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PROJECT TITLE

A STUDY TO DETERMINE WHETHER AND HOW VALUE MANAGEMENT IS APPLIED IN THE CONSTRUCTION INDUSTRY OF KENYA.

BY

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DECLARATION

Declaration of the Candidate

I, Mwangi Ambrose Kiragu, hereby declare that this research project is my original work and has never been presented for a degree in any other university

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DEDICATION

This project is affectionately dedicated to dad & mum who have been, to me, an endless source of joy and inspiration.

To my brothers, Jonah & Peter, my sisters, Esther & Carol and my friend, Irene, for their steadfast love and encouragement extended to me all through.

And to the source and sustainer of all, the Lord Jesus Christ.

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May God bless you all.

ABSTRACT

The main purpose of this study was to establish whether and how value management is applied in the Kenyan construction industry.

Value management/engineering is a creative organized approach aiming at optimizing cost and/ or performance of a facility system. It achieves savings or product value by identification and eliminating or modifying components that add cost to the product without contributing to its required function.

Different concepts are embodied within the term value and this renders value management difficult to understand and is often confused with cost saving, buildablity and cost planning.

The objectives of the study were to find whether and how value management is applied, the phase at which it is applied, the constitution of the value management study and the role of the team in the Kenyan construction industry.

The study hypothesized that the value management team determines how value management is applied in the Kenyan construction industry. The study found that the format of value management that was applied in construction projects was determined by the management style of the team which mainly constituted the design team and the client.

The study concluded that value management was generally applied in the Kenyan construction industry although no specific value management system has been put in place like in other countries where the technique is widely applied.

The study also concluded that value management study was usually undertaken at the design stage and was mainly constituted of the design team whose main role was to evaluate the various design alternatives and come up with the best alternatives to be implemented in the project.

The study recommends that a suitable value management system to be established which should be tailored to meet the objectives of the Kenyan construction industry so as to reap the gains associated with value management technique.

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ABBREVIATIONS AND ACRONYMS

FAST: Functional Analysis System Technique

VETC: Value Engineering Team Coordinator

VECP: Value Engineering Change Proposals

VM: Value Management

VE: Value Engineering

VA: Value Analysis

USA: United States of America

UK: United Kingdom

CHAPTER ONE

INTRODUCTION

Value management technique is a systematic multi-disciplinary effort directed towards the identification and analysis of the functions of a project or part thereof, particularly before the design of a building is done, for the purpose of delivering the clients, end users or market requirements in order to arrive at the best value or sale price of the building after its completion. (www.ivm.org)

The Value Method (VM) is a systematic and organized way to develop and compare alternatives that will get the job done (provide all of the essential functions) with the greatest value (greatest efficiency, economy, and quality with the least delay). The Value Method produces recommendations, not decisions. The Value Method includes the processes known as Value Analysis, Value Engineering, and Value Management. It is sometimes also referred to as Value Control, Value Improvement or Value Assurance. (www.ivm.org)

"...VM helps clients ensure that their investment in construction produces valuable assets which are cost effective to construct, use and maintain. It is a structured approach to defining what 'value' means to a client when meeting a perceived need, and delivering that value via the design and construction process. It does this by clearly defining and agreeing project objectives and the means of obtaining them." (Connaughton & Green 1996)

1.1 Background to the problem

The construction industry can be defined as, "that total industry which involves the utilization of human, economic and natural resources in the conception of design, construction, maintenance or demolition of building and civil engineering works." (Talukhaba, 1988)

It can thus be argued that the construction industry is constituted of three parts namely:-

- The building industry
- The Civil Engineering industry
- The construction materials producing and extracting industry

The latter supplies materials and credit to construction firms to supplement working capital. (Talukhaba, 1988)

The construction industry constitutes both the private and public sectors. The construction industry plays a major role in the process of national development (Talukhaba, 1988)

This important role played by the construction industry can be traced through the industry's contribution to the growth of the economy through employment creation and provision of vital amenities such as housing, hospitals, schools, offices etc.

The importance of the construction industry can be appreciated by examining some of the major economic indicators. These are:-

1. Gross Fixed Capital Formation (GFCF)
2. Employment

Buildings are needed for production to take place and can be seen as investments in the assets of the country. The buildings which are set up are termed as fixed assets and this constitutes the GFCF. The size and capacity of the construction industry is hence important in meeting the needs of a society.

Provision of adequate employment is a primary concern for the government. This poses a challenge because the rate of economic growth which is closely linked to employment creation does not march that of population growth. Unemployment escalation can thus be curbed by maximizing employment opportunities in the country's construction industry.

A recession in a country's economy is characterized by a heavy unemployment level. The most affected are those in the construction industry because during recession the industry suffers

greatest stagnation because of the reduction in the level of investment. A boom has the opposite effect. It is characterized by a high level of employment and the construction industry stands to benefit because of the increased levels of investment. (Talukhaba, 1988)

According to Seeley (1996), value management has been used in various countries and the benefits associated with this technique have been realized in these countries in the projects where the technique was adopted. These benefits includes among others:-

- Cost savings
- Value improvement
- Improved designs

The technique has been used in the construction industry of U.S.A, where contractors submitted 5000-value engineering proposals. Abut 55% of these were approved and resulted in overall savings of about US $50 million. (Kharbada, 1987)

Many other countries have adopted the technique including China, Japan, South Africa, Hong Kong and Australia. During the reconstruction of the new US embassy in Dar-es- salaam, Tanzania, which cost US $50 million, they applied value management and recorded savings of about US $2.2 million, attributed solely to value management application in that project. (Maweu, 2006)

However the system of value management adopted vary due to the differing objectives in the various countries. For example, the UK construction industry had tried to adopt the system used by the US but this did not auger well in their companies because the original objectives differed. For the US, the system of VE was born out of a need for greater accountability on government projects, whereas in the UK the situation was different. The QS system provided all the accountability that was needed. VE was required to provide a platform for the examination of value as opposed to cost (McGeorge and Palmer, 2002).

This prompted the UK construction industry to go back to the original work of Miles and started building its own systems that satisfied its own objectives. These systems are now developing under the title of value management (McGeorge and Palmer, 2002).

For Kenya to reap the benefits associated with the application of value management in the construction industry, a suitable system of value management has to be established which should be tailored to meet the objectives as portrayed above.

1.2 Problem statement

Value management is one of the tools adopted to ensure that a project is undertaken at the least cost and time possible without compromising on the quality. To realize this calls for changes in management.

Countries like US, UK, Japan, Australia and South Africa have established and tested a system of value management to apply in their countries to ensure the successful completion of construction projects with regard to cost, time and quality.

With the respective system of value management adopted in the individual countries, they have been able to detect and address issues that deter the successful completion of a project and provide the necessary remedial actions to these issues.

The adoption of the respective system of value management has also helped the countries mentioned above to establish the persons who are most suited to initiate a value management study. The persons are to make the necessary decisions on functionality and requirements of the project which are supposed to compare with the brief in regard to the set time, budget and quality standards to be achieved.

In the Kenyan construction industry the following questions may be asked:-

"Whether and how value management is applied?"
"Who are involved in the implementation of the value management study?."
"At which phase of the design process is value management study undertaken?"

This research aims to find out whether or not and how value management is applied in the Kenyan construction industry and the persons involved in the implementation of the value management study.

1.3 Objectives

1.3.1 Main objective

- To determine whether and how value management is applied in the Kenyan construction industry.

1.3.2 Sub-objectives

- To identify the phase at which value management is applied in the Kenyan construction industry.
- To identify the participants who are involved in facilitating value management workshops.
- To determine the roles of value management participants in the various phases of a project in the Kenyan construction industry.

1.4 Hypothesis

- The value management team determines how value management is applied in the Kenyan construction industry.

1.5 Significance of the study

The aim of the study is to find out whether and how value management is applied in the Kenyan construction industry.

Application of value management will help the Kenyan construction industry to gain immensely from the benefits that accrue from usage of value management.

The gains may be attributed to the achievement of the core objectives of a project. These are:-

- Cost
- Quality
- Time

Firstly, as a result of good management in construction projects, more investors who have the capital may be enticed to invest in the construction sector.

Consequently, this has the potential to influence the growth of the country's economy if the spaces are optimally utilized. This may be brought about by the increment in the Gross Fixed Capital Formation (GFCF). This is a measure of net new investment by enterprises in the domestic economy in fixed capital assets.

1.6 Scope of study

The construction industry is massive and encompasses the building industry, the civil engineering industry and the construction materials producing and extracting industry. However the research was confined to a manageable scope with regard to the following:-

1. Area (geographical location)

The Nairobi region was chosen as most of the professionals involved in the construction industry are based there.

2. Data sources (participants)

Various professionals are involved in construction projects. These include architects, quantity surveyors, engineers (electrical, mechanical and structural), interior designers and so on. For the purpose of this study, Architects and Quantity Surveyors will be regarded as they are concerned with the implementation and actualization of the project.
Another inclusion will be the contractor who is involved in the construction work.

3. Period involved (time frame)

The study will only cover building projects that have been undertaken for the past three years to date.

4. Area of study

Although the construction industry is a constituent of various industries, the study will limit itself to the building industry.

1.7 Definition of terms

Cost is defined as "the money spent in bringing up something, e.g. building as in our case." (O'Brien, 1976).

Value is defined as "the lowest cost of reliability providing the functions of services at the desired time and place and with essential quality". (O'Brien, 1976).

Value Engineering is defined as "an organized effort directed at analyzing the functions of systems, equipment, facilities, services and supplies for the purpose of achieving the essential functions at the lowest life cycle cost consistent with the required performance, reliability, quality and safety".

Value analysis is defined as "an organized approach to providing the necessary functions at the lowest cost". (Miles, 1972)

Value management is defined as "a structured analysis of project by an independent consultant or person to determine the required functions of the building (product) and to consider alternative (design or construction) solutions to eliminate unnecessary cost." (Seeley, 1996).

Life Cycle Costing is defined as "the summation of all costs over the useful life of a building, system or product. It includes all relevant costs to acquire, own, operate, maintain and dispose of a building, system or product for a specified period of time, less any salvage value". (VE Manual, 2004).

CHAPTER TWO

LITERATURE REVIEW

2.1 The Construction Industry.

The construction industry has characteristics that separate it from all other industries. These are:-

- Physical nature of the product.
- The fact that the product is normally manufactured on client's premises, i.e. the construction site.
- The fact that many of its projects are one-off designs, with no prototype made available.
- The arrangement of the industry, where design is normally separated from construction.
- The organization of the construction process.
- The methods used for price determination.

The final product is often large and expensive, and can represent a client's largest single capital outlay. Buildings and other structures is for the most part bespoke designed and manufactured to suit the individual need of each customer, although there is provision for repetitive and speculative work, particularly in the case of housing. The nature of the work also means that an individual project can often represent a large proportion of the turnover of a single contractor in any year. (Ashworth, 1999)

2.1.1 The Development Process.

The development process applied to a construction project commences at inception and ends with demolition, when redevelopment of the site may occur. The traditional view considers the project from inception through to handing-over stage to the client. This might correctly be termed the capital development process. It is an outmoded view. Greater emphasis is now placed on total- or whole-life analysis and project involvement, the designer or developer thus taking a longer term interest, and often advising the client on maintenance planning and facilities management throughout the life of the project. This links the design to use, makes the designer

more accountable and should result in a feedback loop of problems not being repeated on future schemes. (Ashworth, 1999)

Stage	Phase	Typical tie duration (years)
Inception	Brief Feasibility Viability	1
Design	Outline proposals Sketch design Detail design Contractual documentation Procurement	1
Construction	Project planning Installation Commissioning	3
In-use	Maintenance Repair Modification	80
Demolition	replacement	

Table 2.1 The development cycle

2.2 Historical Development of Value Management.

VE had its origin during World War II, at General Electric, when innovation was required because of material shortages. Some critical materials were difficult to obtain, and a great many of substitutions had to be made. Mr. Harry Erlicker, a vice president, made the observation that many times these changes resulted in lower costs and improved products. This encouraged him to seek an approach to intentionally improve a products value (VE Manual, 2004).

He assigned Lawrence D. Miles, a staff engineer, the task of finding a more effective way to improve a product's value. In 1947, Mr. Miles and his team developed a step-by-step system, called Value Analysis (VA), to analyze a product's cost and function to ferret out unnecessary

costs. As a result of substantial investment, the new methodology, VA, was developed, tested, and proven to be highly effective. However, it wasn't until 1952 that VA began its growth throughout the industry (VE Manual, 2004).

It was later discovered that this process of value analysis produced cheaper overall products without reducing quality and after the war the system was maintained as a means of both removing unnecessary cost from products and of improving design. (McGeorge, 2002)

The central feature of Miles' work as described by (McGeorge, 2002) was the definition of all functions that the customer required of the product. These functions were defined only in terms of one verb and one noun. He believed that if such a definition could not be achieved, the real function of the item was not understood.

The defined facts were then evaluated in terms of the lowest possible cost to achieve them and this evaluation was then used as a means of finding alternatives that also fulfilled the function.

A by-product of the definition and evaluating function is the ease with which it allows further means of achieving the function to be generated.

Example

In a hotel development the architect had included a child's paddling pool next to the main hotel pool. The function of the pool was not, as might first be thought, to provide a leisure activity for children. It was in fact a safety measure to keep them out of the main pool. Once this function of the child's pool was defined as "keep (children) safe" it was much easier to generate alternatives that satisfied this function. A play area, a small playground or even a crèche would all meet the requirements. In the end the design team settled for a water spray which fulfilled the function of safety for less cost than the original paddling pool. This function definition, function evaluation and generation of alternatives is collectively called function analysis and it is the basic technology which forms the basis of value engineering. (McGeorge, 2002)

In complex organizations a system would be required to carry out function analysis; it could not be done on ad hoc basis.

The following questions need to be considered:

- When it would be carried out
- Who would do it
- How it would be organized.

For this reason systems of value engineering grew around the technique of function analysis. (McGeorge, 2002)

Value Engineering began to be used in the construction industry in the USA in1963. The use of the technique in that industry spread rapidly and by 1972 the US General Services Administration required that a clause on value engineering was to be included in all public sector construction contracts. The estimated cost savings reportedly ran into millions of dollars. Value engineering in the UK construction industry followed much later and did not really gain momentum until the late 1980s. (Ashworth, 1999)

2.2.1 Value Management Workshops.

The 40-hour workshop became a feature of Value Engineering. It was carried out at 35% design stage using a team external to the project; that is a team not forming part of the design team.

Value engineering in the US is basically a design audit. It consists of a 40-hour workshop structured loosely around a job plan. It is carried out at 35% design by an external team. It involves selection of high cost areas and the generation of alternatives to them. The selection of high cost areas is a fairly loose procedure. It is based on a comparison of elemental costs with the cost of cheaper alternatives along with a more general analysis of cost centres of the project. This nebulous approach results in a fairly broad Value Engineering output encompassing design changes and cost cuts from all discipline.

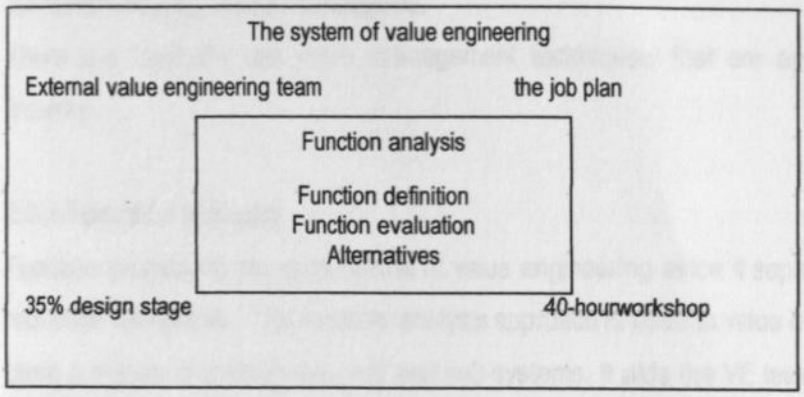

Fig 2.1 Systems of value engineering in construction

Within the workshop the degree of success of the study relates largely to:-

- Personalities involved (especially the group leader)
- The timing of the study
- The interaction of the value engineering team
- The input of the design team
- The role of the client

However this system which was used in the US did not auger well in the British Companies because the original objectives differed. In the US, the system of value engineering was born out a need for greater accountability in government projects whereas in the UK the situation was different. The Quantity surveying system provided all the accountability that was needed. Value Engineering was required to provide a platform for the examination of value as opposed to cost.

The UK construction industry went back to the original work of Miles and started building it own systems that satisfied its own objectives. These systems are now developing under the title of Value Management. (McGeorge, 2002)

2.3 Value Management Techniques.

There are basically two value management techniques that are applied in the construction industry.

2.3.1 Function analysis

Function analysis is the cornerstone of value engineering since it separates VE from direct cost reduction techniques. The function analysis approach is used in value engineering to arrive at the basic purpose of building systems and sub-systems. It aids the VE team in determining the least costs to perform primary functions and peripheral or support functions and identifying costs which can be reduced or eliminated without affecting the performance or reliability of the facility.

Functions are identified by a two word verb-noun description. The verb is an *action verb* and the noun is a *measurable noun. As an* example, the function of an electric cable is to "conduct current." "Conduct" is the action verb and "current" is the measurable noun. Other examples are to "support load,"" contain heat" and" provide access."

The basic function of an item is the specific task or work it must perform. Secondary functions are those functions that may be desired but are not actually required to perform the specific task or work. Required secondary functions are absolutely necessary to accomplish the specific task or work, although they do not exactly perform the basic function.

The following is a list of questions which are helpful in determining the functions of an item:

1. What is its purpose?
2. What does it do?
3. What is the cost?
4. What is its worth?
5. What alternative would accomplish the same function?
6. What would that alternative cost?

In function analysis, it is important to identify functional areas sequentially since the functions vary according to the selected area. For example, the function of the total facility would be established before functions are established for the building elements.

The most difficult part of the function analysis is establishing an estimate of the worth of each subsystem or component for comparison with its estimated cost. Since worth is an indication of the value of performing a specific function, extreme accuracy in estimating the worth is not critical. Worth is merely used as a mechanism to identify areas of high potential savings and value improvement. Subsystems performing secondary functions have no worth because they are not directly related to the basic function. As an example, an access road to an office building does not provide the primary function of housing people even though the road may provide a required secondary function for the facility. Thus, the road is an area to examine for potential savings without affecting the basic function of the facility.

Value engineering looks for alternatives to the original design that might effectively increase the value and or reduce the cost of the project. Alternatives may be developed by asking the basic question, "What else will perform the essential function, and what will it cost?" The alternatives for performing a function identified in determining worth often become part of the creative idea listing for the function.

A function analysis would be completed as follows:

1. Identify the study area.
2. Identify the basic verb/noun function of the study area.
3. List the component parts of the study area.
4. List the verb/noun function of each component and subcomponent.
5. Identify whether each function is basic, secondary, or a required secondary function.
6. Identify the estimated construction cost of each fiction.
7. Speculate on the worth or the least cost to accomplish the function.

As part of the function analysis, the VE team makes a comparison of the cost-to-worth ratios for the total facility and its subsystems. These cost-to-worth ratios are obtained by dividing the estimated cost of the system or subsystems by the total worth for the basic functions or the system or subsystem. High cost-to-worth ratios suggest areas of large potential cost savings and identify systems or subsystems which would be selected for further study by the VE team. Similarly, low cost-to-worth ratios indicate areas where further study efforts would probably not be justified due to diminished potential for cost savings. Cost-to-worth ratios greater than two usually indicate areas with the potential for substantial cost savings and value improvement.

2.3.2 Fast Diagramming:

FAST is an acronym for Function Analysis System Technique. It is a tool that graphically shows the logical relationship of the functions of an item, subsystem, or facility. The FAST diagram is a block diagram based on answers to the questions of "Why?" and "How?" for the item under study. A FAST diagram is most appropriately used on complex systems as a road map for clear delineation of the basic and secondary functions of a particular system.
FAST diagramming may be used to augment the function analysis portion of the information phase and is often most useful in delineating fictional space program issues.

2.4 Organization of the Study.

The systematic methodology used by the VE team to accomplish the workshop is called the VE Job Plan.

2.4.1 Job plan

This is the integral part of value management and it is universal. It represents the discipline or structure of the system similar to the plan of work which architects use. It is the 'life blood' of value management, which runs through the whole process linking the elements together.

Use of the Job Plan assists the VE team in a number of ways:

- It is an organized approach which allows the VE team to analyze a project by quickly identifying high cost to worth areas and selecting alternatives which minimize costs while maximizing quality.
- It encourages the VE team to think in a creative manner, i.e., to look beyond the use of common or standard approaches.
- It emphasizes total ownership costs (life cycle costs) for a facility, rather than just initial capital costs.
- It leads the VE team to develop a concise understanding of the purposes and functions of the facility.

There are six basic phases in the job plan as identified by (Kelly et al, 1993) the combination results in the complete value analysis.. These are:-

1. Orientation
2. Information
3. Creativity
4. Evaluation
5. Development
6. Presentation
7. Feedback

Phase 1: Orientation.

This phase actually precedes the development of the job plan, and so it has been omitted as the first phase of job planning in many considerations. It includes the selection of an appropriate team to accomplish the study. This is done in a meeting whose objective is to pose the questions asked by Mile's namely:

- What is to be accomplished?

- What does the client need or/ and want?
- What are the desirable characteristics?

The purpose of the meeting is to allow everyone involved in the project to understand all the issues and constraints, and also provide an opportunity to those who are to make decisions, to give and receive information. (Maweu, 2006)

Phase 2: Information.

All the information required for the project is gathered. Since this phase is not one of evaluating or judging, the maximum amount of pertinent information should be gathered in the minimum amount of time. (Maweu, 2006)
The specific information being sought at this stage according to (Kelly et al, 1993) includes:-

a) Client's needs; these are the fundamental requirements that a project must possess to serve the client's basic intentions.
b) Client's wants; these are the embellishments that would be nice to have but do not satisfy needs
c) Project's constraints; these are factors that will impose a discipline upon the design e.g. the shape of the site, planning requirements and regulations.
d) Budgetary limits expressed as the total amount, which can be committed to the project, in initial capital and life-cycle costing terms.
e) Time for design and construction as well as the anticipated period for which the client will have an interest in the building.

Fallon (1971) refers to the dilemma between the dangerous consequences of acting upon inadequate information and the possible missed opportunity when waiting for reliable information to arrive.

Phase 3: Speculative/Creative.

The Speculative/Creative Phase is a group interaction process which the VE team uses to identify alternative ideas for accomplishing the function of systems or subsystems associated with specific study areas. This phase involves an open discussion without any restrictions on the imagination or inventive thinking of individual team members. All analysis, evaluation, or judgement of the ideas generated is delayed until the Evaluation/Analytical Phase (VE Program Guide, 1992).

The objective of the Speculative/Creative Phase is to generate a completely free interplay of ideas between team members to create an extensive list of alternative ideas for later evaluation. The key to successful results is the deferral of any critical judgments or comments which might inhibit any of the team members (VE Program Guide, 1992).

Phase 4: Evaluation/Analytical.

According to the VE Program Guide (1992), the ideas developed in the Speculative/Creative Phase are examined to assess which have the best opportunity for implementation, cost savings, and value improvement. The VE team evaluates the feasibility of each idea by identifying its advantages and disadvantages. The ideas are then rated on a scale of one to ten. A ten represents either the best technical idea or the one with the greatest potential for cost savings and value improvement. In ranking ideas, the VE team should consider the following:

- Are the aesthetic, performance, quality and reliability requirements met or exceeded?
- Will excessive redesign or project delay be created?
- Is there improvement in operation and maintenance?
- Will life cycle cost savings be achieved?
- Does the idea have a reasonable chance of acceptance and implementation?

Phase 5: Development/Recommendation.

In this phase, the best ideas from the Evaluation/Analytical Phase are developed into workable VE proposals. The VE team researches and develops preliminary designs and life cycle cost comparisons for the original designs and the proposed alternative ideas. During this phase, the technical expertise of the team becomes very important. Frequently, it is necessary to consult outside experts, vendors, and reference sources to obtain additional evaluation information before developing the VE proposals (VE Program Guide, 1992).

The development of an idea into a proposal should include the following steps:

1. Description of the original design and the alternative idea.
2. Sketch of the original design and the alternative idea.
3. Discussion of the advantages and disadvantages of the alternative idea including its impact on life cycle costs and other key facility issues.
4. Preparation of a cost estimate and a life cycle cost analysis if necessary, for the original design and the alternative idea.
5. Recommendation of preferred approach.

In preparing VE proposals, it is helpful to view them from the design team perspective for value, reliability, cost effectiveness and implementation. In the development of the VE proposals, each alternative idea should be presented as a single independent VE recommendation to ensure each recommendation is reviewed on its own merit (VE Program Guide, 1992).

Phase 6: Presentation.

The refined ideas supported by drawings, calculations and costs are presented by the value management team to the body, which commissioned the value management exercise i.e. the client.

Phase 7: Feedback.

It is important that the value manager receive some details of those ideas that have been put into practice and be given the opportunity of testing the design and cost predictions. (Maweu, 2006)

2.5 Reasons for commissioning a value management study.

Carter (1991/92) identified the following reasons why a client might wish to commission a value management study:

- Client's concern of the escalation of estimated costs;
- Client's concern of tenders received in excess of budget;
- Client loosing confidence in the design team and/or project arising from such factors as planning delays, external factors or lack of competence;
- Client requires an independent audit or appraisal of the project before it is submitted for sanction;
- Client seeks to minimize capital and/or operational costs and maximize profit;
- Client must achieve capital and/or operational savings to make a profit;
- Client wishes genuinely to seek an innovative or better solution to his project;
- Client wishes to experiment with a new technique that he has discovered;
- A consultant recommends a new technique to the client.

2.6 Constitution of the Team.

According to McGeorge and Palmer (2002), the value management team can constitute the design team or an external team that is new to the project and who have no previous involvement in it. Alternatively, it may be a mixture of the two with the presence of a client. In addition specialists may be invited if the project has particular problems and a specialist input is required.

The question of which is the better way of carrying out the study-the design team or external team-is open to dispute. In the US the preferred method tends to be an external team, whereas

the design team is preferred in the UK. There is no wrong or right answer and it is ultimately the choice of the client.

There is of course no such thing as the perfect team. An external team may be advantageous when a project has serious political difficulties for example but it may prove to be more expensive and also unnecessary if functional analysis is used correctly. However, according to McGeorge and Palmer (2002), the design team will provide a more effective value management study than an external team in the majority of cases.

2.6.1 Who should lead the team?

The value management leader or facilitator needs a skill base that includes an in-depth knowledge of functional analysis, group and team building, evaluation of project alternatives and knowledge in construction. It is unlikely that any member of the design team would have these skills and hence an external facilitator is recommended.

2.6.2 Should the client attend the study?

A value management study cannot be carried out without the presence of the client even at the stage of elemental function analysis. The user would also be able to provide a useful insight into the functions of the building and should always be involved. Unfortunately this is not the case (McGeorge and Palmer, 2002).

2.6.3 Team organization

The value management team should not be allowed to become too big. To date, there has been no research into the optimum size of the team of value management study but anecdotal evidence suggests eight as a maximum (McGeorge and Palmer, 2002).

All members of the value management team should be at approximately the same level of seniority; otherwise junior members tend to feel intimidated. Team members must also have enough authority to make major decisions about the project (McGeorge and Palmer, 2002).

2.7 The Timing of the Study

According to McGeorge and Palmer (2002), value management study can be carried out at any point in a project life-cycle. The timing should not in fact, make any difference to the outcome, since the functions of the project do not change simply because the design is at an earlier stage or later stage of development. However, the amount of redesign that may be required increases as the project develops. As a result the cost to change will also increase as will the reluctance of the design team to make the changes.

As the project develops, the ability to change costs decreases rapidly during the design stage as illustrated below. (Ashworth, 1999)

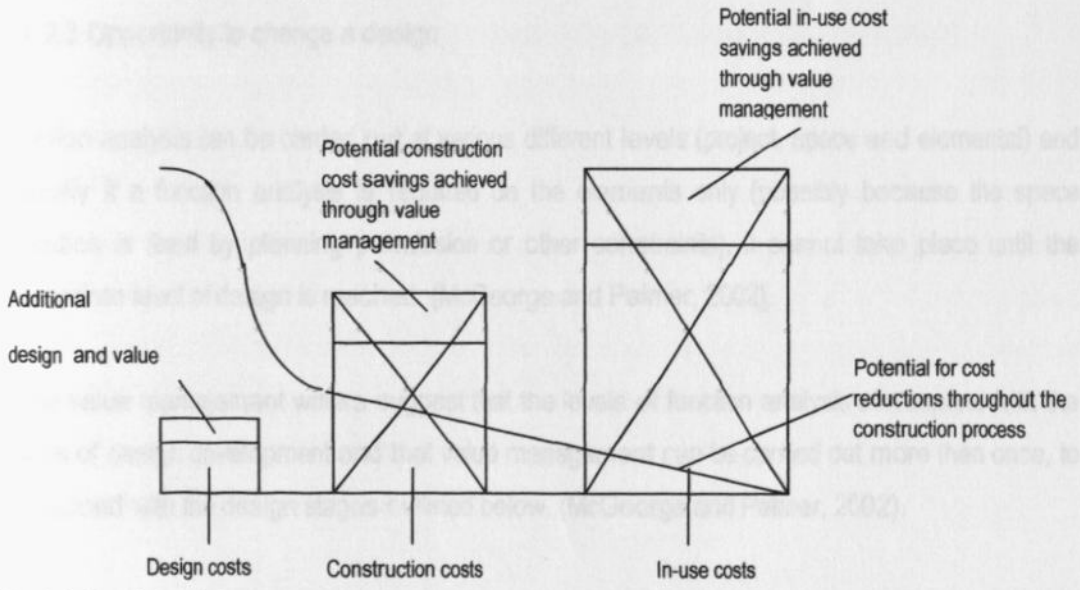

Fig. 2.2 Declining influence on costs

According to Heller (1971) the earlier value management is undertaken the better in order to control subsequent increases in design and planning costs because it is easier to make such changes during the earlier stages of a project than when the project design or the construction phase is nearing completion.

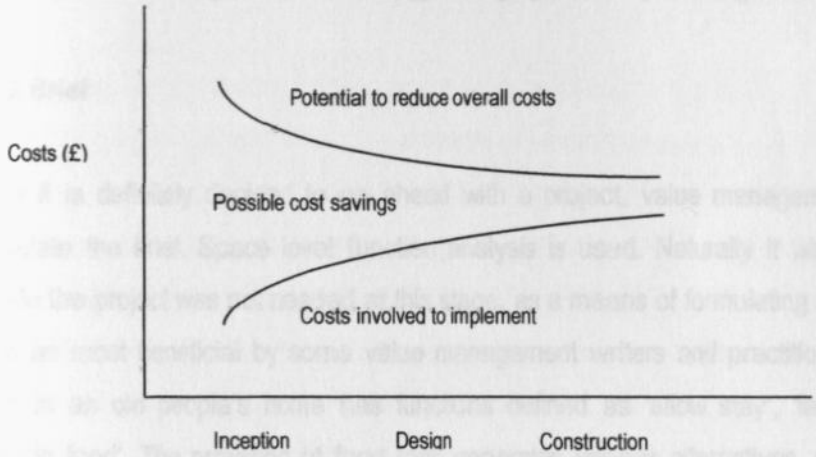

Fig. 2.3 Opportunity to change a design

Function analysis can be carried out at various different levels (project, space and elemental) and naturally if a function analysis is required on the elements only (possibly because the space allocation is fixed by planning permission or other constraints), it cannot take place until the appropriate level of design is reached. (McGeorge and Palmer, 2002).

Some value management writers suggest that the levels of function analysis correspond with the stages of design development and that value management can be carried out more than once, to correspond with the design stages outlined below. (McGeorge and Palmer, 2002).

2.7.1 Inception

Value management can be used as a means of deciding if the project is really needed. The highest level of function analysis is used. For example a local authority decides to build a new

power station. A function analysis shows it is required because the existing power station cannot satisfy demand. The function of the power is therefore to 'satisfy demand'. This can be achieved either by increasing the supply of electricity or reducing the demand. One way to reduce demand is to encourage people to use energy saving light bulbs. Rather than build a power station it might therefore be better to give out free energy saving light bulbs (McGeorge and Palmer, 2002).

2.7.2 Brief

Once it is definitely decided to go ahead with a project, value management can be used to formulate the brief. Space level function analysis is used. Naturally it will still be possible to decide the project was not needed at this stage, as a means of formulating the brief, is the stage seen as most beneficial by some value management writers and practitioners. For example a ward in an old people's home has functions defined as 'allow stay', 'facilitate nursing', and 'provide food'. The provision of food then generates various alternatives, particularly given the current emphasis by large organizations on outsourcing (McGeorge and Palmer, 2002).

2.7.3 Outline proposals (35% design)

At this stage the design is more developed and it is possible for the value management team to offer alternatives based on the elemental design and specifications. Elemental function definition would be used. Once again value management proposals based on changing the nature of the project or its spatial layout could be put forward but this would require redesign work at this stage.

2.7.4 During construction

Value management proposals put forward by the contractor have been used for a considerable period, particularly in the USA where these as known as Value Engineering Change Proposals (VECPs). Often the contractor is given some financial incentive to make the proposal and this is usually in the form of a percentage o the saving achieved. There are many problems associated

with VECPs, not least the question of design liability. In addition many contractors operating under traditional procurement methods particularly feel no incentive to offer change proposals, since the saving achieved may be outweighed by reduction in the scope of the work.

2.8 Evaluation of alternatives

The methods for evaluating value management proposals are numerous but perhaps the one commonly used is weighted matrix, an example of which is shown in the Table 2.2

According to McGeorge and Palmer (2002) the matrix shows a wide range of possible light fittings along with some criteria which they will be evaluated. Each criteria is weighted to reflect their importance, so that in the case illustrated in Table 2.2, aesthetic is viewed as the most important criterion, cost as the next important and so on. Each of the fittings is then given a rating for each of the criteria based on the following scale:

Excellent:	5
Very good:	4
Good:	3
Fair;	2
Poor:	1

In the example shown in Table 2.2, florescent fittings, when evaluated against cost criteria was given the rating of very good (4) whereas aesthetically they were rated poor (1). The rating is then multiplied by the weighting to give a total score of 24 and an aesthetic score of 10. These figures are then collected into an overall total. In this case 64, which can be compared with the other light fittings. The alternative with the highest rating, in this case the fluorescent fittings, is the optimum choice.

Table 2.2 Weighted matrix

Method	Initial cost	Maintenance	Aesthetics	Energy impact	Construction time	Total
Weighted	6	3	10	3	3	
Surface mounted incandescent	18/3	3/1	20/2	3/1	6/2	50
Mercury vapour	18/3	9/3	20/2	6/2	6/2	59
Fluorescent fixture	24/4	12/4	10/1	9/3	9/3	64

Source: (McGeorge and Palmer, 2002)

Another similar method of evaluation is the smart system. This is slightly different from the system above in that, as shown in Table 2.3 the allocated weightings must all be a proportion of 1. In addition the rating of each alternative is not based on a predetermined scale but on the degree to which the alternative satisfies the criteria. This score is given out of 100. In case of fluorescent fittings therefore, it might be judged that in terms of cost it satisfies the criteria 80 out of 100 whereas in term of appearance it only satisfies it 10 out of 100. These scores are then multiplied by the weightings and totaled to give an overall rating. Once again the alternative with the highest score is viewed as the best option (McGeorge and Palmer, 2002)

Table: 2.3 The smart methodology

Method	Initial cost	Maintenance	Aesthetics	Energy impact	Construction time	Total
Weighted	0.24	0.12	0.4	0.12	0.12	1.00
Fluorescent fixtures	80/19	80/10	10/40	60/7	60/7	83

Source: (McGeorge and Palmer, 2002)

Other techniques available for evaluation rely on quantification and more on subjective judgement. Some rely simply on a voting system. The amount of quantitative evaluation that takes place really depends on the stage of project development. At the brief stage it may be very difficult to analyze quantitatively the alternatives proposed by the value engineering team and the choice may simply depend on the preference of the client. If on the other hand the alternatives are well structured then these may be analyzed using a weighted matrix.

2.9 Alternative approaches to value management

There are a number of different approaches that can be adopted when carrying out value management with the choice often being decided by the type and nature of the project, the timing of the operation and the make up of the design team (Seeley, 1996).

2.9.1 Forms of value management

According to Seeley (1997), there are eight forms of value management. These are described as follows:-

2.9.1.1 Charette

This is undertaken after the project brief has been formulated and the design team appointed but before actual design is commenced. The clients representatives and the design team meet under the chairmanship of a value manager/facilitator for one or two days in order that the brief can be examined in detail and questions raised.

The next stage is to generate ideas for rationalizing the brief, when functional analysis of the space requirements can form a major component and improving the projects' cost effectiveness. These ideas are then evaluated and, if accepted, are incorporated in a revised brief.

2.9.1.2 The 40 Hour Value Management Workshop/Study

This is probably the most widely accepted formal approach to value management, and it is used as the basis for training of value engineers as prescribed by the Society of American Value Engineers (SAVE). It is normally undertaken at about 35% of the way through the design stage which is about as late a stage as is reasonably practicable. The sketch design of the project is reviewed by an independently appointed second design team, under the chairmanship of a value management or value engineering team coordinator (VMTC/VETC), the composition of this team of possibly 6 to 8 professionals reflecting the characteristics of the project under review. For example a project involving a substantial proportion of mechanical and electrical work would create the need for 4 persons with these professional backgrounds to form part of the team.

The workshop normally takes place near the project site. The complete drawings are sent to VMTC/VETC for distribution to the team during the week preceding the workshop/study. During the week of the workshop/study, the team strictly follows the stages of the job plan.
The 40 hour study spread over 5 days concludes with a number of design or construction modifications which are referred to the client endorsement and implementation.

2.9.1.3 One-Two Day Workshop/Study

This approach has been strongly advocated to be more appropriate in the UK. It is recommended that a two day study be held on a Friday and Monday, while a one day study can be held on any weekday. All members of the project design team should be represented including the client, facilities manager, letting agent and other relevant parties. At the beginning, each team member usually makes a brief verbal presentation using drawings or other suitable material, with a maximum duration of 10-15 minutes.

The value manager frequently records the relevant data on flip charts, and seeks to identify major constraints which can be physical (site, ground conditions, height, light or access), operational, statutory (company/legislative), time or cost, each having an impact on the project.

The next stage involves the preparation of FAST (Functional Analysis System Technique) diagrams. The quantity surveyor/cost engineer then breaks down the cost plan (where available) over the weekend, hence the choice of Friday and Monday for the study.

The FAST diagram is then examined to identify any functions which appear to have an abnormally high cost or to identify function which can be omitted or modified. The next step is an intensive session (brainstorming) which could reasonably be expected to generate suggestions to modify the design or construction proposals in order to achieve a more efficient design or technical solution to eliminate unnecessary costs.

These suggestions are reviewed as being either:
(a). rejected (with reasons recorded) or
(b). to be developed by the project team.

The latter items are then prioritized. The value manager/engineer then compiles a comprehensive report, encompassing all the elements of the study and concluding with commendations as to which items are to be developed by the project team. This report is normally issued within 5-7 days or at the end of the study to the client or project sponsor for implementation.
This shortened form of study is much cheaper and quicker than the 40 hour workshop

2.9.1.4 Two or Three Day Workshops

This is a joint venture of E.C. Harris and Australian value management and involves a planned series of highly structured think tank sessions chaired by an outside professional facilitator. The

two successive workshops explore the objectives, perceptions and interpretations of the brief and address issues in a pre-emptive way.

On day one of the workshop, arranged at the earliest possible stage, ideas which ay amount to hundreds are reduced to a workable shortlist by rating their cost and functional values. On the second day, approximate cost implications are identified in groups working with the quantity surveyor and project manager. They are finally rated and prioritized for possible incorporation on the third day. After design development a further three day workshop ensures that the project is reflecting its original aims and that cost effective solutions are being identified. It is claimed that potential benefits using this approach are substancial and give as an example the £35m savings made on the £100m Brisbane International Airport.

2.9.1.5 The Concurrent Study

This approach uses the existing project team under the chairmanship of a value manager or facilitator. The group meets on a regular basis during the project design phases, offering maximum continuity. However, it has the disadvantage that creativity is not so evident and it may be more expensive than the 40 hour workshop (Smith, 1993).

2.9.1.6 The Package Review

This is often used in management forms of contract, wherein package reviews, consisting of a detailed appraisal of each package (or element or trade) are undertaken by the project team as an ongoing process, continuing throughout the design, procurement and construction phases. Discussions with specialist contactors and manufacturers form an important part of this process (Smith, 1993).

2.9.1.7 The Contractor's Change Proposal

This is a value management change proposal initiated by the contractor after the contract is let. Under US government contracts, the contractor is encouraged to develop value engineering proposals on a voluntary basis. The contractor then shares in any resultant savings if the value engineering plan is implemented (Smith, 1993). The major benefit is that it permits the contractor to be proactive and to use his construction/engineering knowledge and expertise to improve a facility at the on-site stage. Whilst the disadvantage is that the contract may be delayed while the design team investigates the merits and viability of the proposed changes. For this reason any changes tend to be relatively superficial (Kelly and Male, 1993).

2.9.1.8 Design and/ Construction Audit

This process aims to define a project's objectives by formulating a list of the client's needs and wants, and provides a clear indication of both cost and worth of a project. The procedure adopted often follows that of the charette or a 40 hour workshop (Smith, 1993). Kelly and Male (1993) also describes a value engineering audit, whereby a value engineer acting on behalf of a large corporate company or government department reviews expenditure proposals submitted by subsidiary companies or regional authorities, and the procedure follows that of the normal job plan.

2.10 Importance of Value Management

According to Seeley (1997), there are doubtless many benefits to be gained by adopting value management techniques. The most important aspects are;-

- Reduce project costs;
- Improve design efficiency;
- Optimize value for money;

- Concentrate design effort;
- Advance design decisions;
- Highlight design options for selection;
- Improve ways to comply with the brief;
- Afford an independent functional review.

Carter (1992) has clearly examined both the benefits and possible disadvantages of value management and his findings follow:

2.10.1 Benefits

- Examines function and cost
- Provides opportunity for options to be considered
- Seeks better technical and more cost effective solutions
- Identifies and reviews constraints and criteria affecting the project
- Design changes can be accommodated at minimal cost (if study conducted early)
- Opportunity for in-depth project review and greater understanding for all team members
- Team building
- Identifies and can eliminate unnecessary costs
- Generates greater client confidence
- Can shorten overall programme period (longer brief or design period and shorter production or construction period).
- Assists in client decision making

2.10.2 Disadvantages

- Extra work for existing project team, which is not always reimbursed, as it is at the client's discretion
- Disruption to project team

- Can incur extra fees
- Can extend design period

Carter (1992) also raises the very pertinent point concerning traditional projects, as t how many where the tender comes within the budget, does the design team look for savings or improved value, even though there could be a potential saving of as much as 5-10% on many schemes.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the procedures that have been followed in conducting the study.

3.2 Study area

The purpose of the study is to determine whether and how value management applied in the construction industry of Kenya.

3.3 Target population

The target population consisted of practicing architects, quantity surveyors and contractors based in Nairobi. Inferences were then made from the findings to represent the whole construction industry in Kenya.

Most of the above key industry participants are located in Nairobi although they are involved in construction projects country-wide.

3.4 Research design

To satisfy the scope and the objectives of the research, relevant information was collected from the population through questionnaires. Therefore a survey research was conducted with reference to the construction industry participants.

3.5 Sample size

The sampling frame constituted all the registered architects, quantity surveyors and contractors firms which had Nairobi addresses for convenience and accessibility purposes.

The identification of these was through the lists provided by the Board of Registration of Architects and Quantity Surveyors (BORAQS) and Ministry of Works.

Those who met the above criteria qualified to be included in the population and included 122 registered quantity surveyors' firms, 225 registered architect firms, and 312 contractor firms from which a sample was selected

When determining the sample size a confidence level of 95% of the target population was assumed and thus the response achieved from the sample lay within positive or negative 5%of the true state of the population target.

The following formula was used to arrive at the sample size.

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

Where

N= population size

n= sample size

P= confidence level

q= (1-P)

e= acceptable error. [e=0.05] 5% true

Z= value of standard variant at a confidence level from normal distribution table

According to BORAQS, the list obtained on May 2008 indicated that there were 126 registered quantity surveyors' firms of which 122 were located in Nairobi.

The registered architect firms were 228 and 225 of these were situated in Nairobi.

From the Ministry of Works 312 contractor firms were registered and were located in Nairobi.

The figures were added to constitute the population which was then subjected to the formulae above. This yielded a sample size of 66 firms.

The sample was then constituted as follows:

Quantity surveyors

$$n = \frac{122*66}{659}$$

$$= 12$$

Architects

$$n = \frac{225*66}{659}$$

$$= 23$$

Contractors

$$n = \frac{312*66}{659}$$

$$= 31$$

Table 3.1 Population and sample size selection

Respondents	**Population**	**Sample size**
Quantity surveyors	122	12
Architects	225	23
Contractors	312	31
Total	**659**	**66**

Source: field survey, June 2008

The sample size obtained is big enough to minimize the sampling error compared with the minimum number of 30 members recommended for undertaking this kind of study (Mugenda and Mugenda, 2003)

3.6 Sampling techniques

For ease and simplification of the work the area of study was divided into three cluster groups. These are:-

1. Architects
2. Quantity surveyors
3. Contractors

Random sampling was then carried out in each cluster separately where one firm was picked randomly and every tenth firm thereafter was picked to come up with the sample from each of the list of the three clusters.

3.7 Data collection instruments

The instrument used to collect data was the questionnaire which was administered to the selected sample by the researcher.
Primary data was thus used for the study.

3.8 Data collection procedure

Before the questionnaire was used in the study a pilot study was first conducted. The questionnaire was issued to a selected sample to aid in testing and further improvement.
The questionnaires were taken to the respective firms' offices and given to the relevant persons to be filled in.
The data collected from the respondents through the filled in questionnaires was then analyzed.

3.9 Data analysis techniques

The data collected in this study was basically quantitative and therefore data presentation and analysis is mainly based on empirical techniques. Descriptive statistics have been used to explain the various relationships and outcomes. To achieve this, responses were coded for ease of analysis. This was facilitated by the questions in the questionnaire being close ended.

The few open ended questions in the questionnaire were categorized and numerical values assigned to various categories for ease of analysis.

Simple descriptive statistics like the mode, mean, median, proportions and percentages have been used where applicable for illustration of the findings.

Inferential statistics has been applied to assist in testing of hypothesis.

3.10 Data presentation

Tables have been drawn to show the relationships and proportions of the outcome and findings. A report in narrative form has then been used to explain the findings.

3.11 Measurement of variables

3.11.1 Independent variable

The independent variable in this study is viewed as the level of awareness on value management. An ordinal scale ranging from 1 to 5 was used in the measurement of the components of this variable where the following score sheet was used to rank the level of awareness of each respondent.

Table 3.2 scoring for level of awareness

Component	Maximum score
Knowing about value management	2
Attending value management workshop	2
Total	**4**

Source: field survey, June 2008

3.11.2 Dependent variable

How value management is carried out or applied in the Kenyan construction industry has been viewed as the dependent variable. The measurement of components of this variable was in an ordinal scale ranging from 1 to 4. The following scoring sheet was used to rank how value management was applied by each respondent.

Table 3.3 scoring for how value management is applied

Component	Maximum score
Use of value management technique	2
Design team facilitating the value management workshop	1
Value management study undertaken at design stage	1
Using any value management component	1
Total	**5**

Source: field survey, June 2008

CHAPTER FOUR

DATA ANALYSIS

4.1 Introduction

This section gives a quantitative analysis based on the data collected to determine whether and how value management is practiced in the Kenyan construction industry. The data is interpreted and explained and presented by using tables and descriptions. Of the 66 respondents issued with questionnaires, 54 gave their response which represents 81.82% of the total.

4.2 Value Management Awareness

The aim of the study was to find out whether and how value management is applied in the Kenyan construction industry. A question was put forward to the respective respondents asking them if they had ever heard of the term value management before. The participants were given a brief definition of value management in the questionnaires to enable them to respond to this question. The table below shows the results obtained.

Table 4.1 Value Management Awareness

Response	Contractors		Architects		Quantity Surveyors		combined	
	No.	%	No.	%	No.	%	No.	%
Yes	16	64	19	100	10	100	45	83.3
No	9	36	0	0	0	0	9	16.7
Total	25	100	19	100	10	100	54	10

Source: Field Survey, June 2008

All the architects and quantity surveyors said they were aware or had heard of value management before. For the contractors only 64% of the total had heard of value management before.

4.3 Attendance to a Value Management Workshop

The respondents were further asked if they had ever attended a value management workshop to analyse a clients' brief before the actual design was done. The results obtained are as shown below in Table 4.2.

The total number of participants that had attended a value management workshop was slightly above 50%. The number of architects, which was the highest was 78.9% followed by that of quantity surveyors which was 70%. Contractors however depicted a much lower number which stood at 32%.

Table 4.2 Attendance to a value management workshop

Response	Contractors		Architects		Quantity Surveyors		combined	
	No.	%	No.	%	No.	%	No.	%
Yes	8	32	15	78.9	7	70	30	55.6
No	17	68	4	21.1	3	30	24	44.4
Total	25	100	19	100	10	100	54	100

Source: Field Survey, June 2008

4.4 Stage of Involvement in a Project

In order to verify the results obtained in Table 4.2, a question was put across to determine the stage at the contractors and the quantity surveyors were involved in a construction project.

The results obtained indicated that the quantity surveyors were usually involved during the design stage. The contractors however, more than 65%, were involved after the design stage. This means they don't take part in the design and hence the reason for the low number who have ever attended a value management workshop.

4.5 Stage of Implementation of Decisions

The research also sought to find out the best stage at which the decisions passed during the workshop were implemented. This question was however directed to only those who had attended a vale management workshop before. The results are as shown in table 4.3.

Majority of the respondents, 70%, said that the best stage to implement the decisions was during the design stage. 26.7% thought that the construction stage was the best option while 3.3% of the respondents thought that the brief stage was the best stage to implement the decisions.

Table 4.3 Stage of decision implementation

Response	Contractors		Architects		Quantity Surveyors		combined	
	No.	%	No.	%	No.	%	No.	%
Brief	0	0	1	6.7	0	0	1	3.3
Design	5	62.5	12	80	4	57.1	21	70
Construction	3	37.5	2	13.3	3	42.9	8	26.7
Total	8	100	15	100	7	100	30	100

Source: Field Survey, June 2008

4.5.1 How Decisions are implemented

Further, a question was posed to the architects and quantity surveyors to find out how the decisions passed in the workshops were implemented. The question was also restricted to those who had attended a value management workshop before. The total number of participants who responded to this question was 30.

The data obtained was classified in three groups:

1. Project function
2. Space function
3. Elemental function

Two architects and one quantity surveyor said that the decisions were implemented based on the three groups. However majority said that the decisions were mostly implemented based on the project function followed by the space function or both.

4.6 Constitution of the Value Management Team

Another question was put across to find out who facilitated the value management workshop. The respondents, those who had attended a workshop before gave the following results as indicated in Table 4.4.

Majority of the participants, 76.7%, said that the value management workshop was facilitated by the design team. 13.3% said that the workshop was facilitated by an external team who in their case was a project manager. 10% said that the workshop was facilitated by a mixture of the two: the design team and the external team.

Table 4.4 Value management team

Response	Contractors		Architects		Quantity Surveyors		combined	
	No.	%	No.	%	No.	%	No.	%
Design Team	4	50	13	86.7	6	85.7	23	76.7
External Team	2	25	2	13.3	0	0	4	13.3
Mixture	2	25	0	0	1	14.3	3	10
Total	8	100	15	100	7	100	30	100

Source: Field Survey, June 2008

4.7 Duration of the Workshop

The researcher wanted to find out how long the workshops lasted and posed a question to the architects and quantity surveyors.

All responded saying it took a day or more but said various factors determined how long the workshop lasted. The factors mentioned include:-:

- the client
- the members in the value management team
- the nature of the project (clients brief)
- the timing of the workshop

4.8 Offering of Value Management Services

A question was directed to the quantity surveyors to find out if they offered value management services. This question targeted those who were aware of this technique as they were in a better position to respond to this and the results obtained are as shown in the Table below.

Table 4.5 Quantity surveyors offering value management services

Response	Quantity Surveyors	
	No.	%
Yes	7	70
No	3	30
Total	10	100

Source: Field Survey, June 2008

70% of the quantity surveyors interviewed said that they offered value management services while 30% said that although they were aware of the technique they did not offer the services.

4.9 Benefits

All the respondents said there were benefits associated with application of value management on building construction projects. The question was however directed to architects and contractors who were aware and had attended a value management workshop.

Further, the researcher also aimed to find out how satisfactory the benefits that resulted from the application of value management technique were. The results obtained are as shown below in Table 4.6.

From the table not even one respondent was totally satisfied with the benefits that arose as a result of value management application. Majority of them said that they were just satisfied. This represents a 78.3% of the total interviewed. 21.7% of the respondents said they were neutral

Table 4.6: Level of satisfaction

Response	Contractors		Architects		combined	
	No.	%	No.	%	No.	%
Totally satisfied	0	0	0	0	0	0
Satisfied	6	75	12	80	18	78.3
Neutral	2	25	3	20	5	21.7
Dissatisfied	0	0	0	0	0	0
Total	8	100	15	100	23	100

Source: Field Survey, June 2008

4.10 Minimization of Life Cycle Costs

Life cycle costing should be undertaken in every project in order to determine the worth of a building in terms of the expected returns and the total costs to be incurred over the useful life of the building.

Only contractors were considered in this question as they are the ones involved in the actual construction works and thus were thought to be more knowledgeable in terms of materials used in construction and their maintenance rate than the other two parties. The results obtained are as shown in Table 4.7.

Table 4.7 Potential to reduce life cycle costs

Response	Contractors	
	No.	%
Design	15	60
Construction	9	36
In-use (Maintenance)	1	4
Total	25	100

Source: Field Survey, June 2008

60% said that the best stage to minimize life cycle costs was during the design stage. 36% on the other hand said that the best stage to minimize life costs was during the construction stage as compared to 4% who said it was during the maintenance stage that this could be best realized.

4.10.1 Source of Unnecessary Costs

This question targeted the contractors only and the researcher wanted to find out which was the most contributing factor of the unnecessary costs.

64.1% of those who responded to this question cited poor material specification as the major source of unnecessary costs.

This was followed by failure to properly account for the life cycle costs of the building which was cited by 29.3%.

6.6% of the participants cited other factors such as;

- the failure of the design to consider buildability aspects
- incorporation of components with no real function

4.10.2 Elimination of Unnecessary Costs

Measures must be put in place in order to eliminate unnecessary costs in construction projects. A question was thus put across to the architects and quantity surveyors in order to identify the best

stage in a construction project at which unnecessary costs can be eliminated. The table below gives an account of the results that were obtained.

Table 4.8 Unnecessary costs elimination phases

Response	Architects		Quantity Surveyors		combined	
	No.	%	No.	%	No.	%
Brief	2	10.5	0	0	2	6.9
Design	14	73.7	8	80	22	75.9
Construction	3	15.8	2	20	5	17.2
Total	19	100	10	100	29	100

Source: Field Survey, June 2008

6.9% of the participants recommended that the best stage to eliminate unnecessary costs was during the brief. However this only came from the architects. 75.9% on the other hand recommended the design stage to be the best stage to achieve this which also represents the majority of the participants. The construction stage was recommended by 17.2% of the total respondents.

4.11 Maximization of Profits

In most construction projects, profits or returns is a major factor to be considered. This may influence the undertaking or the abandonment of a project depending on the gains it is anticipated to garner in the short run or long run.

The researcher intended to seek which method is mostly used to maximize the profits in construction projects. The information was sought from architects and quantity surveyors who provided the following information as shown in Table 4.9.

Table 4.9 Profits maximization

Response	Architects		Quantity Surveyors		combined	
	No.	%	No.	%	No.	%
Cost cutting Measures	7	36.8	4	40	11	37.9
Value maximization Measures	12	63.2	6	60	18	62.1
Total	19	100	10	100	29	100

Source: Field Survey, June 2008

37.9% of the total participants said that cost cutting measures were employed in order to maximize costs. These measures were achieved through cost planning and life cycle costing techniques.

62.1% cited that profit was maximized by employing price/value maximization measures which are achieved through value management.

4.11.1 Clients' Concern

The main contract in a construction project is signed between the contractor and the client. The contractor is deemed to know what the client wants to attain from the project through the clients' representatives.

The researcher aimed at finding out the major concern from clients through the contractors. Table 4.10 shows the results obtained.

Table 4.10 Clients' concern in construction projects

Response	Contractors	
	No.	%
Cost Minimization	15	60
Value Maximization	10	40
Total	25	100

Source: Field Survey, June 2008

From the table we find that most of the clients are concerned with cost minimization which represents 60% as opposed to value maximization which represents 40% of the total during the pre-contract stage.

4.11.2 Value for Money

This question was directed to the architects and quantity surveyors in order to find out how value for money is obtained through the minimization of life cycle costs.

Majority responded that proper specifications in the initial stages of design was the best way to achieve this. All architects believed that this is the best way to achieve value for money. 80% of the quantity surveyors were at par with this.

Quality construction was also regarded to assist in the minimization of life cycle costs. 52.3% believed that quality construction and proper specifications were equally important whereas for the quantity surveyors, only 30% agreed to this.

Quality maintenance was considered by a minority to aid in life cycle costing. They argued that the above two are the primary factors and when they have been properly carried out; life cycle costs are drastically reduced. Quality maintenance is regarded as a secondary factor and is dependent on how the above two are administered.

4.12 Rating of the three core objectives

For a project to be deemed successful, the three core objectives must be realized. This research aimed at finding out how the three core objectives (time, cost and quality) are rated in construction projects. The results obtained are as shown in the table below.

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Table 4.11: Scores of the core objectives

Objective	Rating					
	1	2	3	4	5	Average
Time		4	10	9	6	3.6
Quality		1	3	9	16	4.4
Cost		2	4	11	12	4.1

Source: Field Survey, June 2008

From the table, quality was ranked highly followed by cost and the time.

The table below summarizes the scores obtained for the level of awareness and how value management is applied in the Kenyan construction industry. The scores are then used for various inferential statistical analyses in order to answer the objectives of the project.

Table 4.12 Scores of respondents

Respondent No.	Level of value management awareness	How value management is applied
1	2	0
2	0	0
3	0	0
4	2	0
5	4	5
6	4	4
7	0	0
8	2	0
9	2	0
10	0	0
11	2	0
12	4	4
13	2	0
14	2	0

Respondent No.	Level of value management awareness	How value management is applied
15	4	5
16	0	0
17	0	0
18	0	0
19	4	4
20	4	5
21	4	5
22	0	0
23	4	4
24	0	0
25	2	0
26	2	0
27	4	5
28	4	5
29	4	4
30	4	5
31	4	5
32	2	0
33	2	0
34	4	5
35	4	5
36	4	4
37	4	5
38	4	5
39	4	5
40	4	5
41	2	0
42	4	5
43	4	5
44	4	5
45	4	5
46	4	5

Respondent No.	Level of value management awareness	How value management is applied
47	4	5
48	2	0
49	4	5
50	4	5
51	4	4
52	4	5
53	2	0
54	2	0

Source: Field Survey, June 2008

The respondents were each ranked on a scale of four for the awareness and five for how value management is applied.

The mode, median, and mean for the two variables are shown in the table below.

Table 4.13 Simple descriptive statistics for illustration of the findings

		Level of value management awareness	How value management is applied
N	Valid	54	54
	Missing	0	0
Mode		4	0
Median		4	4
Mean		2.78	2.65

Source: Field Survey, June 2008

The mean for the level of value management awareness was 2.78 out of 4 while that of how value management is applied was 2.65 out of 5. 4 and 5 represents the respective weighted averages accorded to the level of value management awareness and how value management is applied as shown in Chapter Three.

4.13 Findings on the study objectives

Value management has several indicators which have been identified in countries which have a value management system in place. These are:-

1. Function definition
   - Project function
   - Space function
   - Elemental function
2. Group approach
   - Design team
   - External team
   - Mixture of the two
3. Format of value management study
   - 40 hour workshop
   - 2 day workshop
   - Other as applicable
4. Timing of study
   - Brief stage
   - Design stage
   - Construction stage
5. Function evaluation (lowest cost to achieve function)
6. value management facilitator
   - In-house
   - Independent
7. Allocation of cost to function
8. Organization of the study (Job plan)
9. Calculation of worth

10. Evaluation of alternatives
    - Weighted matrix
    - Voting
    - Subjective evaluation
    - Other mathematical technique
11. FAST diagrams application
12. Generation of ideas
    - Brainstorming
    - Other creative technique
    - Ad hoc
13. Location of the study
    - Within site environment
    - Outside site environment

The main objective of the study was to determine whether and how value management is applied in the Kenyan construction industry. To establish this, construction industry practitioners were interviewed in order to find out how conversant they were with the technique.

From the findings of this study, many of the industry participants are aware of value management as reflected by the high percentage number (83.3%). 64% of contractors interviewed are aware of the technique whereas all the quantity surveyors and the architects rare conversant with the technique.

Despite the fact that majority of the respondents were aware of the technique, not all have attended a value management workshop. Only 55.6% of the total has attended a workshop to analyse a clients' brief before the actual design. Only 32% of the contractors have attended a workshop compared to 78.9% of the architects and 70% of the quantity surveyors. This means that contractors are usually left out in the design stages of a project.

The study found that majority of the contractors were involved in the construction stage although their inclusion in the design stage is highly important because they are the ones who are well versed with the buildability aspects which are known to emanate from the design. This is reflected by the low number of contractors who had attended a workshop.

The constitution of the value management team is a factor to be considered when undertaking the study. The team members should be well versed with the construction industry practices and technology in order to come up with sound decisions which are to be implemented in the construction projects. It was found that majority of the workshops were facilitated by the design team. This was represented by (76.7%) and their role was to evaluate the various design alternatives and come up with the best alternatives to be implemented in the construction project.

The format of value management applied is usually determined by the duration of the workshop. The study found that there is no particular format of value management that is applied in the Kenyan construction industry. The duration depended on the management style of the team and the client. The workshop could run for one day or a couple of days.

The decisions passed on in the workshop are supposed to be implemented in the project. The phase of implementation consequently bears to a large extent the productivity of these decisions. The study found that the best stage for implementing these decisions was during the design stage through a majority of 70% of the total participants. This was based on the fact that a good design produced a quality finished product all the other factors held at a constant and the opposite, a faulty design resulted to a poor finished product was found to be true also.

The study also found that the decisions were implemented based on two factors; the project function and the space function. Majority of the quantity surveyors preferred the implementation of the decisions through the functions of the project while the majority of the architects preferred the implementation of decisions through the functions of the spaces.

Value management has various advantages. All those who had applied value management in their projects witnessed this but when asked how satisfied they were with results it was found that not even one of the respondents was totally satisfied with the results. 78.3% said they were satisfied while the rest said they were neutral.

Quantity surveyors are endowed to advise their clients on the cost implication of the projects at the initial stages. Offering of value management services comes in hand because the quantity surveyor is the most resourceful person to offer advice on cost related decisions. The study found out that 70% of the quantity surveyors offered value management services to their clients.

Unnecessary costs (costs which provide neither use, nor life, nor quality, nor appearance, nor customer features) may lead to cost and time overruns when they are not dealt with in the correct manner. The main cause of unnecessary costs was found to be poor material specification as cited by a majority 64.1%. Failure to properly account for the life cycle costs of the building was found to be the second most contributing factor. This was cited by 29.3%.

Measures have to be undertaken to counter these factors that give rise to unnecessary costs and these measures have to be implemented at the right phase to realize this. The study found out that the best stage to implement these decisions so as to eliminate unnecessary costs is during the design stage. During this stage the standards and quality of materials to be used are specified.

Life cycle costs in any building construction project have to be put into consideration in order to determine how they should be minimized. Life cycle costs encompass the total costs of the building throughout its whole economic life. The design stage was found to be the best stage to minimize the life cycle costs by a majority 75.9% of the respondents.

Achievement of value for money in every project is a major target. The best way to achieve this was found to be through proper specifications in the initial design. This helped to minimize the lifecycle costs through a substantial reduction in the maintenance costs.

It is the desire of every client to maximize profits in every business. This may be achieved through cost minimization or through value maximization. From the study it was found out that most clients (60%) are concerned with cost minimization in order to maximize their profits.

The study also found that although the three core objectives which determine the success of a project; cost, quality and time are paramount, they are ranked differently in different projects. The ranking depended on various factors like;

- The necessity of the project
- The financial base of the client
- The purpose of the project.

In spite of this quality was ranked highly obtaining a score of 4.4 out of 5. Cost came in second with a score of 4.1 out of 5 while time came in third with a score of 3.6 out of 5. This shows that quality is highly regarded in most of the construction projects over cost and time.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From the study it can be concluded that value management is generally applied in the Kenyan construction industry because most of the value management indicators are carried out. From the checklist nine out of the thirteen value management indicators listed in the previous chapter are carried out.

Majority of the industry practitioners are also conversant with the technique as indicated by the mean rates. The mean rate for the awareness of value management stands at 2.78 out of 4 which is above half. The same case applies to the mean rate of how value management is applied which stands at 2.65 out of 5.

Another objective of the study was to find the stage at which value management is applied in the Kenyan construction industry. It can be deducted that value management is usually undertaken at the design stage of a construction project.

The study also found that the design team was used to facilitate the value management study in most cases in the Kenyan construction industry. The main role of the design team was to evaluate the various design alternatives and come up with the best alternative which fulfilled the laid down functions without compromising the quality standards that were set out.

It can also be concluded that there is no value management system that is applied in the Kenyan construction industry. The study found that there was no specific way through which a value management study was undertaken but each study was unique in its own way. The study of depended on various factors such as the financial base of the client and the nature of the project.

Most of the crucial decisions are made in the design stage. Decisions which assist in the elimination of unnecessary costs and minimization of life cycle costs have been found to be more effective when passed and implemented at this stage.

It was hypothesized that the phase at which the value management team determine how value management is applied in the Kenyan construction industry. This has been found to be true in that the value management team which mainly constituted the design team (Architects, Quantity Surveyors and Engineers) and the client usually determined the phase at which value management is applied. The design team also facilitated the value management study in majority of the cases.

The design team and the client also determined the format of value management that was applied in the construction projects as established in the study.

5.2 Recommendations

Since the contractors undertake the construction works of the building, other procurement methods that involve the contractors in the design stage would be encouraged. However, the procurement methods would have to be tested first and if found to be advantageous recommended to be used in the Kenyan construction industry. This may assist in cost saving in construction projects because the contractors are conversant with the buildability aspects. This is the 'extent to which the design of the building facilitates ease of construction subject to the overall requirements of the completed building'.

Clients should also be sensitized by the design team on value maximization because from the study, majority of the clients who are involved in construction projects are concerned with cost saving in the pre-contract stages which may result in compromising quality. Value maximization on the other hand puts into consideration the life cycle costs and how they can be minimized and also how a project may obtain maximum returns. Value management weighs the costs and the returns to determine the worth of a project.

Other countries like Japan, US, UK, and Australia have established and tested a form of value management system that is applied in their countries to suit their needs. Kenya on the other hand has no specified system and should establish one to suit its objectives.

5.3 Further Areas of Study

1. The suitable value management system or Kenya's construction.
2. Can introduction of other procurement methods favour value management application?
3. How does value management compare with other cost management techniques?

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APPENDIX A

QUESTIONNAIRE FOR ARCHITECTS, QUANTITY SURVEYORS AND CONTRACTORS

BY MWANGI AMBROSE KIRAGU

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT

UNIVERSITY OF NAIROBI

The author of this letter is a student in the University of Nairobi and is conducting a research on the application of *value management technique* in the construction industry in Kenya, as a part fulfillment for the award of the Bachelor's degree of Arts in Building Economics.

Your assistance in the completion of this questionnaire will be highly appreciated.

DECLARATION:
THE INFORMATION COLLECTED THROUGH THIS QUESTIONNAIRE SHALL BE TREATED AS CONFIDENTIAL A WELL AS YOUR IDENTITY.

Date.....

Questionnaire No.....

INSTRUCTION: Please tick (✓) and /or state the appropriate answer in the spaces or boxes provided. More than one answer may be ticked or stated where applicable.

Value Management technique is "a structured analysis of project by an independent consultant or person to determine the required functions of the building (product) and to consider alternative (design or construction) solutions to eliminate unnecessary cost." (Seeley, 1996).

APPENDIX B

ARCHITECT'S QUESTIONNAIRE

OBJECTIVE:

To determine whether and how value management is applied in the Kenyan construction industry.

1. For how long have you practiced as an architect in the Kenyan construction industry?

_____

2. Have you ever attended a workshop to analyze a clients' brief before the design of the building was done?

YES [ ]

NO [ ]

3. If yes, who were the participants involved in the workshop? List them

(If not, go to question 11)

_____

_____

_____

4. What was the role of the participants? State

_____

_____

_____

5. How long did the workshop last? State _____

6. Have you ever implemented the decisions passed in the workshops in the projects that you have been involved in for the last three years?

YES [ ]

NO [ ]

_____

7. How were they implemented?

Based on project function (i.e. the intended purpose of the building) [ ]

Based on space function (i.e. the use or purpose of the spaces) [ ]

Based on elemental function (i.e. the purpose of the elements e.g. door [ ]

8. At what stage were they implemented in the project?

Brief [ ]

Design stage [ ]

Construction stage [ ]

Continuous process [ ]

9. Were there any benefits that resulted from their implementation?

YES [ ]

NO [ ]

10. How satisfied were you with these benefits?

4 Totally satisfied [ ]

3 Satisfied [ ]

2 Neutral [ ]

1 Dissatisfied [ ]

11. The following two ways can be used in order to maximize profits. Which one is mostly used in construction projects?

- Cost cutting measures achieved through cost planning and control, life cycle costing techniques etc [ ]
- Price /value maximization measures achieved through value management [ ]

12. In order to obtain value for money, the whole life cycle costs should be taken into account. Which is the best way to ensure that life cycle costs are minimized?

Through proper specifications in the initial design [ ]

Through quality construction [ ]

Through quality maintenance [ ]

13. Which is the best stage in the development process of a project to eliminate unnecessary costs (costs which provide neither use, nor life, nor quality, nor appearance, nor customer features)?

Brief [ ]

Design stage [ ]

Construction stage [ ]

14. How is this accomplished?

_____

_____

_____

15. For a project to be deemed successful, the three core objectives must be realized. How are these rated in the projects that you have been involved in?

	Least important		neutral		most important
Time	1	2	3	4	5
Quality	1	2	3	4	5
Cost	1	2	3	4	5

16. Have you heard of the term value management before?

YES [ ]

NO [ ]

Thank you

APPENDIX C

QUANTITY SURVEYOR'S QUESTIONNAIRE

OBJECTIVE:

To determine whether and how value management is applied in the Kenyan construction industry.

1. For how long have you practiced as a quantity surveyor in the Kenyan construction industry?

_____

2. Who was the main design team leader(s) in the projects that you have been involved?

Architect [ ]

Quantity surveyor [ ]

Project manager [ ]

Other(s) specify _____

3. What was his role?

_____

_____

4. At what stage do you get involved in a project?

Brief [ ]

Design stage [ ]

Construction stage [ ]

5. Have you ever attended a workshop to analyze a clients' brief before the design of the building was done?

(If not, go to question 10)

YES [ ]

NO [ ]

6. If yes, who constituted the team?

The design team [ ]

An external team [ ]

A mixture of the two [ ]

7. How long did the workshop last? State

_____

_____

8. What is the best stage to implement the decisions passed in the workshop in a project?

Brief [ ]

Design stage [ ]

Construction stage [ ]

Continuous process [ ]

9. How are the decisions implemented?

Based on project function (i.e. the intended purpose of the building) [ ]

Based on space function (i.e. the use or purpose of the spaces) [ ]

Based on elemental function (i.e. the purpose of the elements e.g. door [ ]

10. The following two ways can be used in order to maximize profits. Which one is mostly used in construction projects?

- Cost cutting measures achieved through cost planning and control, life cycle costing techniques etc [ ]
- Price /value maximization measures achieved through value management [ ]

11. Unnecessary costs (costs which provide neither use, nor life, nor quality, nor appearance, nor customer features) need to be eliminated in order to obtain the maximum value worth of a project. Which measures are undertaken to achieve this?

_____

_____

_____

12. What is the best stage to implement these measures?

Brief [ ]

Design stage [ ]

Construction stage [ ]

13. In order to obtain value for money, the whole life cycle costs should be taken into account. Which is the best way to ensure that life cycle costs are minimized?

Through proper specifications in the initial design [ ]

Through quality construction [ ]

Through quality maintenance [ ]

14. For a project to be deemed successful, the three core objectives must be realized. How are these rated in the projects that you have been involved in?

	Least important		neutral		most important
Time	1	2	3	4	5
Quality	1	2	3	4	5
Cost	1	2	3	4	5

15. Have you ever heard of the term value management before?

YES [ ]

NO [ ]

16. Do you offer value management services?

YES [ ]

NO [ ]

Thank you

APPENDIX D

CONTRACTOR'S QUESTIONNAIRE

OBJECTIVE:

To determine whether and how value management is applied in the Kenyan construction industry.

1. For how long have you practiced as a contractor in the Kenyan construction industry?

_____

2. Have you ever been invited into a workshop to analyze a clients' brief before the design of the building was done?

(If not, go to question 7)

YES [ ]

NO [ ]

3. If yes, what was the purpose of the workshops? State

_____

_____

_____

4. Who were the other participants in these workshops?

The design team [ ]

An external team [ ]

A mixture of the two [ ]

5. Were there any benefits that resulted from the implementation of the decisions passed in these workshops?

YES [ ]

NO [ ]

6. How satisfied were you with these benefits?

4 Totally satisfied [ ]

3 Satisfied [ ]

2 Neutral [ ]

1 Dissatisfied [ ]

7. At what stage do you mainly get involved in a construction project?

Brief [ ]

Design stage [ ]

Construction stage [ ]

8. Who was the main design team leader(s) in the projects that you have been involved?

Architect [ ]

Quantity surveyor [ ]

Project manager [ ]

Other(s) specify _____

9. What role did he play?

_____

_____

10. Which of the following is of more concern to your clients?

Achievement of value for money [ ]

Cost minimization [ ]

11. Which measures are undertaken to realize the above?

_____

_____

_____

12. According to you where do most of the unnecessary costs (costs which provide neither use, nor life, nor quality, nor appearance, nor customer features) stem from?

Incorporation of components with no real function [ ]

Failure to account for life cycle costs [ ]

Failure by design team to consider the buildability aspects [ ]

Poor material specifications [ ]

_____

13. Which measures do you employ in order to ensure efficient and effective use of resources in the production of buildings to eliminate unnecessary costs?

_____

_____

_____

14. To obtain value for money the life cycle costs must be accounted for. Which is the best stage to minimize these costs?

Design stage [ ]

Construction stage [ ]

In-use (maintenance) [ ]

15. How are they minimized in the stage named above?

_____

_____

_____

_____

16. Have you heard of the term Value management before?

YES [ ]

NO [ ]

Thank you