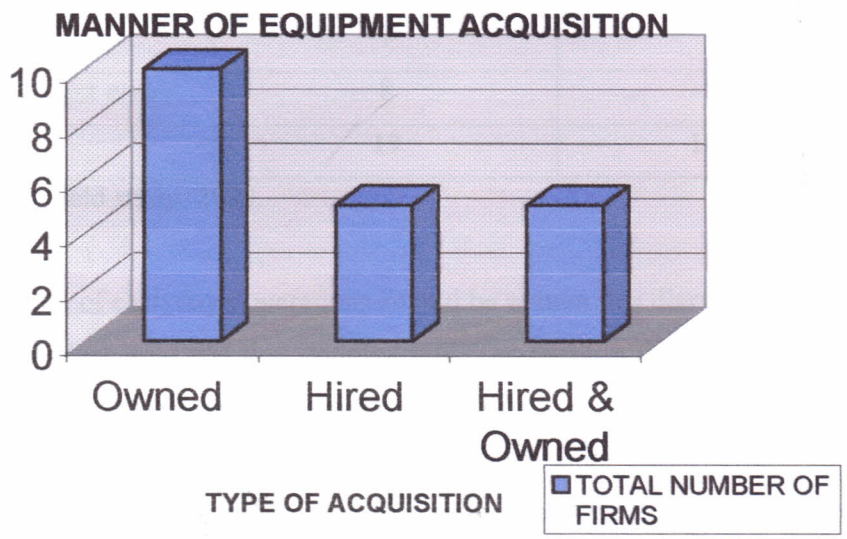
1. Plant and equipment control.

Construction equipment in its general sense implies the machinery, tools (other than craftsmen's personal tools) and other equipment used in the contractors' yard and workshop, and on site. (Masu S.M., 2003).

The equipment found on the sites studied included or ranged from mixers of various types and capacities, lorries, excavators, rollers, cranes, vibrators, dumpers, compressors, compactors, water pumps hoists to hand tools on small sites.

10 firms (50%) out of the 20 studied, owned the construction equipment, 5 firms (25%) hired the equipment while the other 5 firms (25%) hired as well as owned the equipment.

Chart 6: Equipment ownership / acquisition.



Source: Own field study, 2003

On 15% of the firms studied, plant managers were responsible for the plant or equipment owned, site superintendents were responsible for the equipment on

55% of the firms studied while on 30% firms, the foremen were left in charge of the equipment.

The personnel responsible for the equipment recorded the plant information, such as active time, idle time, breakdown time and maintenance time for which the equipment was engaged.

Asked what happens to hired equipment after use in case of hire, (25%) of the firms responded that they retained the equipment till the next use, while the other 60% returned the plant immediately to the hirer.

85% of the firms that owned equipment did not bother to record the plant time i.e. engagement programme of the equipment, such as active time, idle time, maintenance time and breakdown time.

Asked about any economic use to which the owned equipment was put at time of no work, 50% of the firms studied kept the equipment in the yards or stores till next use or when they had work. 1 firm responded that, equipment was sold when there was seriously no work. 35% of the firms rented out the equipment to other firms that needed the plant for work.

Table 4.7: Use to which equipment is engaged at time of no work.

	Number of firms	**Percentage (%)**
Hired out	10	42.1
Sold	1	5.3
Keeping till next use.	8	52.6
	19	**100.00**

Source: Own field study, 2003.

Site diary.

A description of each day's operations should be written in a diary, together with a note of the plant used and that standing idle. The purpose for noting down any idle plant is so that later, should there be any claims for plant brought to site and left standing idle, the extent of the lost time and the reasons for it may be checked from the diary records. In this manner, any gross overstatement of claim may be detected and settled.

Simple records were kept on site concerning equipment, such as consumption of fuel, working hours, plant maintenance, plant utilization and transfer of plant from site to another.

On 10% of the firms, the foremen kept the records for plant only when it was being rented or hired out.

Communications control.

An effective system for passing on information and instructions, and for receiving feedback, is essential for management control. In construction, this system must work both within and among the many firms - consultants, contractors, subcontractors, suppliers and client, who contribute to the design and production of the final product.

As for the system of intercommunication commonly used between the head office and site, 9 firms (45%) responded as using radio calls and telephones, 3 firms (15%) used written, oral (face to face) and radio calls, while 5% relied entirely on written system of communication.

The site managers mainly used foremen to pass down any instructions and information to the operatives. On sites, written form of communication is rarely used for passing down instructions of work to operatives and workers.

11 sites (55%) had telephones on site; secretaries or foremen were in charge of telephones on site and ensured that only calls relevant to work were made. This is so as to ensure that the telephone costs are regulated. Foremen were the ones mainly in charge of keeping the drawings register, for all drawings received from consultants i.e. the engineers, Architect are stamped on receipt, recorded and kept safely for use.

Regarding the order in which firms deal with telephone calls, mail and drawings received on site, 20% of the firms studied first filed and passed later on to concerned parties. 3 sites (15%) fist passed on to concerned party and recorded later, 8 sites (40%) recorded, passed on to concerned party and filed later.

5. **Progress control.**

Progress is measured against the planned targets, and the schedule or cost deviations corrected. Controlling timescale must be a top priority for any project manager. While it is true that circumstances are hurdles to be overcome, careful attention to timescale planning and progress control are essential if a project is to stand any chance of success.

Out of the 20 sites studied, only 1 (5%) responded as not having site management team hold the site meetings with foremen / supervisors to discuss

various matters regarding the project. 19 sites (95%) held site meetings to discuss issues regarding the project.

Table 4.8: Issues discussed in the site meetings.

	Large	Medium	Small
Progress of works	4	2	-
Materials & labour	-	-	-
Safety of work	-	-	-
All of the above	3	3	6
None	-	1	-

Source: Own field study, 2003.

From the table, the issue mainly discussed on the progress meetings is the progress of works and material and labour requirements.

On all sites studied, it was confirmed that the directors or principle partners or owners of the firm make visits to the site. This is important so that they are updated on the progress of works.

On 10 sites (50%), the directors visited weekly, on six sites directors visited daily, monthly on 2 sites (10%) and on 2 other sites, directors visited occasionally.

During these visits, directors do hold meetings with site management (except on 2 sites), during which various aspects of the project are discussed, such as progress of work, material and component stocks and quality of work.

Progress recording highlights operations either behind or ahead of schedule. This indicates to the Site manager critical operations that require attention in the immediate short-term period. The master programme should be kept under constant review in order to achieve completion of the project by the planned date.

6. Reports.

An important part of the site manager's responsibility is the keeping of site records and the submission to the contractor's head office of weekly reports. Progress reports, cost reports and schedules should all be prepared accurately and updated on a regular basis to ensure that they serve the purpose for which they were designed.

Table 4.9 : Summary of the field findings in percentages of each control item.

Percentage occurrence per firm category.

	Elements of control	Large (%)	Medium (%)	Small (%)
1	**Types of reports**			
	Cost reports only	00,00	33.33	14.29
	Cost and progress reports	71.43	50.00	85.71
	Other types of repots	28.57	16.67	00,00
2	**Preparation of cost reports.**			
	On site	00,00	33.33	14.29
	In head office	71.43	66.67	57.14
	Data on site reported in head office	28.57	0.00	28.57
3	**How are reports prepared.**			
	Manually	28.57	66.67	57.14
	Computers	57.14	00,00	14.29
	Manually then keyed in computers	14.29	33.33	28.57
4	**Who prepares cost reports**			
	Site personnel	14.29	16.67	28.57
	Head office	57.14	66.67	42.86
	Site & head office personnel.	28.57	16.67	28.57
5	**How often are they prepared**			
	Daily	14.29	00,00	00,00
	Weekly	57.14	16.67	28.57
	Monthly	14.29	33.33	42.86
	Occasionally	14.29	50.00	28.57
6	**Types of schedules**			
	Bar chart	57.14	100.00	85.71
	Bar chart & critical path	42.86	00,00	00,00
	Others	00,00	00,00	14.29
7	**Updating of schedules**			
	Weekly	28.57	33.33	42.86
	Monthly	42.86	16.67	14.29
	After major changes	14.29	33.33	28.57
	Under special	14.29	16.67	00,00
	Never	00,00	00,00	14.29

8	**Who does scheduling?**			
	Site personnel	42.86	33.33	42.86
	Head office	42.86	50.00	57.14
	Independent bureau	00,00	00,00	00,00
	Site & head office personnel.	14.29	16.67	00,00
9	**Job diaries - who keeps?**			
	Site manager	71.43	50.00	57.14
	Other persons (head office)	14.28	00,00	14.29
	Never	14.28	50.00	28.57

Source: own field study, 2003.

The data presented in the preceding table shows that cost reports and schedules are mostly prepared in head offices.

It was also found that irrespective of the size of the company or firm, the contract value or type of project, the majority of contractors prepared cost accounting reports which they called cost reports and used bar chart schedules as control tools.

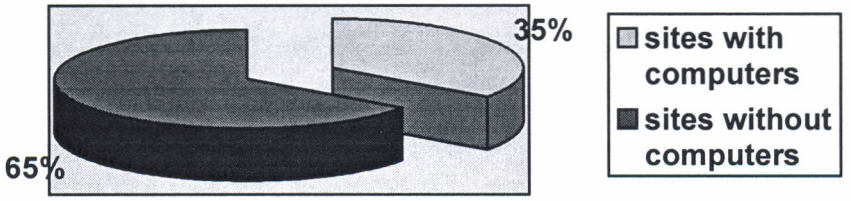
It was also found that scheduling was either done by the site personnel or head office and no firm went to independent bureaus. A small percentage of the firms studied kept other types of reports other than the cost reports and progress reports.

Computers.

The arrival of computers resolved most of the difficulties, since they have been used to speed up manual operations and processes i.e. to compensate for human inadequacies, such as slow links, poor memory, poor speed of calculation.

It was found that, 13 sites (65%) of the studied sites did not have computers and therefore could not take advantage of the uses the computer can be put to, to make work easier- as they did a lot of manual work. 35% firms had computers for which they used for various purposes as follows: preparation of cost reports, programme scheduling, equipment costing, finance and accounting and communication through internet.

Chart 7: Computers on construction sites.



Source: Own field study, 2003.

7. Quality control.

All work on site should be quality controlled. Materials for construction work require laboratory tests to ensure that they meet the required specification and standards.

Concerning the responsibility of quality of construction work, site management is accountable on 60%, in 35% of the firms the quality control engineers were there to ensure that quality was achieved. 5% firms confessed that quality was ensured by good workmanship.

55% firms were working on more than one site at time of the study. 3 firms out of these had only one site manager who managed all these projects, as there were no supervisors permanently stationed in these sites.

35% firms of those studied guaranteed quality by buying quality materials. 55% firms ensured quality by testing materials and supervising of the works.

4.3 PROBLEMS ENCOUNTERED.

1. In order to get an accurate and true representative sample of the population, the researcher had to obtain the information from the Nairobi City Council-Department of Architecture & Planning Development control unit. This department is in charge of controlling all developments coming up. Unfortunately, the unit does not keep records of the active construction sites but rather the approved project plans. This made difficult for the researcher to trace the sites.
2. The researcher could not be allowed into some construction sites as they were suspicious and thought the researcher was an inspector from the ministry of public works and Labour and therefore would spy on them.
3. Among the questionnaires distributed, some were returned blank, not completely filled while others could not be picked for inclusion in the study, as the respondents had not filled yet time was out.

   The principal reasons for lack of response may be: -

- Failure to maintain up to date, accurate and relevant records.
- Lack of interest in the research oriented studies.

CHAPTER FIVE.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

5.1 Summary.

The main concern of the research was to study site management control and it's on the construction operations. The best approach was to start with the elements of control, collect actual data related to the present practices of the various contractors and to observe any trend among them.

It was found that irrespective of the size of the company, the value of the contract or the category of the firm, the majority of the contractors prepared cost accounting reports that they called cost reports and used bar chart schedules as control tools.

5.1.1. Labour.

Of the sites studied, a great percentage of construction workers are non-unionized and are employed on a temporal basis when work is available. Piecework method was mostly initiated on most sites as a means of improving productivity.

The personnel records kept on site by the site management were mainly labour recruitment registers and payment records. Most construction site managers allocated tasks to labourers on the same day of work.

5.1.2. Subcontractors control.

On most sites studied, the subcontractors had their own foremen or representatives who supervised the subcontract works. Main contractor and the specialist consultants did the overall supervision of subcontract works.

Most firms held subcontractor meetings monthly, during which progress of works was discussed.

The records kept by various firms about subcontractors are labour records, payment records, progress of works, material and equipment storage records, programme of works, change and amendments, name of subcontractors and other records showing performance.

5.1.3. Plant and equipment.

Most firms owned the equipment and the persons responsible for the equipment recorded information such as active time, idle time, breakdown time and maintenance time for plant equipment.

Records such as consumption of fuel, working hours, plant maintenance, plant utilization and transfer sheets.

5.1.4. Communications control.

The system of intercommunications commonly used between the head office and the site is written and telephones. They are used to pass down instructions of work to those responsible of control of various site activities.

5.1.5. Cost control.

Cost reports are not cost accounting reports, they are a snapshot of the cost status of the project. Site personnel are the only individuals capable of preparing cost reports.

5.1.6 Progress control.

Schedules like cost reports are monitoring devices. Unless they are prepared carefully and accurately and updated on a regular basis, these schedules will not serve the purpose they were designed for. Site personnel are the only individuals who are capable of preparing and updating schedules accurately.

5.1.7 Computers.

Although computers were found on some 35% of the firms studied, they were regarded only as fast printing machines. The contractors were unable to take full advantage of the potential benefits of computer application.

The researcher observed that most sites are very badly organized, have poor materials management and give little responsibility to site personnel. Their transformation into effective application tools is slowed down by the reluctance of construction enterprises to commit themselves to the considerable investment and organizational changes required and due to difficulties in realistic modeling of construction decision process.

5.1.8 Reports.

Reports are very powerful communication and control tools. They should encompass all elements that have a bearing on the project's progress to ensure smooth and consistent distribution of information throughout the project organization on a need-to-know basis and to expedite all required attention and crucial decisions when needed.

Site management can be the only source of data for completion of reports, yet it was noted that many reports were produced in the head office by the head office personnel. This often leads to a long turn around time (normally a month) for the preparation of progress reports and their feedback to site. This combined with an absence of regular monitoring and updating of work schedules (short term planning) indicates that present reporting procedures are failing to provide tight control of site activities.

There is also limited authority vested in the site staff and direct involvement of head office in daily operations.

5.1.9. Materials.

Site management was mainly responsible for materials control on most sites studied i.e. purchasing, storing, and keeping of records.

Simple records such as materials received, material cost records, stock cards and material delivery notes were kept.

5.1.10. Health, Safety and Welfare.

Bigger firms among the sampled ones had better safety performances. This phenomenon is attributed to the fact that the bigger firms had more formal safety programmes. The formality of the programmes in the bigger firms was mainly evident in more prevalent use of accident reports, more formal training for new employees and safety personnel, more extensive use of safety incentives and more rigid company requirements on safety in general.

5.2 Discussion of the results.

The hypothesis of the study is, the management of various construction firms do not incorporate adequate control of the operations on site in order to achieve optimum efficiency and productivity (formal control process). The researcher proved that the management of construction firms do not exercise formal control of construction processes since:

A cross-examination of contractors working on more than one project revealed that field management efficiency was not consistent on all projects. Although major company policies are the same or they should at least have the same minimum requirements, one would expect to find some consistency in the performance, however, the fact was the opposite. Most of the firms that were working on more than one project had one site manager who went round all the

projects. This could be due to the fact that contractors would like to save by employing a few numbers of site managers.

The lack of proper records, including the long turn around in time for updating records, the limited authority vested in the staff and the direct involvement of the head office in the daily operations, indicate that the present practices of many construction firms do not provide tight control of site activities.

Since site management control was the focus of the research, the number of managers was studied versus the number of workers, the contract value and the efficiency of the site, to see any relationship.

Theoretically, the number of managers should be directly proportional to the contract value and the number of workers. 6 sites out of the 20 sites studied had four managers or more. These sites have an increased output and efficiency than other sites studied. This finding proves somehow the basic argument i.e. the number of managers and their input is directly proportional to efficiency.

The fact that a certain firm is making money or profits does not necessarily mean that the job is run effectively and efficiently. The study did not allow for the collecting of data that could lead to determining of the trade-off or the relationship between control and profit. The objectives of the study are,

- To evaluate construction site management control practices of Kenyan firms.
- To investigate the machinery or instruments necessary in the formal control of construction sites.

The study objectives have been achieved as discussed in the findings of the study.

5.3Conclusion.

The findings of the research led to the belief that control is exercised from the head offices as opposed to site control.

The style of management is a very important determinant of the level of productivity and the efficiency of construction activities, through its motivational consequences for the workforce and the supervisory staff on site.

5.4 Recommendations to improve efficiency and productivity of site operations.

Records that are so complex that nobody can find the time to keep them going are of no value at all, and the site manager should therefore first concentrate on getting down on paper, notes about things. They enable the site manager to remain fully in charge of his job; they enable him to give accurate and prompt guidance to his supervisors.

The project personnel must have specialized skills and knowledge of the techniques used in project planning, financial management and control. In addition, they must have skills in handling the human problems, which arise because of the characteristic nature of projects and also because of the particular problems associated with projects.

A system of short term planning and cost control should be compatible with the existing control system. Its purpose is to be able to control daily and weekly activities as opposed to monthly progress as currently practiced. It should allow the various crews their daily output, meeting deadlines and any deviations from the planned. The processing of reports and forms should be formalized and kept to a minimum so as not to burden site staff.

The system of control practiced should be capable of detecting deviations and allow for fast and timely corrective actions.

The system should allow for delegation of the necessary authority to the site staff. If the organization is medium or bigger, with the decrease in prices of computers, it may have its own electronic data processing department on site. The department will have the responsibility of assisting site management in computer aided facilities for carrying out various functions e.g. preparation of contract documents, control of cost, work progress and procurement dissemination of project information and various clerical operations.

Control of projects should be done on the sites where actual changes and work is taking place rather than head offices, as control from head offices takes a long time and head office personnel may not have a true picture of the site operations.

5.5 Suggestions for further research.

- Research should be carried out to study the optimal number of management level personnel or the organizational set up on construction sites given the contract value and the number of workers. By management level personnel, it means project managers, Site engineers and superintendents, site agents, general foremen and foremen and site managers.
- Studies are needed in the areas of personnel management with an interest in finding out the influence of their educational level and the attitudes on the efficiency and effectiveness of their work.
- Studies are needed to find out the costs and the time involved in implementation of formal site control and the consequences.

BIBLIOGRAPHY

Published sources.

1. Ahuja.H.N, **Construction Management & Engineering** - A Wiley series (1976).
2. Ashford.J.L, **The management of Quality in Construction**. Great Britain, (1989) (pg. 123).
3. Barry .F. **The Practice of Construction Management** .3rd ed. London, Blackwell science (1996).
4. Barrett .P. **Profitable Practice Management for the Construction Professional.** Great Britain, TJ Press Ltd., Padstow Cornwall. (1993)
5. Brian .C., Peter .W. **Construction Planning, Programming and Control**, London. Macmillan Press Ltd., (1998).
6. Cleland D.I. & King, W.R. **Systems Analysis and Project Management**, New York. , McGraw Hill, (1985).
7. Cooke .B. **Contract planning and contractual procedures**. London, Macmillan Press Ltd., (1981).
8. Dennis. L. **Gower Handbook of Project Management** 2nd ed. England, Gower Publishing Ltd., (1987).
9. Dennis. L. **Project Management** 6th ed. England, Gower Publishing Ltd., (1996).
10. Gall, M.D., Burg, W.R., Gall, J.P., educational Research, An introduction, 6 th edition, New York., Longman Publishers, (1996).
11. Gidado, K.I., **"Project Complexity: The Focal Point of Construction Production Planning,"** Construction Management and Economics, Vol.14. (1996).
12. Goodman, **Project Planning and Management**; An integrated system for improving Productivity, (1988).
13. Habitat, **Role and Contribution of the Construction Industry to socio-economic Growth of Developing Economies**, GMT, inc, Cambridge. (1982).
14. Harrison F.L. **Advanced Project Management** 2nd ed. (1985).
15. Harris.F. **Modern Construction Management** 3rd ed. Black science. (1989).
16. Hill.S, **Managerial Economics: The Analysis of Business Decisions.** Macmillan Press Ltd. (1989).

17. Horgan .M.O'C & Roulston. F.R. **Project Control of Engineering Projects.** London, E & F.N. Spon Ltd. (1988).
18. Jimmie .H. & parker H.W. **Safety – Productivity and Job pressures.** Journal of Construction Division, American society of civil engineers Vol. 104, No. Col, (1978). Pg 27-34.
19. Kast & Rosenzweig, **Organization & Management**: A Systems Approach, International students ED., New York: McGraw-Hill, 1970.
20. Katz .D. and Khan, R.L. **The social psychology of organizations**, 2ed., New York, John Wiley & Sons, (1978). Pg.428.
21. Koontz, H. O'Donnell C. & Weihrich H. **Management**. 8ed., Singapore McGraw- Hill, (1984).
22. Lansley P.R. & Harlow. P.A. **Managing Construction Worldwide. Construction and organization in perspective.**Vol.3. London, E. & F.N. Spon Ltd. (1988).
23. Lansley P.R. & Harlow. P.A. **Managing Construction Worldwide** Vol.2. London E. & F.N. Spon Ltd. (1987).
24. Mugenda & Mugenda., **Research Methods**, Nairobi, Acts Press.(1999).
25. Newcombe, R., Langford, D. and Fellow R., **Construction Management,** London, Mitchell, (1990).
26. Nicholson M.P., **Architectural Management**. Great Britain, University Press, Cambridge. (1992)
27. Nkado, R.N., **Construction Time Information System for the Construction Management & Economics**, Vol.10. (1992)
28. Raina, V.K., **Construction Management Practice** – The Inside Story. India. Tata Mc Graw-Hill Publishing Company Ltd. (1988)
29. Sidwell, A.C., **Project Management Dynamics and Performance**, Construction Management & Economics, Vol.8, (1990) pg. 159-178.
30. Strong, E.P. & Smith, R.D. **Management Control Models**, New York, Rinehart and Winston, (1968).
31. Toakley, R.A., **The Nature of Risk and Uncertainty in Building Procurement Process,** Australian Institute of Building papers, Vol.4, (1990), pp 171-181.
32. Twort A.C., **The supervision of civil engineering contracts**. Great Britain. (1995).

33. Uher, T.E., **Cost Estimating Practices in Australian Construction.** Blackwell Science Ltd., Engineering Construction & Architectural Management. Vol.1, No.2. (1996b).

34. Walker, A., **Project Management in Construction**. Granada Publishing Ltd., London. (1984).

35. Walker, A., **Project Management in Construction**, London, BSP Professional books, (1989).

Journal

36. Construction Review Journal of Construction Industry. **Plant & equipment.** Vol. 12 No.7. (2003).

Unpublished sources

37. Maluu .J. **Introduction to Management**. Class notes, University of Nairobi (Unpublished), (2000).

38. Masu S.M., **Construction Plant & Equipment**. Class notes University of Nairobi (Unpublished), 2003.

39. Mathenge M.J., **Variability of Productivity of Labour in Construction.** Undergraduate Project. University of Nairobi (Unpublished), (1986).

40. Mbaya J.S. **Construction project management**. Class notes, University of Nairobi. (Unpublished), (2000).

41. Mwangi C.M., **A study of construction safety administration on building sites in Nairobi area**. Masters thesis, University of Nairobi. Unpublished, (1989).

42. Mwangi R.N. **Effective site organization on building projects**: Case study of Construction sites around Nairobi. Undergraduate Project University of Nairobi. Unpublished, (2002).

43. Nyagah B.K. **Systems approach to Building Project Management Experience in Kenya**, Masters Thesis University of Nairobi. Unpublished, (1989).

44. Nyangito, H., **4th Africa training course on Local & Regional development planning & management, Monitoring and evaluation**; United Nations, Nairobi, (1998).

45. Talukhaba, A.A, **An Investigation into factors Causing Construction Project Delays in Kenya** – case study of high rise bldg projects in Nairobi, PHD. Thesis., University of Nairobi. (Unpublished), 1999.

46. Watuka J.M., **Sustainable Construction. An investigation into the awareness and implementation of sustainable construction practices in the Kenyan construction industry.** Undergraduate project. University of Nairobi. Unpublished. (2002).

APPENDIX A.

QUESTIONNAIRE TO SITE MANAGER.

TOPIC: SITE MANAGEMENT CONTROL, EFFICIENCY AND PRODUCTIVITY.

Study objectives:

- *To evaluate construction site management control practices of Kenyan firms.*
- *To investigate the machinery or instruments necessary in the formal control on construction sites.*

This is in partial fulfillment for the award of Bachelors Degree course in Building Economics & Management.

Your firm has been selected to be included in the study and your response will be a representative of the other firms in the industry.

Kindly fill the attached questionnaire as objectively and honestly as possible. In case of more information or comments on a particular question, please use the space following or below the question or back of sheet. The information given is strictly for purposes of research and shall therefore be treated with a lot of confidence.

Your assistance will be greatly appreciated.

Signed.....

Martha M. Kitutu.

B.A. Bldg. Econ. Student.

SITE DETAILS:

(Please tick appropriately or answer where applicable)

1a) Name of site / project.....

b) Plot number.....

c) Street name / Highway /Road /Avenue.....

d) Division of city where the site is located.

i) Eastern

ii) Central

iii) Western.

e) Nature of works.

i) New works

ii) Alterations

f) Stage of construction reached at time of the site visit.....

2ai) What is your specialty?

i) Building contractor.

ii) General contractor.

iii) Developer.

ii) Are you registered with the Ministry of public works?

- Yes
- No

iii) If so which category? (*Tick appropriate*) A, B, C, D, E, F, G.

b) What kind of project are you currently undertaking?

i) Commercial

ii) Institutional

iii) Residential

c) How many projects are you currently undertaking? (*Number*)...

d) What is the contract value?.....

e) When did you commence the project.....

f) What is the original duration of the project?.....

g) What percentage have you tackled up to now? (*Specify*).....

Matters of control and supervision.

3. **Labour control.**

a) What is the total number of workers currently on site?.....

b) How many are:

i) Unionized?.....

ii) Non-unionized?.....

c) What is the number of managers on site and what areas of the project are they involved in managing (*please mention. If more use space below*).....

i) iii)

ii) iv)

d) What personnel records are kept on site by the site management?

(*Tick appropriately*).

i) Payment records

ii) Labour recruitment register

iii) Warnings of misconduct.

iv) Labour budgetary expenditure.

v) Others (*please mention*).

e) When are laborers paid?

i) Daily

ii) Weekly

iii) Monthly

iv) Any other

f) When are tasks allocated to laborers?

i) More than 2 days earlier

ii) A day earlier

iii) Same day of work

iv) Other specify.

g) How do you improve the labour turnover?

i) By use of piece work / a worker paid as a function of amount of work he performs

ii) By setting a minimum daily output which is expected from the workers

iii) Any other specify.

4. **Subcontractors control.**

a) How many subcontractors do you have on site?.....

b) Who supervises their work?

i) Main contractor and specialist consultant.

ii) Subcontractors' foremen

iii) General foreman.

c) What nature of work are they doing? (*Tick appropriately*).

i) Plumbing

ii) Electrical installations

iii) Landscaping

iv) Security installations

v) Structured cabling

vi) Others (please mention).

d) Does the site management team hold meetings with the subcontractors?

i) Yes

ii) No

e) If yes, how often? (Please tick the relevant).

i) Daily.

ii) Weekly

iii) Monthly

iv) Occasionally (*mention how often*).....

f) What are the aspects discussed in the meetings?

i) Progress of works

ii) Problems facing subcontractors

iii) Material and labour requirements of subcontractors.

iv) Others (*please mention*).

v) None of the above.

g) What records are kept on site concerning subcontractors? (Mention please).

i) iii)

ii) iv)

5. **Materials control.**

a) Who is responsible for materials purchasing, scheduling and ensuring that on site in time? (*Tick appropriately*).

i) Site agent / site manager

ii) Stores man

iii) Quantity Surveyor /Estimator

iv) The director.

b) Who is responsible for materials control?

i) Materials department

ii) Head office

iii) Site management

iv) Other (*mention*)

c) What materials records do you keep on site?

i) Material cost records

ii) Materials received records

iii) Materials delivery notes

iv) Stock cards

v) Other (*mention*)

6. **Plant and equipment control.**

a) What equipment do you have currently on site? List all. (*Use space below if more*).

i) iv)

ii) v)

iii) vi)

b) Is the equipment? (*Tick appropriately*).

i) Owned ii) hired

iii) Both (owned and hired).

c) Who is responsible for the equipment or plant you own? Tick appropriate.

i) Plant manager

ii) Site superintendent

iii) Foreman

iv) Other (*specify*)

d) In case of hire who becomes responsible for the equipment?.....

e) Which of this plant information do you record?

i) Active time

iii) Idle time

iv) Breakdown time

v) Maintenance time.

f) At time when not using hired equipment...? Tick appropriate.

i) It is returned immediately to the hirer.

ii) Retained till next use.

g) When the hired equipment is not in use what economic use do you engage them in?

i) Rent them out

ii) Sell them

iii) Other (*specify*).....

e) What records are kept on site concerning plant & equipment?

i) Plant utilization sheets.

ii) Plant maintenance

iii) Transfer of plant sheets

iv) Other (Please mention)

7. **Communication control.**

a) What is the system of intercommunication between the head office and site.

i) Written

ii) Verbal / Oral

iii) Radio calls, phones

iv) Other (please mention).

b) Who is responsible for the following? (*Please indicate against*)

i) Telephone

ii) Filing

iii) Mail

iv) Drawings register.

c) How are the above i.e. telephone calls, mail, drawings received dealt with? (*Tick appropriate*).

i) Filed and passed later on to concerned party

ii) Passed on to concerned party and recorded later.

iii) Recorded, passed on to concerned party and filed.

8. **Cost control**.

a) Where is the preparation of cost records done?

i) On site

ii) In head office

iii) Data on site reported to head office.

b) How are cost report(s) prepared?

i) Manually

ii) On computers

c) Who prepares the cost reports?

i) Site Manager

ii) Head office personnel

iii) Site & head office personnel

d) How often are the cost reports prepared? (*Tick appropriately*).

i) Daily

ii) Weekly

iii) Monthly

iv) Other mention

9. **Progress control**.

a) Does the site management team in your site hold periodic meetings with foremen / supervisors to discuss various matters regarding the project?

i) Yes

iii) No

b) If yes, among the following aspects, which are discussed in the site meetings?

i) Progress of work

ii) Material and labour requirements of various gangs and trades

iii) Safety of work

c) Do the directors / Principal partners /owners of the firm make visits to the site?

i) Yes

ii) No

d) If yes, how often are these site visits?

i) Daily

ii) Weekly

iii) Monthly

iv) Occasionally

e). Which of the following aspects of the project do they inspect during such visits?

i) Progress of the works

ii) Material & component stocks

iii) Quality of the work

iv) All of the above

v) Other (*mention*)

vi) None of the above

f) Do the principal owners hold meetings with the site management during these visits?

i) Yes

ii) No

10. **Reports.**

a) Are you required by overall management in the firm to prepare periodic reports about the site you manage?

i) Yes

ii) No

g) If yes, which of the aspects listed below are included in the report?

i) Financial statement

ii) Labour management on site

iii) Progress of works

iv) Costs i.e. material costs, labour costs.

11a) What type(s) of programme schedules are used on site?

i) Bar charts

ii) Bar charts and critical path method (CPM)

iv) Other –mention.

b) How often are programme schedules up dated? (*Tick applicable*)

i) Weekly

ii) Monthly

iii) After major changes

v) Under special circumstances

vi) Never

c) Who prepares the schedules?

i) Site manager

ii) Head office

iii) Independent bureau

12a) Do you have computer(s) on site?

i) Yes

ii) No

b) If so, for what purposes are they used for? (*Tick appropriately*)

i) Preparation of cost reports

ii) Programme scheduling

iii) Estimating

iv) Equipment costing

v) Finance & accounting

vi) Secretarial work

vii) Communication through internet

viii) Allocation of resources

13a). Do you keep site diary?

i) Yes

ii) No

b) Who keeps the job/ site diary?

i) Site manager

ii) Others (*mention*)

iii) None

14.What other types of records do you keep on site regarding management and control of works?

i)

ii)

15. **Quality control.**

a) Do you have supervisors permanently stationed on site(s) for all projects?

i) Yes

ii) No

b) Which of the following guarantees quality work?

i) Buying of quality materials.

ii) Testing and supervision of the works.

iii) Workers are competent so no supervision.

c) Who is responsible for ensuring quality standards are met on site? Tick

i) Quality control engineer

ii) Site management.

iii) Other (mention).....

16. **Safety, health and welfare.**

Facilities on site. (*Please tick appropriately*).

		Available	Not available
i)	Canteen / mess facilities		
ii)	First Aid kit		
iii)	Dispensary		
iv)	Dressing room / showers		
v)	Recreational facilities.		

APPENDIX B

CODING MANUAL.

1) i What is your specialty?

Value	Variable
1	Building contractor.
2	General contractor.
3	Developer.
88	Missing information.

2 ai) Are you registered with the Ministry of public works?

Value	Variable
1	Yes
2	No
88	Missing information

ii) If so which category? (*Tick appropriate*)

Value	Variable
1	A - B
2	C - E
3	F & G
88	Missing information.

b) What kind of project are you currently undertaking?

Value	Variable
1.	Commercial
2	Institutional
3	Residential
88	Missing information

Matters of control and supervision.

3. **Labour control.**

a) Are your labourers?

Value	Variable.
1	Unionized
2	Non-unionized
88	Missing information

b) What personnel records are kept on site by the site management? (*Tick appropriately*).

Value	Variable
1	Payment record
2	Labour recruitment register
3	Warnings of misconduct.
4	Labour budgetary expenditure.
88	Missing information.

c) When are laborers paid?

Value	Variable
1	Daily
2	Weekly
3	Monthly
88	Missing information.

d) When are tasks allocated to laborers?

Value	Variable
1	More than 2 days earlier
2	A day earlier
3	Same day of work
88	Missing information

e) How do you improve the labour turnover?

Value	Variable
1	By use of piece work / a worker paid as a function of amount of work he performs
2	By setting a minimum daily output which is expected from the workers.
55	Not applicable
88	Missing information.

4. Subcontractors control.

a) Who supervises subcontractor's work?

Value	Variable
1	Main contractor and specialist consultant.
2	Subcontractors' foremen
3	General foreman.
88	Missing information.

b) Does the site management team hold meetings with the subcontractors?

Value	Variable
1	Yes
2	No
88	Missing information

c) If yes, how often? (Please tick the relevant).

Value	Variable.
1	Daily.
2	Weekly
3	Monthly
4	Occasionally
55	Not applicable
88	Missing information

d) What are the aspects discussed in the meetings?

Value	Variable
1	Progress of works
2	Problems facing subcontractors
3	Material and labour requirements of subcontractors.
55	Not applicable
88	Missing information

5. **Materials control.**

a) Who is responsible for materials purchasing, scheduling and ensuring that materials are delivered on site in time? (*Tick appropriately*).

Value	Variable
1	Site agent / site manager
2	Stores man
3	Quantity Surveyor /Estimator
4	The director.

b) Who is responsible for materials control?

Value	Variable
1	Materials department
2	Head office
3	Site management
88	Missing information

c) What materials records do you keep on site?

Value	Variable
1	Material cost records
2	Materials received records
3	Materials delivery notes
4	Stock cards
5	All the above
88	Missing information

6. **Plant and equipment control.**

a) Is the equipment? (*Tick appropriately*).

Value	Variable
1	Owned
2	hired
3	Both (owned and hired).

b) Who is responsible for the equipment or plant you own? Tick appropriate.

Value	Variable
1	Plant manager
2	Site superintendent
3	Foreman
55	Not applicable
88	Missing information

c) Which of this plant information do you record?

Value	Variable
1	Active time
2	Idle time
3	Breakdown time
4	Maintenance time.
55	Not applicable
88	Missing information

d) At time when not using hired equipment…? Tick appropriate.

Value	Variable
1	It is returned immediately to the hirer.
2	Retained till next use.

e) When the hired equipment is not in use what economic use do you engage them in?

1 Rent them out

2 Sell them

3 keep them till next use.

55 Not applicable

88 Missing information

f) What records are kept on site concerning plant & equipment?

1 Plant utilization sheets.

2 Plant maintenance

3 Transfer of plant sheets

55 Not applicable

88 Missing information

7. Communication control.

a) What is the system of intercommunication between the head office and site.

1 Written

2 Verbal / Oral

3 Radio calls, phones

55 Not applicable.

88 Missing information.

b) How are the above i.e. telephone calls, mail, drawings received dealt with? (*Tick appropriately*).

1 Filed and passed later on to concerned party

2 Passed on to concerned party and recorded later.

3 Recorded, passed on to concerned party and filed.

88 Missing information.

8. Cost control.

a) Where is the preparation of cost records done?

1 On site

2 In head office

3 Data on site reported to head office.

88 Missing information.

b) How are cost report(s) prepared?

1 Manually

2 On computers

88 Missing information.

c) Who prepares the cost reports?

1 Site Manager

2 Head office personnel

3 Site & head office personnel

55 Not applicable

88 Missing information

d) How often are the cost reports prepared? (*Tick appropriately*).

1 Daily

2 Weekly

3 Monthly

55 Not applicable.

88 Missing information

9. **Progress control.**

a) Does the site management team in your site hold periodic meetings with foremen / supervisors to discuss various matters regarding the project?

1 Yes

2 No

88 Missing information.

b) If yes, among the following aspects, which are discussed in the site meetings?

1 Progress of work

2 Material and labour requirements of various gangs and trades

3 Safety of work

55 Not applicable

88 Missing information

c) Do the directors / Principal partners /owners of the firm make visits to the site?

1 Yes

2 No

88 Missing information

d) If yes, how often are these site visits?

1 Daily

2 Weekly

3 Monthly

4 Occasionally

55 Not applicable

88 Missing information

e). Which of the following aspects of the project do they inspect during such visits?

1 Progress of the works

2 Material & component stocks

3 Quality of the work

4 All of the above

55 Not applicable

88 Missing information

f) Do the principal owners hold meetings with the site management during these visits?

1 Yes

2 No

88 Missing information

10. **Reports.**

a) Are you required by overall management in the firm to prepare periodic reports about the site you manage?

1 Yes

2 No

b) If yes, which of the aspects listed below are included in the report?

1 Financial statement

2 Labour management on site

3 Progress of works

4 Costs i.e. material costs, labour costs.

5 All the above

55 Not applicable

88 Missing information

11a) What type(s) of programme schedules are used on site?

1 Bar charts

2 Bar charts and critical path method (CPM)

55 Not applicable

88 Missing information

b) How often are programme schedules up dated? (*Tick applicable*)

1 Weekly

2 Monthly

3 After major changes

4 Under special circumstances

55 Not applicable

88 Missing information

c) Who prepares the schedules?

1 Site manager

2 Head office

3 Independent bureau

55 Not applicable

12a) Do you have computer(s) on site?

1 Yes

2 No

88 Missing information

b) If so, for what purposes are they used for? (*Tick appropriately*)

1 Preparation of cost reports

2 Programme scheduling

3 Estimating

4 Equipment costing

5 Finance & accounting

6 Secretarial work

7 Communication through Internet

8 Allocation of resources

9 All the above

55 Not applicable

88 Missing information.

13a). Do you keep site diary?

1 Yes

2 No

88 Missing information

b) Who keeps the job/ site diary?

1 Site manager

2 Others persons

55 Not applicable

88 Missing information

15. **Quality control.**

a) Do you have supervisors permanently stationed on site(s) for all projects?

1 Yes

2 No

88 Missing information

b) Which of the following guarantees quality work?

1 Buying of quality materials.

2 Testing and supervision of the works.

3 Workers are competent so no supervision.

88 Missing information

c) Who is responsible for ensuring quality standards are met on site? Tick

1 Quality control engineer

2 Site management.

88 Not applicable

16. **Safety, health and welfare.**

Facilities on site. (*Please tick appropriately*).

a) Canteen / mess facilities.

1 Available

2 Not available

88 Missing information

b) First Aid kit.

1 Available

2 Not applicable

88 Missing information

c) Dispensary

1 Available

2 Not available

88 Missing information

d) Dressing room / showers

1 Available

2 Not available

88 Missing information

e) Recreational facilities

1 Available

2 Not available

RESPONSE TO QUESTIONNAIRES

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	2	3	3	2	1	2	2	3	2	1	1	1	2	2	1	2	2	1	2	3
2ai	1	2	2	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1
_ aii	1	55	55	88	88	1	88	88	1	1	1	2	2	1	1	1	1	1	2	3
2b	1	3	1	2	1	1	3	1	3	1	2	2	1	1	1	1	2	1	2	1
3a	2	2	2	2	2	1	2	1	2	3	2	2	2	88	2	2	2	1	2	2
b	2	1	1	2	4	5	5	2	1	5	5	2	5	1	5	1	5	5	2	1
c	2	2	2	2	3	3	2	3	2	2	2	2	2	2	2	2	2	3	5	2
e	1	1	2	1	1	2	1	2	1	2	1	2	2	2	2	1	1	1	2	2
4a	88	3	3	1	2	1	2	88	1	2	4	4	1	88	2	3	4	1	1	2
b	1	1	1	1	1	1	1	88	1	1	1	1	1	88	1	1	1	1	1	1
c	3	3	3	1	2	3	4	88	2	2	3	3	1	88	2	3	3	3	1	4
d	1	1	1	3	4	1	3	88	1	4	4	1	4	88	4	1	4	4	2	1
5a	4	4	1	1	1	1	1	88	1	1	4	1	1	88	4	1	4	1	1	2
b	3	3	3	4	2	1	3	3	3	3	3	3	3	2	3	3	3	1	2	3
c	2	2	1	3	5	5	3	2	5	5	5	5	5	5	5	2	5	5	2	2
6a	1	1	1	3	2	1	1	3	1	1	2	3	1	1	1	3	2	2	5	2
b	2	3	3	3	3	2	2	1	1	2	2	3	2	2	2	3	2	2	3	3
c	1	1	4	2	5	5	2	2	88	1	1	88	5	5	1	4	1	5	1	1
d	88	1	1	88	2	88	1	2	1	1	1	1	2	1	1	1	1	1	1	2
e	2	3	3	1	1	3	1	3	3	1	1	1	3	88	1	3	1	3	2	3
f	1	55	2	2	3	5	2	2	1	1	1	88	1	1	1	2	1	55	3	1
7a	3	3	3	3	5	3	3	3	3	4	5	3	2	4	5	3	4	5	1	1
b	88	3	3	3	1	88	88	88	88	3	2	1	3	3	2	3	3	1	2	1
8a	2	2	3	2	3	2	1	2	2	2	3	2	88	2	2	2	2	3	2	2
b	2	1	1	2	3	1	1	3	2	2	3	3	1	2	2	1	2	3	2	2
c	2	1	2	2	3	1	2	3	2	3	3	2	1	2	2	1	3	1	1	2
d	2	3	2	3	4	2	5	88	1	2	3	2	2	3	1	3	2	2	2	3
9a	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1
b	1	1	1	1	4	4	2	4	1	4	4	88	4	4	1	4	4	4	1	4
c	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
d	2	2	2	2	2	2	4	3	1	1	1	1	2	2	1	1	2	2	2	3
e	4	4	1	3	3	1	3	1	1	1	4	4	4	3	1	1	3	4	4	2
f	1	2	1	1	1	1	88	2	1	1	1	1	1	1	1	1	1	1	1	1
10a	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
b	5	5	4	5	5	5	88	88	88	5	5	5	5	5	5	4	5	5	1	3
11a	1	1	1	55	1	2	1	1	1	2	1	1	1	88	2	1	1	2	88	1
b	2	3	2	55	2	88	1	3	1	4	2	1	1	1	4	2	2	1	3	3
c	2	1	1	55	1	88	2	1	2	1	1	2	2	1	1	1	1	2	2	2

12a	2	2	2	2	1	2	2	2	1	1	2	2	2	1	1	2	2	2	2	2
b	9	55	55	55	9	55	55	55	1	9	88	55	55	1	9	1	1	1	55	55
13a	1	2	2	2	2	2	33	1	1	1	1	1	1	1	1	1	1	1	2	2
b	1	55	55	1	1	2	88	1	1	1	1	1	1	1	1	1	1	2	55	88
14a	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2
b	2	2	1	2	1	2	1	2	2	1	2	2	3	2	1	1	2	1	2	2
c	2	2	1	2	1	2	1	2	2	1	2	2	3	2	1	1	2	1	2	2
15a	2	2	2	1	1	2	1	1	1	1	2	1	1	2	1	2	2	1	2	1
b	1	1	1	1	1	1	55	1	1	1	1	2	1	1	1	1	2	1	1	2
c	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2
d	1	2	2	1	1	1	2	2	1	1	2	2	1	1	1	2	1	1	2	2
e	2	2	2	2	1	2	2	2	2	2	2	2	1	1	2	2	1	1	2	2

APPENDIX D

Contractors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Speciality of contractors	G	D	D	G	B	G	G	D	G	B	B	B	G	G	B	G	G	B	G	D
Category of firm (as per MOW)	A	E	C	H	F	A	D	G	A	A	B	D	G	H	C	E	H	G	D	G
Contract value in millions (Millions)	100	8	10	30	20	300	30	20	130	276	55	36	30	5	80	32	16	24	18	5.6
Original duration of the project (months)	22	12	17	14	18	9	11	6	12	17	27	12	26	6	12	23	20	14	22	17
Balance period (months)	5	4	5	2	14	4	3	4	6	_	15	2	3	_	7	0	14	7	12	4
Forecasted extension (months)	0	1	_	2	_	_	1	5	8	3	0	10	_8	3	_	16	0.5	1	0	1
No. of projects being undertaken by firm.	10	1	1	3	1	5	3	1	1	4	2	2	2	3	2	_	1	1	2	1
Percentage completion (%)	90	60	80	35	5	60	70	60	18	90	30	40	99	70	30	55	33	45	40	65
Type of labour	U	NU	NU	NU	NU	U	NU	U	NU	NU	U	NU	NU	NU	U	NU	NU	NU	NU	U
Number of workers	50	32	19	12	40	120	40	109	85	208	120	60	11	30	50	65	35	80	41	34
Number of managers	3	2	2	2	2	3	1	1	3	8	6	2	1	6	3	9	2	4	6	3
Equipment owned, hired, both	O	O	O	B	H	O	O	B	O	O	H	B	O	O	O	B	H	H	B	H
Preparation of cost reports																				
Preparation of schedules																				
Efficiency																				

Legend.

G - General contractor
B - Building contractor
D - Developer

NU - Non-unionized
U - Unionized
O - Owned

H - Hired
B - Both hired & owned.