# APPLICATION OF VALUE MANAGEMENT IN CONCEPTION OF CONSTRUCTION PROJECTS IN RWANDA: PROFESSIONALS' AWARENESS OF AND BARRIERS TO VALUE MANAGEMENT IN CONSTRUCTION PROJECTS

**DICK RWAMUHINDA**

**MASTER OF SCIENCE**

**(Construction Project Management)**

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**2024**

# Application of Value Management in Conception of Construction Projects in Rwanda: Professionals' Awareness of and Barriers to Value Management in Construction Projects

**Dick Rwamuhinda**

**A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Construction Project Management of the Jomo Kenyatta University of Agriculture and Technology**

**2024**

## DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature……...……Date……..……

**Dick Rwamuhinda**

This thesis has been submitted for examination with our approval as the University Supervisors

.

Signature……...……Date……..……

**Dr Abednego Gwaya, PhD**

**JKUAT, Kenya**

Signature……...……Date……..……

**Prof. Titus Kivaa, PhD**

**JKUAT, Kenya**

## DEDICATION

To my parents Denis and Marion, this work is dedicated. You remain my special inspiration for life.

## ACKNOWLEDGEMENT

This is to acknowledge with much gratitude the support and help rendered by JKUAT faculty team during the entire period of pursuing this course.

My special gratitude and sincere appreciations go to Dr. Abednego Gwaya and Prof. Titus Kivaa, who took the responsibility to guide me in this undertaking. Your invaluable inputs into this work will be forever recognized with a great sense of humility and gratitude.

Last but not least, my thanks to the students of Construction Project Management program that we have sailed together from the start until this far.

However, I will not be honest if I did not mention notable names of those individuals whom we have shared the major part of this academic journey devising and implementing the road map towards completion of this course. Thank you Philibert, Jean Claude and Anaclet for your support. Your courage, dedication and commitment to this course have always strengthened my resolve to push further during difficult times. To Enock MUSABYIMANA, I will forever be indebted to you as well.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **A&E** | Architectural and Engineering |
| **CPD** | Continuing Professional Development |
| **DfT:** | Department for Transport |
| **GDP** | Gross Domestic Product |
| **ICT** | Information and Telecommunication Technologies |
| **KES** | Kenyan Shilling |
| **LCC** | Life Cycle Cost |
| **NISR** | National Institute of Statistics of Rwanda |
| **RWF** | Rwanda Francs |
| **SPSS** | Statistical Package for Social Sciences |
| **USD** | United States Dollars |
| **VE**: | Value Engineering |
| **VECP** | Value Engineering Change Proposals |
| **VfM**: | Value for Money |
| **VM:** | Value Management |
| VMCP | Value Engineering Change Proposals |

## ABSTRACT

Despite the proven capability of Value Management (VM), in securing maximum output from limited resources, this management technique is not a common practice in construction industry of Rwanda. From review of related literature, the benefits of value management were underlined to be improved quality and reduced cost, whereby value is measured, considering monetary and non-monetary benefits and thus value for money is demonstrated. Additionally, most of the project evaluation techniques adopted in construction projects in the developing world have so far relied on evaluation of project performance in terms of cost, quality, delivery and progress. Since project evaluation is carried out after the work has been undertaken, the output of the analysis will just give the client an indication or a good understanding of the project performance. Such evaluations only reveal the competence or incompetence of the project participants instead of providing value for money which is addressed by VM practice which is an ex-ante analysis that takes into consideration of all value parameters. The aim of this study was to investigate the application of VM, particularly in the conception stage of construction projects in Rwanda. The specific objectives of the study were to: find out the awareness of construction industry professionals on the benefits of adopting VM in construction projects in Rwanda; find out the barriers to usage of the VM approach in the earliest stages – i.e. conception and design stages - of construction project in Rwanda; explore the possibility of making use of VM in the design of large and complex infrastructure projects in Rwanda a mandatory requirement; and develop a VM framework that may guide the conceptualization and design process of large and complex construction projects in Rwanda.The study adopted a descriptive survey research design to obtain responses from construction industry professionals in Rwanda, whereby a sample size of 170 respondents was selected, out of which 113 members were responsive. It was observed that the construction industry professionals in Rwanda have awareness of the benefits of adopting the VM technique, but that the level of awareness is rather low. Additionally, barriers to the VM adoption are: lack of awareness; high costs; wrong choice of procurement system; lack of training and education; rigid application of standards; lack of contractual provisions; lack of communication; ignorance of key aspects; and conflict of interest. It is concluded that VM approach is not used in construction industry in Rwanda, and recommended that VM practice be instituted in the construction industry, as a mandatory requirement for conception of all construction projects with a budget of twenty billion Rwanda Francs, and above.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

The construction industry plays a crucial role in the economic development of Rwanda. In recent years, the government has invested heavily in expanding the country's infrastructure, including the construction of roads, bridges, buildings, and other critical infrastructure. The construction industry is also an essential employer in the country, providing job opportunities for thousands of Rwandans. The construction industry in Rwanda faces several challenges, including a shortage of skilled labor, inadequate infrastructure, and limited access to financing. In addition, the industry is highly fragmented, with many small and medium-sized contractors operating in the market, (International Labour Office, Rwanda, 2018). This fragmentation can lead to inefficiencies and a lack of standardization in construction practices.

In this context, value management has emerged as a valuable approach to ensure that construction projects are delivered on time, within budget, and to the satisfaction of clients. Value management involves a systematic and structured approach to maximize value while minimizing costs, with the primary focus being on meeting client needs and objectives, (Kelly J. &., 1993). VM has the potential to improve the quality of construction projects and reduce their costs. By adopting value management, stakeholders can ensure that projects are designed to meet client needs, are sustainable, and deliver value for money. Value management also encourages collaboration among stakeholders, ensuring that decisions are made in the best interest of the project.

Despite its potential benefits, the application of value management in Rwanda's construction industry is still limited. Many stakeholders remain unaware of the value management concept and its potential benefits. Moreover, the implementation of value management requires specialized skills and resources, which may not be readily available in the local context. In effect, big and complex infrastructure projects that have so far been put in place have not been done in consideration of the value analysis at any stage of construction. Thus, notable frivolous scope changes, redundant

facilities, huge and unjustifiable costs, (Gahigi, 2017). There is in record so far, some public infrastructure projects notably those of energy generation which have been completed but functioning at the minimum and lower levels of their initial intended production.

Overall, the construction industry in Rwanda has significant potential for growth and development. By addressing the challenges facing the industry and promoting best practices, stakeholders can contribute to the country's economic development and improve the quality of life. The application of value management in the conception of construction projects in Rwanda holds significant potential for improving project outcomes and meeting client needs. By adopting value management, stakeholders can ensure that projects are designed and delivered to maximize their value while minimizing their costs, leading to a more sustainable and successful construction industry.

### 1.2 Statement of the Problem

The problem being investigated in this study is the limited adoption of Value Management (VM) in the Rwandan construction industry despite its proven benefits in enhancing efficiency and cost-effectiveness in construction projects worldwide. Value Management is a structured approach aimed at optimizing the value of a project by ensuring that the necessary functions are achieved at the lowest possible cost without comprising on quality and performance, (Kelly & Male, 2014). What is not clear is the level of VM awareness of construction professionals and barriers to their application of VM in construction projects in Rwanda, particularly at the conception stage of the projects.

The Rwandan construction industry has been experiencing rapid growth, driven by the government's ambitious infrastructure development plans. However, the industry faces challenges related to cost overruns, delays, and suboptimal quality in project delivery, (Construction Industry Development Board (CIDB), 2007). The integration of VM into the early stages of project conception could offer a systematic approach to address these issues by promoting better planning, enhanced stakeholder collaboration, and

efficient resource utilization, (Shen, 2003). Therefore, understanding the current state of VM awareness and identifying the obstacles to its adoption are critical steps toward improving the performance of construction projects in Rwanda.

Investigating the feasibility and potential impacts of mandating VM in the design phase of large-scale projects can provide insights into regulatory and policy implications. Applying VM in the conception of construction projects in Rwanda can be substantial influencing various aspects of project performance including: improved cost efficiency; enhance quality and performance; increased stakeholder collaboration; reduction of project delays; better risk management; higher client and user satisfaction; and policy and regulatory improvements, (Ekanayake & & Perera, 2016). This exploration will include comparative studies of countries where VM is mandatory, consultations with industry experts, and policy analysis.

## 1.3 Objectives of the Study

### 1.3.1 Main Objective

The main objective for this study was to investigate the current state of VM practices, particularly during the conception of construction projects, for the purpose of fostering effective achievement of value for money in the construction projects, in Rwanda.

### 1.3.2 Specific Objectives

1. To find out the awareness of the construction industry professionals on the benefits of its adoption in construction projects in Rwanda.
2. To examine the barriers of the adoption of VM approach, in the early stage(s) of conception in construction projects in Rwanda.
3. To explore the possibility of making use of VM in the design of large and complex infrastructure projects in Rwanda a mandatory requirement.
4. To develop a VM framework that will guide the conceptualization and design process of large and complex construction projects in Rwanda.

## 1.4 Research Questions

The following research questions guided the study: -

1. Are construction professionals in Rwanda aware of the benefits of VM application in construction projects?
2. What are the barriers of the application of VM approach in the early stage(s) of the project conception in construction industry in Rwanda?
3. To what extent would a mandatory use of VM in the design of large and complex construction projects in Rwanda impact on the function and quality of those projects?
4. What VM framework can guide project conceptualization and design process of large and complex construction projects in Rwanda?

## 1.5 Justification and Significance of the Study

This study will serve as a guide and help in introducing a systematic approach to delivering the required functions of a project output at optimum whole life cost without detriment to quality, performance and reliability. This new and innovative approach in the local construction industry will enable a broader assessment of value for money than that which is based on cost alone. The research will benefit individuals and institutions in construction industry in Rwanda to plan and implement infrastructure projects in a manner that enhances value for money.

## 1.6 Scope and Limitations of the Study

This study was constrained geographically, methodologically and theoretically. The geographic scope of this research was confined to Rwanda encompassing various regions to capture comprehensive view of the construction industry across the country. The study focused on both urban and rural areas. Key regions included Kigali city and secondary cities - such as Huye, Musance and Rubavu - which are experiencing vibrant growth and development.

Methodically, the study applied quantitative approach distributing surveys to a broad range of construction industry professionals including project managers, architects, engineers and contractors.

Finally, the study was constrained in terms of theoretical background. Because VM is a relatively new concept in the Rwandan context, there was limited academic and industry literature specific to Rwanda. Consequently, the theoretical framework for the study relied on studies from other countries.

## 1.7 Definition of Terms

### 1.7.1 Value Engineering (VE)

This a method used to improve the value of a product or project by analyzing its functions and finding ways to achieve those functions at a lower cost without compromising quality, (Kelly & Male, 2014).

### 1.7.2 Life Cycle Cost (LCC)

Life cycle cost refers to the total cost of owning and operating a product or system over its entire lifespan, (Fuller, 1996).

### 1.7.3 Value Engineering Change Proposals (VECP)

These are suggestions made during a project to alter the design, materials, or construction methods to reduce costs, improve quality or enhance efficiency. These proposals are typically submitted by contractors or project teams and aim to achieve the same or better performance at a lower cost, (Dell'Isola, 1997).

## 1.8 Outline of the Study

This study is comprised of five chapters. Chapter One discusses the background of the study and describes the concept of value management in terms of process and benefits, the statement of the problem, research objectives and their corresponding questions are also paused. It also highlights the contribution of the construction sector to the national economy. The limitation, justification and significance of the study are also

discussed in this chapter. Chapter Two narrates the related literature from the studies of other researchers and academics. It discusses the concept, risks, drivers and barriers, as well as the application of value management in construction. Concepts and theories of value management are also presented. Chapter Three discusses the research methodology used to conduct the study. It consists of the research design, population sample, data collection procedure and ethical consideration in conducting of the study. Chapter Four presents data analysis and research findings. It also gives a comparison between the findings in this study and findings in previous related studies. Chapter Five presents the conclusions of the study, and its recommendations based on the study findings.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter covers relevant literature on the application of VM in the conception of construction projects in Rwanda, theoretical framework, conceptual framework and research gap. The literature reviewed include the concept of VM, success factors for Implementation of value management, barriers to the adoption of Value Management in Construction and finally the application of VM in big infrastructure projects. The main aim of the study was to develop a framework to guide conceptualization and adoption of VM. Developing a practical and context-specific VM framework will outline processes, tools and best practices tailored to the Rwandan construction industry, aiming to enhance project value and performance.

## 2.2 Concept of Value Management

Value management, also known as value engineering or value analysis, is a systematic and structured approach used to improve the value of products, services, or processes. The primary is to maximize the value of an organization's resources while minimizing their costs, (Miles, 1961) . VM involves identifying and analyzing the functions of a product, service, or process and then finding ways to optimize its performance and reduce its cost.

VM has been widely used in a variety of industries, including construction, manufacturing, and healthcare. In construction, VM has been used to improve the design of buildings and infrastructure projects, reduce costs, and increase efficiency, (Royal Institution of Chartered Surveyors (RICS), 2015). In manufacturing, it has been used to improve product design, reduce production costs, and improve quality. In healthcare, value management has been used to improve patient care and reduce costs.

Value management by definition a five-part process, (Olawumi, Akinrata, & Arijeloye, 2016):

a) Systematic process: it has a definite beginning and end and it differs from cost reduction exercise which are normally unstructured and conducted in an informal way. This process is referred to as the job plan which consists of a sequence of steps that guide the VM team through the problem-solving process.
b) Multi-disciplinary effort: a group of individuals are brought together to analyze all aspects of the project. They work together as a group under the leadership and guidance of the VM facilitator.
c) Functions: VM asks the question, what does it do and what is the function that it seeks to achieve. VM must be undertaken without compromising the quality, reliability, safety and aesthetic features that the client requires.
d) Value: The main function of VM is not to reduce costs but to improve value Value is made up by balancing cost, time, and function/quality of the product/project.
e) Life cycle costs: It is the present value of the total cost of the building/asset over its entire operation life and includes the initial capital and construction costs, operating and maintenance costs and the cost or the benefit of eventual disposal of the asset.

VM was first developed by Lawrence D. Miles in the 1940s during World War II. Miles was working as an engineer for General Electric and was tasked with finding ways to reduce the cost of production without compromising quality. He developed a methodology that focused on identifying the functions of a product or process and finding ways to optimize them, (Miles, 1961). Today, VM has become an integral part of project management and is often used to improve the performance and cost-effectiveness of projects. It is also used in strategic planning to identify opportunities for cost reduction and process improvement.

Globally, it has been adopted by several countries and organizations as a tool for improving efficiency and reducing costs. In the United Kingdom, it is widely used in construction projects to improve the value of projects and reduce their cost. The UK government's Construction Strategy (2011) emphasizes the importance of VM in construction projects and requires its use in all public sector projects. Similarly, in Australia, VM is mandatory for all government-funded construction projects, with the

aim of improving value for money. In Japan, the government actively promotes VM and provides training programs for its implementation. In the United States, it has been used to improve the design of products and reduce their cost. The National Institute of Standards and Technology (NIST) has developed a value engineering standard that outlines the implementation of value management in various industries, (NIST, 2018).

In Africa, the concept of VM is gaining popularity as a way to improve efficiency, reduce costs, and optimize resources. Countries such as Nigeria, Ghana and South Africa use VM to improve the value of buildings and infrastructure projects, (Adebiyi, 2018). In the manufacturing industry, countries such as Kenya, Tanzania and Ethiopia use VM to improve on the manufacturing processes and increase efficiency, (Njeri, 2020). For example, Ethiopia use VM to improve the production of cement resulting in the reduction of costs and improvement in quality, (Misganaw, 2021). Overall, the continent adoption of VM techniques is expected to increase in the future as organizations strive to remain competitive in the global market.

### 2.2.1 Stages for Application of Value Management

Value Management can be applied at any point in the project, even during construction. However, typically the earlier it is applied the higher the return on time and effort invested. There are generally three main stages of a project and VM' application as described by Chavan (2013. Each stage has distinct characteristics and opportunities for VM application to enhance project value, efficiency, and quality, (Chavan, 2013).

a) Pre-construction stage: this includes the initial phases of a project, such as conceptualization, feasibility studies, design, and planning. This stage is crucial for setting the foundation for project success by defining objectives, scope, and budget. VM can be used at this stage to identify the essential functions and objectives of the project, ensuring that the project aligns with stakeholder needs and expectations. Regarding design optimizations, VM workshops and studies, design elements are critically analyzed to eliminate unnecessary features and costs while maintaining or enhancing functionality and quality. This reduces the likelihood of scope changes and cost overruns

later in the project. In addition, it enhances clarity and agreement on project objectives and requirements promoting innovative and cost-effective design solutions, (Chavan, 2013).

b) Construction stage: VM can be applied to develop procurement strategies that ensure the selection of suppliers and contractors who offer the best value in terms of cost, quality, and reliability. In addition, ongoing VM reviews during construction help in monitoring costs and identifying opportunities for savings without compromising quality or performance. VM also ensures that construction methods and materials used align with the project's value objectives, leading to better quality and fewer defects or reworks. This helps in maintaining control over project costs and schedules ensuring high quality construction through continuous value-focused assessments, (Chavan, 2013).

c) Post-construction stage: This phase include project completion activities such as commissioning, handover and operation and maintenance. Carrying out VM during this stage ensures that all systems and components are tested and verified to meet the specified requirements. Facilitating a smooth handover to the client. In addition, VM can be used to develop strategies for efficient operation and maintenance, ensuring that the project delivers value throughout its lifecycle. This includes evaluating the long-term costs and benefits of different maintenance approaches. This ensures that the project delivers long term value and meets performance expectations. It also provides valuable insights and lessons that can be applied to future projects, (Chavan, 2013).

Applying Value Management at each stage of a project—pre-construction, construction, and post-construction—ensures that value is maximized throughout the project lifecycle. By focusing on essential functions, eliminating unnecessary costs, and promoting collaboration and innovation, VM helps in achieving cost-effective, high-quality, and sustainable project outcomes.

### 2.3 Success Factors for Implementation of Value Management

A value engineering workshop provides an opportunity to bring the design team and client together to review the proposed design solutions, the cost estimates and the

proposed implementation schedule and approach. The point of entry for VM is either during the planning stage of later on during the design process and often follows the five-step job plan outlined below, (Kelly & Male, 2014);

a) Information phase - involves gathering and analyzing information about the project or organization. This includes understanding the project objectives, identifying key stakeholders, and collecting data on the current state of the project. This is critical for establishing a common understanding of the project and identifying areas where value can be added.
b) Speculation (creative) phase - the project team and stakeholders brainstorm ideas for improving the project's value. This is a creative phase where participants are encouraged to generate a wide range of ideas, without judgment or criticism. The ideas may be related to cost savings, improved functionality, increased efficiency, or other aspects of the project.
c) Evaluation (analysis) phase - Once a list of potential ideas has been generated, the evaluation phase begins. This involves assessing the feasibility and potential impact of each idea, as well as estimating the costs and benefits of implementing them. The ideas are prioritized based on their potential value and feasibility.
d) Development (value management proposal) phase - the most promising ideas are developed into specific recommendations during this stage. This may involve creating new designs, modifying existing processes, or making other changes to the project plan. The recommendations are then reviewed and refined to ensure they are feasible and will deliver the desired value.
e) Presentation (report/oral) phase - This involves presenting the recommendations to stakeholders and decision-makers. The presentation should clearly outline the benefits of the recommendations, as well as the costs and risks associated with implementing them.

The identification of key factors for value management success enables appropriate allocation of the limited resources in order to achieve better input. The table below highlights the critical factors for value management successful implementation, (Shen, 2003).

**Table 2.1: Nominated Critical factors for Value Management**

| Groups | Factors |
|---|---|
| Preparation of Workshop | 1. Clear Objective of VM study<br>2. Qualified VM facilitator<br>3. Multidisciplinary composition of VM team<br>4. VM experiences and knowledge of participants<br>5. Professional experience and knowledge of participants in their own disciplines<br>6. Personalities of the participants<br>7. Preparation and understanding of related information<br>8. Timing of VM study |
| VM workshop | 9. Structured job plan<br>10. Control of workshop<br>11. Attitude of participants<br>12. Presence of decision takers<br>13. Interaction among participants<br>14. Function analysis<br>15. Use of relative skills and techniques such as brainstorming<br>16. VM proposals selection and development |
| Implementation of generated proposals | 17. Plan for implementation<br>18. Follow-up training and support for implementation |
| Supporting factors | 19. Client's support and active participation<br>20. Cooperation from related departments<br>21. Adequate time for study<br>22. Financial support<br>23. Logistical support |

As discussed by Shen (2003), two factors, "clear objective of the study" and "professional experience and knowledge of the participants," have a significant impact on the value management workshop. By applying factor analysis, the most important factors relate to the VM team requirements, followed by client's influence, facilitator competence and relevant departments' impact, (Shen, 2003). In summary, the success of VM workshop requires a combined effort from all parties involved.

### 2.4 Barriers to the Adoption of Value Management in Construction

There are many barriers that hinder the adoption of value management in the construction industry, these include: -

a) Limited Awareness and Understanding – limited awareness and understanding of the concept is one of the main barriers to the adoption of VM. Many stakeholders in the industry may not be familiar with the value management process, its benefits, and how it can be applied to construction projects.
b) Lack of resources – Value management requires significant time and resources to implement effectively. Many construction firms may not have the necessary resources, such as trained personnel, to implement the value management process.
c) Limited Government support – there was limited government support for value management in the industry. Governments in many developing countries may not prioritize value management or may not provide the necessary support to encourage its adoption.
d) Resistance to change – Resistance to change is a common barrier to the adoption of new practices in any industry, including the construction industry. Many stakeholders in the industry may be resistant to change due to concerns about cost, time, and risk.
e) Lack of collaboration - Collaboration among stakeholders is critical for the successful adoption of value management in the construction industry. However, the industry is fragmented often resulting to information islands. This lack of collaboration among stakeholders, make it difficult to implement value management effectively, (Aghimien, 2018).

## 2.5 Application of Value Management in big Infrastructure projects

At present, VM is widely accepted and practiced in many countries. For example, the US government mandated that all projects that cost USD 2 million or more must adopt VM study whereas its Department for Transport (DfT) has been more stringent, making it compulsory for projects as low as USD 100,000. On the other hand, the Japanese government mandated the use of VM for projects costs JPY175 million (USD 2 million) or more and the Australian government implemented VM for its federal projects' costs of at least AUD5 million (USD4.5 million), (Karim, 2014). While this may be so for construction industries in developed countries, the situation is by no means so clear for developing nations, (Olawumi, Akinrata, & Arijeloye, 2016).

As discussed by Olawumi (2016), the following types of projects will benefit the most from Value Management:

a) **Costly projects**: VM can result in savings of up to 5-15% of the total costs involved on the project and therefore it is very cost effective to apply VM to higher cost projects although Karim (2014) noted that VM should be applied on all projects irrespective of the project cost.
b) **Complex projects**:With a VM study one has the opportunity to get expert second opinions, especially, if there are members of the team that is independent of the original design team. On complex projects, it is vital to get expert opinions. By using VM, attention can be given to complex issues.
c) **Repetitive projects:** When the same type of building/asset needs to be built in many different locations, the utilization of VM becomes very cost effective because cost reduction and ideas that add value to the project can be incorporated into all the buildings to be built later on.
d) **Unique projects** with new technology elements and few precedents: The reason for using VM in the above type of projects is similar to complex projects. It relates to the obtaining of expert opinions.
e) **Projects with very restricted budgets**: For these projects, it is imperative to get maximum value for the least amount of money. VM seeks to eliminate unnecessary costs. Projects with compressed design programs: VM should be properly coordinated with the construction program to minimize time spent on it. VM can come up with innovative ideas to relieve pressure on design programs and accelerate programs.
f) **High visibility projects:** These are projects sponsored by the government or environmentally sensitive projects. It is important that as little as possible goes wrong to these projects to avoid the media embarrassing the parties involved on the project.

Summarily, VM is not restricted to the types of projects mentioned above, but can be applied to any project/building or asset. VM can be applied to parts of buildings or subdivisions of projects. The general feel is that VM is more beneficial on larger

projects due to the fact that there are certain costs associated with a VM study, (Rangelova, 2014).

### 2.5.1 Case Study 1: Application of Value Management in the Conception of the Crossrail Project, United Kingdom

#### Introduction

The Crossrail project, now known as the Elizabeth Line, is one of Europe's largest infrastructure projects, aimed at improving rail transport in London and the South East of England. The project involved the construction of a new 118-kilometer railway line, including 42 kilometers of new tunnels, and was designed to increase capacity, reduce journey times, and enhance the connectivity of London's transport network. Value Management (VM) was applied extensively during the project's conception phase to optimize value and ensure efficient use of resources, (Kelly & Male, 2014), (Crossrail Ltd, 2019).

#### Project Background

- **Location**: London, United Kingdom
- **Project Type**: Railway (Urban Rail Network)
- **Key Stakeholders**: Transport for London (TfL), Department for Transport (DfT), Crossrail Ltd, and various contractors and consultants
- **Project Value**: Estimated at £18.25 billion
- **Objective**: To deliver a high-capacity, high-frequency rail service that connects key areas of London and its suburbs, reducing congestion and improving overall transportation efficiency.

**Value Management Application**

**1. Conceptualization and Feasibility**

**VM Activities**

- **Stakeholder Workshops**: Early VM workshops were conducted with key stakeholders, including government bodies, transport authorities, engineers, urban planners, and community representatives. These workshops aimed to identify the essential functions of the Crossrail project, such as capacity enhancement, journey time reduction, and network integration.
- **Function Analysis**: The core functions of the project were analyzed, focusing on how to maximize the rail network's capacity, improve passenger experience, and ensure seamless integration with existing transport systems.

**Outcomes**

- **Defined Objectives**: Clear objectives were established for the Crossrail project, focusing on critical aspects like passenger capacity, travel time efficiency, and connectivity.
- **Design Alternatives**: Various design alternatives were evaluated to determine the most cost-effective solutions that still met the project's functional requirements.

**2. Design Optimization**

**VM Activities**

- **Cost-Benefit Analysis**: Detailed cost-benefit analyses were conducted for different design options, including the alignment of the tunnels, station locations, and construction methods.
- **Value Workshops**: Additional VM workshops were held to scrutinize design proposals, focusing on maximizing functionality and minimizing costs while ensuring high standards of safety and quality.

**Outcomes**

- **Optimized Design**: The selected design provided the best balance between cost, functionality, and quality. For instance, innovative tunneling techniques and modular construction methods were adopted to enhance efficiency and reduce costs.
- **Innovative Solutions**: Technological innovations such as advanced signaling systems and energy-efficient train designs were incorporated to improve operational efficiency and sustainability.

**3. Risk Management**

**VM Activities**

- **Risk Workshops**: VM was used to identify and mitigate risks associated with the construction and operation of the railway. This included environmental impact assessments, financial risk evaluations, and stakeholder engagement strategies.
- **Contingency Planning**: Comprehensive plans were developed to address potential risks such as construction delays, cost overruns, and community opposition.

**Outcomes**

- **Risk Mitigation Plans**: Detailed risk mitigation plans were established, addressing environmental and social impacts, ensuring financial viability, and securing stakeholder support.
- **Community Engagement**: Effective community engagement strategies were implemented to address concerns and gain support, minimizing the risk of project delays due to local opposition.

**Impact and Benefits**

- **Cost Savings**: The application of VM resulted in significant cost savings, helping to keep the project within budget while delivering high-quality infrastructure.
- **Enhanced Quality**: The focus on critical functions and innovative solutions improved the overall quality and operational efficiency of the railway.
- **Increased Capacity**: The Crossrail project significantly increased rail capacity in London, reducing congestion and improving travel times for millions of passengers.
- **Sustainability**: Sustainable construction practices and energy-efficient technologies reduced the environmental footprint of the project, aligning with global sustainability goals.
- **Stakeholder Satisfaction**: Effective stakeholder engagement ensured that the project met the needs and expectations of all parties involved, fostering strong support and collaboration.

The application of Value Management in the conception of the Crossrail project in the United Kingdom demonstrates how VM can optimize project outcomes by focusing on essential functions, improving design efficiency, and managing risks effectively. This case study highlights the importance of early stakeholder engagement and the systematic application of VM principles to achieve cost-effective, high-quality, and sustainable infrastructure projects.

### 2.5.2 Case Study 2: Application of Value Management in the Conception of the Lekki Deep Sea Port Project, Nigeria

**Introduction**

The Lekki Deep Sea Port project, located in Lagos State, Nigeria, is one of the largest infrastructure projects in West Africa. This port is designed to enhance Nigeria's maritime industry by providing a deep-water port capable of accommodating large vessels and improving the efficiency of cargo handling. Given its scale and importance, Value Management (VM) was applied during the conception phase to

optimize the project's value, ensuring it met its functional requirements while controlling costs and maintaining quality, (Chavan, 2013), (Akinyemi, 2018).

**Project Background**

- **Location**: Lagos State, Nigeria
- **Project Type**: Deep Sea Port
- **Key Stakeholders**: Tolaram Group, Nigerian Ports Authority (NPA), Lagos State Government, and China Harbour Engineering Company (CHEC)
- **Project Value**: Estimated at $1.5 billion
- **Objective**: To create a world-class port facility that will serve as a hub for maritime trade in West Africa, reduce congestion at existing ports, and stimulate economic growth in the region.

**Value Management Application**

**1. Conceptualization and Feasibility**

**VM Activities**

- **Stakeholder Workshops**: Early VM workshops were conducted involving key stakeholders, including government agencies, investors, engineers, and port operators. These workshops aimed to define the essential functions of the port and align them with the stakeholders' expectations.
- **Function Analysis**: The core functions of the port, such as cargo handling efficiency, accessibility for large vessels, and scalability for future expansion, were identified and prioritized.

**Outcomes**

- **Clear Objectives**: The workshops helped in setting clear, achievable objectives for the port, focusing on critical aspects like capacity, efficiency, and sustainability.
- **Alternative Solutions**: Different design alternatives were evaluated to find the most cost-effective solutions that would still meet the required standards.

**2. Design Optimization**

**VM Activities**

- **Cost-Benefit Analysis**: Detailed cost-benefit analyses were performed for various design options. This included comparing different construction materials, technologies, and layouts.
- **Value Workshops**: Additional VM workshops were held to scrutinize design proposals, focusing on maximizing functionality and minimizing costs.

**Outcomes**

- **Optimized Design**: The selected design provided the best balance between cost and functionality. For instance, the use of advanced dredging technology reduced construction time and cost while ensuring the port's capability to handle large vessels.
- **Innovative Solutions**: Innovations such as automated cargo handling systems and energy-efficient lighting were incorporated to enhance operational efficiency and reduce long-term operational costs.

**3. Risk Management**

**VM Activities**

- **Risk Workshops**: VM was used to identify and mitigate risks associated with the construction and operation of the port. This included environmental impact assessments, financial risk evaluations, and stakeholder engagement strategies.

**Outcomes**

- **Risk Mitigation Plans**: Comprehensive risk mitigation plans were developed, addressing potential environmental impacts, ensuring financial viability, and securing stakeholder support.
- **Contingency Measures**: Provisions for dealing with unforeseen challenges, such as delays or cost overruns, were established.

**Impact and Benefits**

1. **Cost Savings**: The application of VM resulted in significant cost savings, estimated to be around 10-15% of the total project cost. These savings were achieved through optimized design and efficient resource allocation.
2. **Enhanced Quality**: The focus on critical functions and innovative solutions improved the overall quality and operational efficiency of the port.
3. **Stakeholder Satisfaction**: Effective stakeholder engagement ensured that the project met the needs and expectations of all parties involved, fostering strong support and collaboration.
4. **Sustainability**: The inclusion of sustainable practices and technologies reduced the environmental footprint of the port, aligning with global sustainability goals.

The application of Value Management in the conception of the Lekki Deep Sea Port project in Nigeria demonstrates how VM can optimize project outcomes by focusing on essential functions, improving design efficiency, and managing risks effectively. This case study highlights the importance of early stakeholder engagement and the systematic application of VM principles to achieve cost-effective, high-quality, and sustainable infrastructure projects.

## 2.6 Theories Related to Application of Value Management in Conception of Construction Projects

### 2.6.1 Functional Analysis Theory

Functional Analysis Theory is a systematic approach used in Value Management (VM) to identify and analyze the essential functions of a product, service, or project. The theory is central to VM and Value Engineering (VE), as it focuses on understanding what functions need to be performed to achieve the desired outcomes, rather than just the physical components or processes involved, (Kelly J. &., 1993). Functional analysis during the various phases of project enhances clarity; cost efficiency; innovation; risk reduction and stakeholder satisfaction. The aim of this study is to explore the application of VM in the construction projects in Rwanda. This theory

provides an approach to enhance the value of construction projects by ensuring that all necessary functions are achieved at the lowest possible cost while maintaining or improving quality and performance.

### 2.6.2 Life Cycle Costing Theory

Life Cycle Costing (LCC) Theory is a comprehensive approach to assessing the total cost of ownership of a product, system, or project over its entire life span. This includes all costs from initial acquisition through operation, maintenance, and disposal. LCC is particularly relevant in construction and Value Management (VM), as it helps stakeholders understand the long-term economic implications of their decisions, rather than just focusing on initial costs, (Flanagan, 2005). The key concepts of life cycle costing include: -

1. **Total Cost of Ownership**: LCC encompasses all costs associated with a project, from initial planning and design through construction, operation, maintenance, and finally disposal or decommissioning.
2. **Cost Categories**:
    - **Initial Costs**: Costs incurred during the planning, design, and construction phases. These include materials, labor, equipment, and administrative expenses.
    - **Operating Costs**: Costs related to the daily operation of the project. This includes utilities, staffing, and other operational expenses.
    - **Maintenance Costs**: Expenses for regular upkeep and repairs to ensure the project remains functional and safe.
    - **Replacement Costs**: Costs associated with replacing components that have a limited lifespan.
    - **Disposal Costs**: Costs incurred at the end of the project's life span for decommissioning, demolition, and site restoration.
3. **Time Value of Money**: LCC considers the time value of money, discounting future costs and benefits to present value terms. This ensures a fair comparison between costs incurred at different times.

4. **Cost-Benefit Analysis**: Evaluates the economic feasibility of different design and construction options by comparing their life cycle costs against the expected benefits.
5. **Sustainability**: LCC promotes sustainable practices by considering long-term environmental impacts and costs associated with different materials and construction methods, (Kirk, 1995).

Life Cycle Costing Theory is a critical component of Value Management in construction projects. By considering the total cost of ownership over a project's life span, LCC ensures that decisions are made with a long-term perspective, leading to sustainable and cost-effective outcomes. This approach helps in balancing initial costs with future savings, optimizing the overall value delivered by the project.

## 2.7 Literature Gap

While Value Management (VM) is a well-researched topic globally, its application in the context of construction projects in Rwanda presents unique challenges and opportunities that are not fully explored in the existing literature. Identifying these gaps is essential to tailor effective strategies and frameworks suitable for the Rwandan construction industry. Global studies highlight the benefits of VM, such as cost savings, improved project quality, and enhanced stakeholder satisfaction. However, these studies are predominantly based on data from developed countries or regions with a long history of VM application. There is limited research specifically focusing on the level of awareness and understanding of VM among construction professionals in Rwanda. This gap includes the extent to which the professionals are familiar with VM principles, its potential benefits, and the practical aspects of its implementation in the local context. Filling this gap would provide insights necessary for designing targeted education and awareness programs.

## 2.8 Theoretical Framework

In this study, the Functional Analysis Theory and the Life Cycle Costing (LCC) Theory are combined, in order to provide a comprehensive approach to understanding and implementing VM in this context. Functional Analysis Theory is central to VM

and focuses on identifying and analyzing the essential functions that a project must perform. In the context of Rwandan construction projects, Functional Analysis will be used to identify and evaluate the functions of various project components. By focusing on the essential functions, the study will explore how VM can enhance project value, reduce unnecessary costs, and improve overall project performance.

Life Cycle Costing (LCC) Theory involves evaluating the total cost of ownership of a project over its entire life span, including initial acquisition, operation, maintenance, and disposal costs. This approach ensures that all costs are considered, not just the initial investment. In the Rwandan context, LCC will be used to evaluate the economic implications of different construction project designs and methods. The study will analyze how adopting LCC can lead to more sustainable and cost-effective construction practices, helping stakeholders make informed decisions that consider long-term benefits.

By integrating these theories, the study aims to enhance understanding of VM benefits, identify and address barriers to adoption, explore the feasibility of mandatory VM practices, and develop a tailored VM framework for the Rwandan context. This comprehensive approach will contribute to more efficient, cost-effective, and sustainable construction practices in Rwanda.

### 2.9 Conceptual Framework

From the theoretical framework, a conceptual framework for the study is formulated as shown in Figure 2.2.

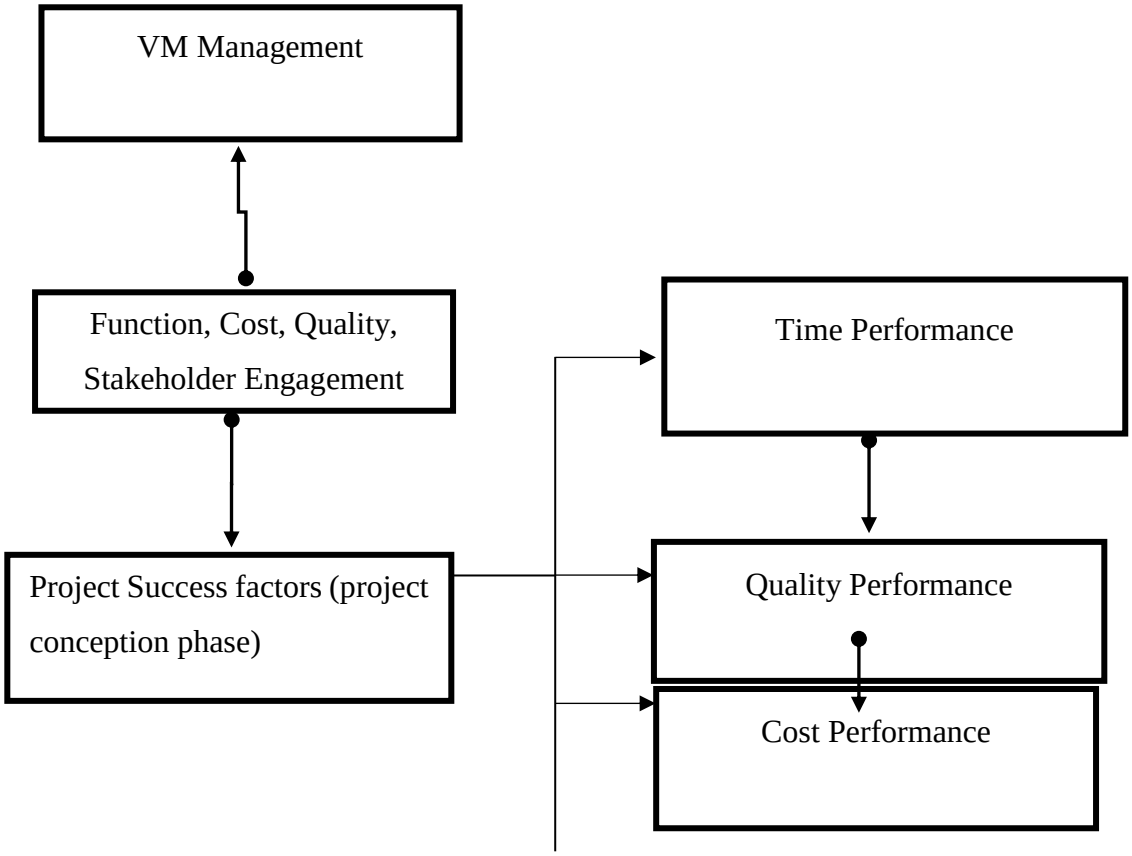


**Figure 2.1: Conceptual Framework**

Source: (Researcher 2022)

Key: ⟶ Leads to

VM directly influences cost management, quality assurance, and stakeholder engagement, which are critical during the conception phase. The application of VM during the conception phase of construction projects in Rwanda is expected to significantly enhance project outcomes. By systematically analyzing functions, managing costs, ensuring quality, and engaging stakeholders early, VM provides a robust framework for achieving project success. This conceptual framework can serve as a basis for further empirical research to validate the proposed hypotheses and refine the model based on findings specific to the Rwandan context.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter presents the research design, the target population, sampling method and sampling size. It also presents source of data, data collection methods, and data analysis and presentation procedures. Finally, ethical considerations made in the study are presented.

## 3.2 Research Strategy

The research strategy employed in this research is quantitative research strategy. As stated before, the working hypothesis in this study is that projects that utilize VM do secure maximum output from limited resources. Quantitative data on VM application in construction was used to suggest ways of increasing the adoption in the industry. This approach seeks to address questions such as 'how much' or 'how many?' and provides a strong basis for explaining phenomenon. It also highlights ways of regulating or responding to the variable interactions. It is a research strategy that emphasizes quantification in the collection and analysis of data, (Bryman, 2012). It also allows explanatory assertions and inferences to be made regarding the sample and population at large.

## 3.3 Research Design

Cross-sectional design was adopted in this research. The researcher obtained information concerning the current status in application of VM in construction projects in Rwanda. As discussed by Bryman (2012), it involves collection of data predominantly by questionnaire or by structured interview in more than one case at a single point in time in order to collect a body of quantitative data in connection with two or more variables. The variables under consideration are then examined so as to detect patterns of association, (Bryman, 2012).

### 3.4 Population and Sample

The target population for this study comprised of professionals from construction companies, consultancy firms and Government institutions in charge of conception, design and implementation of large and complex construction projects. Fundamentally there are two points of entry for VM in projects. One is the planning phase whereby the project team decides to carry out VM. It can also be introduced during the design phase or partially during the construction phase. Convenient sampling was applied for this study to get the respondents for the study.

A sampling matrix of the accessible population was prepared as shown on table 3.1 below. The accessible population was 1116 subjects. According to Mugenda & Mugenda (2003: pg 42), "for descriptive studies, ten percent of the accessible population is enough." For this reason, a suitable sample size for this study was estimated at 15% of the accessible population (i.e. 170 respondents), in order to cater for attrition in the responses, as shown in the last column of Table 3.1, (Mugenda O. &., 2013).

**Table 3.1: List of Respondents**

| Category | Total Number | Sample Size |
|---|---|---|
| Clients | 150 | 23 |
| Architects | 85 | 13 |
| Engineers | 806 | 121 |
| Quantity Surveyors | 25 | 5 |
| Project Managers | 50 | 8 |
| **Total** | **1116** | **170** |

### 3.5 Data Collection Methods

Quantitative research methods were used in the data collection and analysis. The research main aim was to investigate the application of value management approach in Rwanda, particularly during the conception of construction projects. Open ended and close ended questions were applied in this research to derive feelings of respondents, motivations as well as the background. Close ended questions were used in the questionnaires. These were used to derive feelings of the respondents,

motivation as well as the background. The questionnaires were categorized to include all parts under study in the objectives. As discussed by Bryman (2012), closed questions provide fixed alternatives to the respondents to choose the most appropriate, (Bryman, 2012). A draft version of the questionnaire was distributed to some respondents and collected back for finetuning before the actual data collection. The questions were categorized to include all parts under the objectives. Respondents would then answer and submit their answers back to the researcher. The major challenge experienced was the reluctance of some respondents to provide feedback upon sharing the questionnaires while others declined to provide full information as requested.

### 3.6 Data Analysis

Data analysis could be described as organizing, providing structure and elicit meaning to the collected data. Quantitative data analysis was performed using Statistical Package for Social Scientists (SPSS). SPPS is a tool used to collect, analyze and interpret data in an organized pattern. Raw data from the questionnaire was fed into the software to produce new statistics which were then used as predictors. Representation was done in form of tables, graphs and statistical reports.

Summarily, the data analysis was carried out in the following order: Firstly, data collection; Secondly data categorization; thirdly data summarization and fourthly the interpretation. Quantitative data analysis was performed using the statistical Package for Social Scientists (SPSS). Raw data was fed into the software to produce new statistics that were then used as predictors. In addition, available project information – project reports and manuals were also reviewed. Finally, representation was done in form of tables, graphs and statistical reports.

### 3.7 Validation and Reliability

Reliability is primarily concerned with issues of consistency of measures whereas validity evaluates whether a measure of a concept really measures that concept, (Bryman, 2012). To maintain validity in this study, the researcher first established face validity by consulting few experts involved in projects that have successfully utilized

VM during the conception of the projects. Upon evaluating whether the questions were valid, a pilot survey was carried out on a sample of the intended population. The respondents derived from the pilot were then used to refine the research questions for the main survey.

For reliability purposes, the research re-administered the questions to the same group of respondents so as to ensure that the responses did not fluctuate.

### 3.8 Ethical Considerations

Ethics revolves around four main areas namely: whether there is harm to participants; whether there is lack of informed consent; whether there is invasion of privacy and whether deception is involved, (Bryman, 2012). To ensure there is ethical practice in carrying out this research, the researcher observed the following: Caution was practiced not to interfere with their privacy necessitated by the constant follow ups. Also, the researcher obtained consent before digging into the particularities of the project which might involve disclosing information which might seem confidential.

Confidentiality was also treated with utmost regard. Caution was practiced to ensure that the information obtained from the research participants was confidential. To achieve this, the researcher avoided putting down any names on the questionnaire sheets. In addition, no subject knew the identity of any other subject.

# CHAPTER FOUR

# DATA ANALYSIS AND RESULTS

## 4.1 Introduction

This chapter presents the data analysis and the research findings. It starts with the response rate and background information of the respondents, followed by the data analysis results and their interpretation for each of the research objectives. Finally, a discussion of the findings is presented, to give a comparison between findings in this study and findings in previous research. These results form the basis of the recommendations covered in chapter five.

## 4.2 Background to the Structured Questionnaire

Open ended and close ended questions were applied in the study. These were used to derive the feelings of respondent's motivation as well as the background. These were categorized based on the objectives. Google forms, which is a survey administration software was used to send out the questions to respondents via email. Respondents would then answer and submit their answers back to the researcher. The responses were then fed into SPSS which is a software package used for interactive or batched statistical analysis.

The major challenge experienced while conducting this field study was the reluctance of some of the respondents to provide feedback upon sharing the questionnaires while others declined to provide full information as requested.

## 4.3 Response Rate and Demographic Profile of the Respondents

### 4.3.1 Respondents Response Rate

Convenient sampling was applied in this research. Out of the target sample size of 170 respondents, 113 subjects responded, giving a response rate of 66.50% as shown on table 4.1 below.

**Table 4.1: Questionnaire Return Rate**

| | Questionnaires Sent | Questionnaires Returned | Response Rate (%) |
|---|---|---|---|
| Respondents | **170** | **113** | **66.50%** |

Source: (Author, 2022)

Mugenda & Mugenda (2003) explain that in questionnaire administration, a response rate of 50% is adequate for analysis and reporting; 60% is good response while 70% is very good, (Mugenda O. &., 2003). The response rate of 66.5 % is good and sufficient for data analysis, reporting and drawing conclusions.

### 4.3.2 Demographic Profile of the Respondents

The demographic profile of the respondents was evaluated in two dimensions namely; the role in project implementation and experience in the construction industry. Regarding the former, majority of the respondents were Engineers followed by Architects and Project Managers in figure 4.1 below.

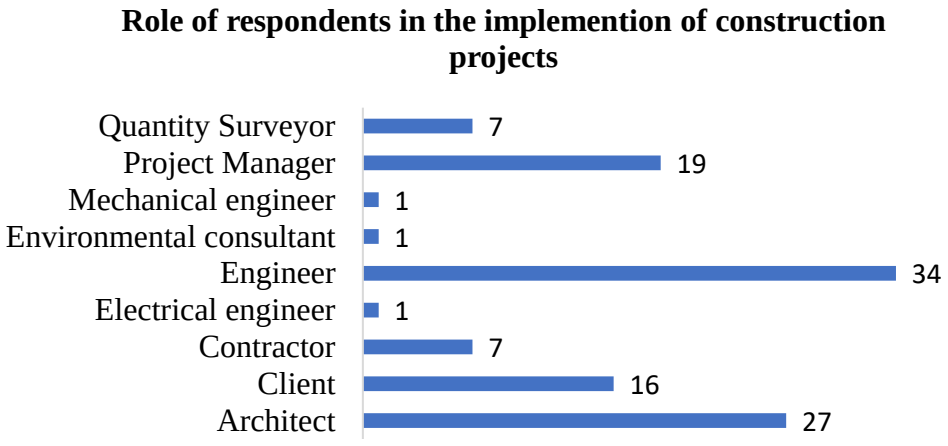


**Figure 4.1: Role of Respondents in the Implementation of Construction Projects**

Source: (Field Survey, 2022)

The involvement of engineers, architects, and project managers during the project inception phase is crucial because they bring together essential expertise, ensure

comprehensive planning, facilitate effective communication, and manage risks and resources efficiently. Their collaborative effort lays a solid foundation for the project, aligning it with client requirements and regulatory standards while ensuring feasibility and sustainability.

Assessing the years of experience, most of the respondents had experience of 11-15 years at 31.0%, 29.2% had over 15 years while 15.0% had 1-5 years of experience as shown on table 4.2 below.

**Table 4.2: Years of Experience in Construction Project Implementation**

| Years of Experience in project Implementation | No | % |
|---|---|---|
| 1-5 Years | 17 | 15.00 |
| 11-15 Years | 35 | 31.00 |
| 6 -10 Years | 28 | 24.80 |
| Above 15 years | 33 | 29.20 |
| **Total** | **113** | **100.00** |

Source: (Author, 2022)

The utility of experienced professionals during the project conception phase is indispensable. Their expertise, comprehensive planning, effective stakeholder engagement, proactive risk management, commitment to quality assurance, and focus on sustainability and innovation significantly enhance the likelihood of project success. Their contributions lay a strong foundation, ensuring that the project is well-conceived, feasible, and aligned with the client's vision and objectives.

## 4.4 Data Analyses for the Study Objectives

### 4.4.1 Objective 1: Respondent's Level of Awareness of the Benefits of VM Adoption in Construction Projects

This study aimed to examine the current state of VM practices in Rwanda during the conception phase. As shown in figure 4.2, Twenty-nine respondents out of 113 being 25.7% of the target population were aware of the application of value management on project management. The majority, 74.3% were not aware of VM approach as used/applied in construction projects. This low awareness rate indicates that VM

practices are not widely recognized or understood among construction professionals in Rwanda. Moreover, this highlights a significant gap in knowledge and education about Value Management.

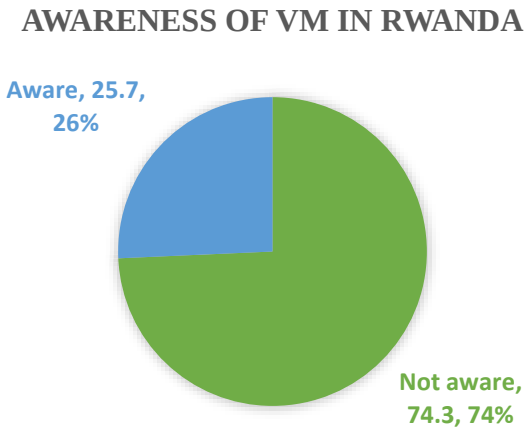


**Figure 4.2: Respondents' Awareness of VM**

Source: (Field Survey, 2022)

Further inquiry on the level of understanding of VM revealed that 51.7% who were aware of VM approach, had a very good understanding of it. 37.9% were average whereas 10.4% indicated that their understanding was poor as in figure 4.3 below. Moreover, regarding application of VM in the early stages of conception, majority of the respondents who were aware had not applied the VM approach. Only 2 (7%) out of the 29 respondents seemed to have applied the VM approach in projects averaging $20M (Rf 20 Billion / KES 2 Billion) all undertaken in the past three years.

As already established in theory, limited awareness and understanding is the leading factor for slow VM adoption rate. In comparison, these findings highlight similar reasons accounting for the low awareness of VM in Rwanda construction practices. Summarily these are;

a) Lack of training and education – it is possible that VM is not sufficiently covered in academic curricula or professional development programs in Rwanda.

b) Limited exposure – if VM is not widely practiced or promoted by leading firms or government projects, many professionals may not have the opportunity to learn about or engage with VM methodologies.
c) Cultural and structural barriers – traditional approached to project management might be deeply entrenched, and there might be resistance to adopting new technologies.

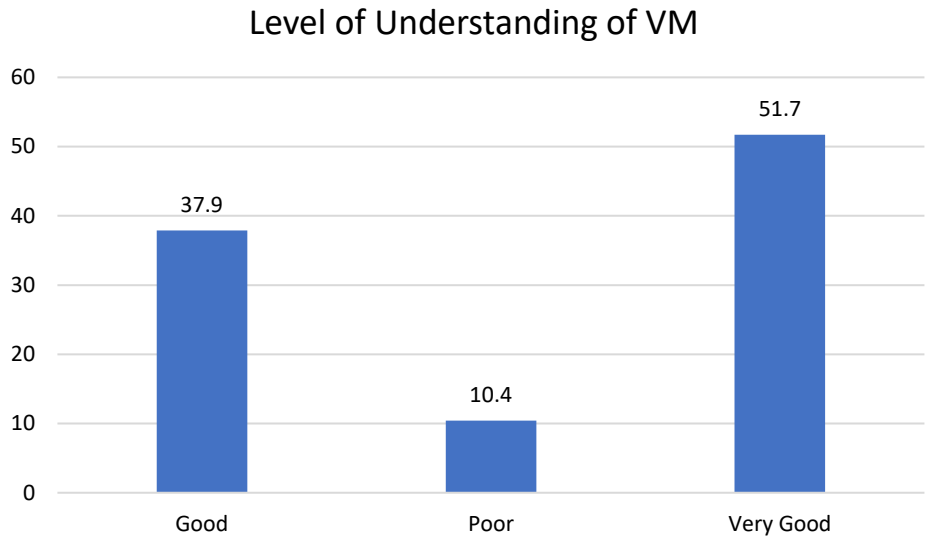


**Figure 4.3: Level of Understanding of VM**

Source: (Field Survey, 2022)

In effect, the low awareness leading to low VM adoption rate have undesirable effects on project outcomes including;

a) Missed opportunities for improvement – VM is designed to improve efficiency, reduce costs, and enhance the overall value of construction projects. The low awareness signals that many projects in Rwanda might not be benefitting from these potential improvements.
b) Quality and satisfaction – without VM, projects might not fully align with stakeholder needs and expectations, potentially leading to lower quality outcomes and stakeholder satisfaction.

c) Cost and time overruns – VM helps in early identification and management of risks, which can prevent cost and time overruns. The lack of VM awareness might result in projects being more susceptible to such issues.

The researcher sought to find out the drivers of application of Value Management in the construction industry. It was observed that 25.7% of respondents were indeed aware of VM and its benefits which are normally the drivers for its adoption. All the studies factors are considered to be of great importance, scoring an average of at least 4.00 on a scale of 0 to 5 as shown in table 4.3 below.

**Table 4.3: Drivers of Application of Value Management in Construction Industry**

| Drivers | Total score | Weighted score |
|---|---|---|
| Vm achieves improved designs, construction and overall value for money | 118 | 4.1 |
| Vm at conception stage eliminates/reduces unnecessary reviews during implementation | 118 | 4.1 |
| Vm improves functional performance of the project | 116 | 4.0 |
| Vm minimizes delays in their implementation | 116 | 4.0 |
| Vm to be done at early stage of the project | 117 | 4.0 |

The highest ranked drivers of VM application in conception of construction projects to; (a) to achieve maximum benefits, and (b) to improve designs, construction and overall value for money. From these findings, it is evident that much remain desired in increasing the adoption of VM practices in Rwanda. From the analysis, some of steps that need to be taken include: -

a. Enhancing education and training - this can be done either through curriculum development or professional development. Incorporation VM principles and practices into academic programs for engineering, architecture and project management, offering workshops, seminars and training sessions on VM to construction professionals can accelerate the uptake.
b. Promoting VM awareness - this is mainly through industry initiatives through conferences, publications and case studies. Government agencies could also

play a role by mandating or encouraging the use of VM in public construction projects.

c. Encouraging adoption – Implementing pilot projects that use VM to demonstrate its benefits and create successful case studies that can be shared within the industry. In addition, engaging stakeholders in discussions about the benefits of VM can build support and buy-in for adoption.

In conclusion, the findings indicate a significant gap in the awareness and application of Value Management practices in the Rwandan construction industry. Addressing this gap through targeted education, promotion, and demonstration of VM's benefits can enhance project outcomes, improve efficiency, and align projects more closely with stakeholder needs. Increasing awareness and adoption of VM has the potential to transform the construction industry in Rwanda by fostering more effective and value-driven project management practices.

### 4.4.2 Objective 2: Barriers Hindering Value Management Practice

As shown in figure 3.2, the findings revealed that the top three barriers against use of VM in construction projects are lack of awareness followed by lack of training and/or education in VM among industry practitioners. The lack of contractual provisions in construction contracts to support VM came in third. The least weighted factors were conflict of interest, high costs and lack of communication. The following paragraphs discuss in depth each of these barriers;

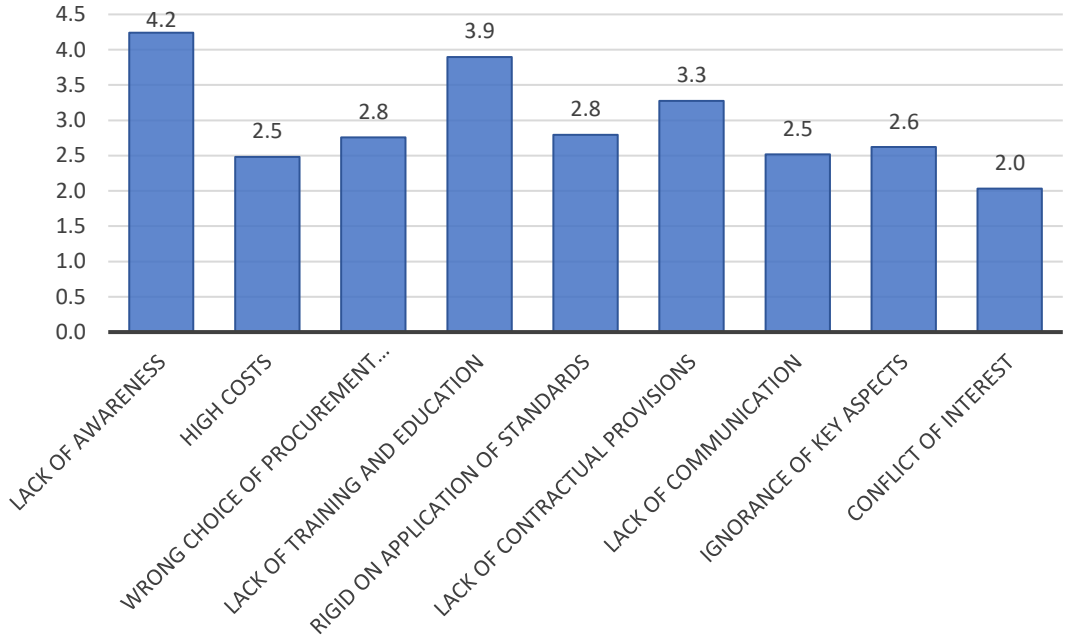


**Figure 4.4: Barriers against Value Management Practice**

Source: (Field Survey, 2022)

**1. Lack of Awareness**

**Findings**

- **Prevalence:** The study revealed that lack of awareness is the most significant barrier to the use of VM in construction projects.
- **Impact:** When industry practitioners are not aware of VM, they are unlikely to consider it as an option or appreciate its benefits, leading to its underutilization.

**Implications**

- **Educational Outreach:** There is a critical need for educational outreach and awareness campaigns to inform industry professionals about what VM is and how it can be beneficial.
- **Knowledge Dissemination:** Professional associations, industry bodies, and educational institutions should prioritize disseminating knowledge about VM through seminars, workshops, and publications.

**Strategies to Address:**

- **Awareness Campaigns:** Launch targeted awareness campaigns using industry conferences, trade publications, and online platforms.
- **Case Studies and Success Stories:** Share successful case studies and testimonials from projects that have benefited from VM to illustrate its practical advantages.

**2. Lack of Training and Education**

**Findings:**

- **Prevalence:** The second most significant barrier is the lack of training and education in VM among industry practitioners.
- **Impact:** Without proper training, even those who are aware of VM may not have the necessary skills to implement it effectively.

**Implications:**

- **Curriculum Development:** There is a need to integrate VM into the curriculum of construction-related degree programs and professional development courses.
- **Professional Training:** Industry practitioners need accessible, practical training programs that provide the skills and knowledge required to apply VM.

**Strategies to Address:**

- **Academic Programs:** Develop and incorporate VM modules into engineering, architecture, and project management programs at universities and technical colleges.
- **Certification Programs:** Create certification programs and continuing education courses focused on VM, offered by professional bodies and training institutions.

**3. Lack of Contractual Provisions**

**Findings:**

- **Prevalence:** The lack of contractual provisions to support VM came in third as a significant barrier.
- **Impact:** Without contractual support, there is no formal requirement or incentive for project teams to implement VM, making it less likely to be adopted.

**Implications:**

- **Contractual Reforms:** Standard construction contracts need to be revised to include clauses that mandate or encourage the use of VM.
- **Policy Advocacy:** There should be advocacy for policy changes that promote the inclusion of VM in contractual agreements.

**Strategies to Address:**

- **Model Contracts:** Develop model contract templates that include provisions for VM and promote their adoption across the industry.
- **Government Initiatives:** Encourage government bodies to include VM clauses in public sector construction contracts as a standard practice.

**Least Weighted Factors**

- Conflict of Interest
- High Costs
- Lack of Communication

**Findings**

- **Conflict of Interest:** Some respondents indicated that potential conflicts of interest could deter VM use, but this was a less significant barrier.
- **High Costs:** The perceived high costs of implementing VM were not seen as a major barrier, suggesting that cost concerns are less impactful compared to awareness and training issues.
- **Lack of Communication:** While communication issues were noted, they were considered the least significant barrier to VM adoption.

**Implications**

- **Addressing Lesser Barriers:** Although these factors were less significant, addressing them could still contribute to more widespread adoption of VM.
- **Perception Management:** It's important to manage perceptions about the costs and benefits of VM and ensure transparent communication to prevent conflicts of interest.

**Strategies to Address:**

- **Conflict of Interest:** Establish clear guidelines and ethical standards to manage and mitigate potential conflicts of interest.
- **Cost-Benefit Analysis:** Provide data and case studies demonstrating the cost-effectiveness of VM to alleviate concerns about high costs.
- **Improving Communication:** Foster better communication practices within project teams to support the integration of VM principles.

The findings of the research provide a clear direction for addressing the barriers to VM adoption in construction projects in Rwanda. Prioritizing awareness, education, and contractual support will be crucial in overcoming these barriers.

### 4.4.3 Objective 3: Expert Views on Making VM Use a Mandatory Requirement in Rwanda

The views gathered from various experts in the construction field regarding the compulsory application of VM in conception of construction projects in Rwanda, are summarized here under: -

a) The government of Rwanda to make it a requirement for public infrastructure projects to incorporate VM approach in their conception and design stages. This can be enforced through relevant institutions like Districts' one stop centers to introduce VM approach into the design requirements for public and complex projects of specified nature, for application of construction permits.

b) Inclusion of VM, through policy and legal framework (standards, laws and regulations), in the Terms of References and key clauses for procurement of public and complex infrastructure projects in Rwanda. In this case, Rwanda Public Procurement Agency (RPPA) should add VM approach into the particular conditions of contract for procurement of public infrastructure projects.

### 4.4.4 Objective 4: Framework for Enhancing VM Use in Complex Projects in Rwanda

Increased adoption of VM in Rwanda's construction, especially in complex projects requires an interplay of training and awareness campaigns, institutional support, development of local case studies, and finally monitoring and evaluation as shown in Figure 4.4 below. Firstly, to foster the adoption of Value Management (VM) in Rwanda's construction industry, it is crucial to conduct training programs for industry professionals on VM principles and techniques. These training sessions will equip professionals with the necessary skills and knowledge to implement VM effectively. Additionally, raising awareness about the benefits of VM through workshops, seminars, and publications can help highlight the practical advantages of adopting VM practices. Such campaigns will ensure that industry stakeholders are well-informed and motivated to integrate VM into their projects.

Secondly, Institutional Support is paramount. Developing policies and guidelines that promote the adoption of VM is essential for creating an environment where VM is encouraged and supported. Establishing frameworks for monitoring and evaluating VM initiatives will help track progress and assess the effectiveness of VM practices. Furthermore, providing funding and resources to support VM projects is critical to ensuring that organizations have the necessary means to implement and sustain VM efforts. Institutional support will thus play a pivotal role in embedding VM into the construction industry's standard practices.

Thirdly, development of Local Case Studies: Documenting and sharing successful VM projects in Rwanda can illustrate the practical benefits of VM and serve as a powerful tool for advocacy. Local examples of VM application can build confidence among

industry stakeholders and encourage wider adoption. By showcasing these success stories, other professionals can see the tangible outcomes of VM, which can inspire them to implement similar approaches in their projects. Local case studies will therefore act as a catalyst for broader acceptance and integration of VM.

Finally, monitoring and evaluation. Engaging stakeholders at all levels in the VM process is essential for fostering collaboration and ensuring that diverse perspectives are considered. Implementing frameworks to monitor and evaluate the impact of VM on project outcomes will provide valuable insights into the effectiveness of these practices. Facilitating open discussions and knowledge sharing among stakeholders can help identify opportunities for improvement and drive continuous enhancement of VM practices. Monitoring and evaluation will ensure that VM initiatives remain relevant and effective over time.

To accelerate this adoption the following implementation strategy needs to be put in place which includes: -

a) Government Mandates: Making VM a requirement for public infrastructure projects through relevant policies and regulations can significantly drive its adoption. Including VM clauses in the Terms of References and procurement contracts for public projects will formalize its use and ensure that all public projects benefit from VM principles. Government mandates will thus provide a strong foundation for integrating VM into the construction sector.
b) Educational Integration**:** Integrating VM into the curricula of construction-related academic programs will prepare future industry professionals with the knowledge and skills needed to apply VM. Offering professional development courses and certification programs in VM will enable current practitioners to update their skills and stay abreast of best practices. Educational integration will ensure that VM becomes an integral part of the professional development of construction industry stakeholders.
c) Policy Advocacy and Development: Advocating for policy changes that support VM adoption in construction projects can create a more conducive environment for its implementation. Developing model contracts and standards

that incorporate VM provisions will provide clear guidelines and frameworks for practitioners to follow. Policy advocacy and development will thus establish a robust regulatory and operational foundation for VM.

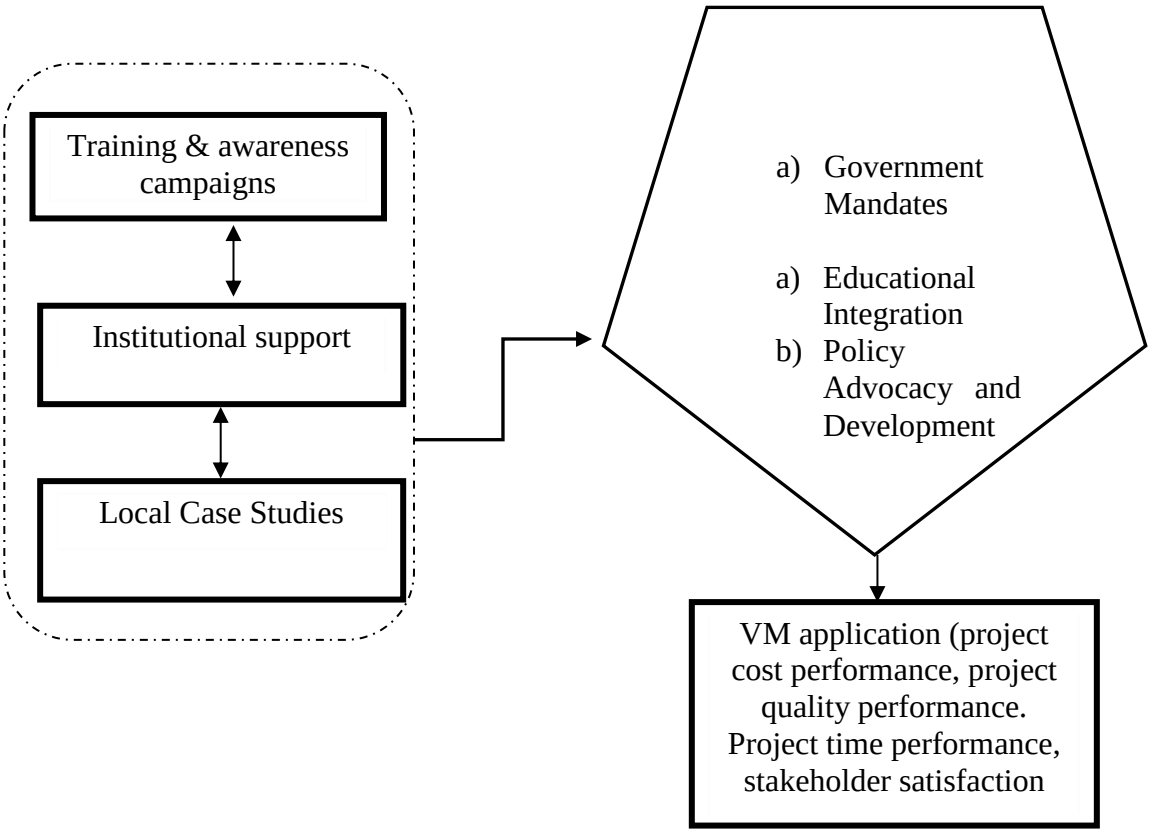


**Figure 4.5: A Framework for Enhancing VM adoption in Complex Projects in Rwanda**

Source: (Field Survey, 2022)

Key:

⟶ Communication

By integrating training, institutional support, local case studies, and continuous monitoring, the proposed framework aims to enhance the adoption of Value

Management in Rwanda's construction industry. This multifaceted approach will help maximize the value of construction projects, improve project outcomes, and ensure alignment with stakeholder expectations. Through collaborative efforts and strategic implementation, the construction industry in Rwanda can achieve more efficient, cost-effective, and high-quality project outcomes.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Introduction

This chapter presents the conclusions of the study, and its recommendations based on the study findings. It starts with a summary of the research findings, followed by the conclusions made in respect of each of the study objectives. Additionally, policy and practice recommendations made on the basis of the research findings are presented. Finally, the suggested areas for study are given.

## 5.2 Summary of Findings

### 5.2.1 Objective 1: Respondents level of Awareness on the Benefits of VM Adoption in Construction Projects

This study aimed to examine the current state of Value Management (VM) practices during the conception phase of construction projects in Rwanda. The findings revealed that only 25.7% of the respondents were aware of VM, indicating a significant lack of awareness among professionals. Further analysis showed that 51.7% of those aware had a very good understanding of VM, yet only a small fraction had actually applied it in projects. The low awareness and application of VM can be attributed to factors such as inadequate training and education, limited exposure, and entrenched traditional practices. These barriers lead to missed opportunities for improving project efficiency, quality, and stakeholder satisfaction, and increase the risk of cost and time overruns.

The study also identified key drivers for adopting VM, such as achieving better designs, enhancing overall value for money, and minimizing delays. Despite recognizing these benefits, the adoption of VM in Rwanda remains low. To address this, the study suggests enhancing education and training through curriculum development and professional workshops, promoting VM awareness via industry initiatives and government support, and encouraging adoption by implementing pilot projects and engaging stakeholders. By addressing these gaps, the construction

industry in Rwanda can significantly improve project outcomes and foster more effective, value-driven project management practices.

### 5.2.2 Objective 2: Barriers Hindering VM Practice

The study identified the top three barriers to the adoption of Value Management (VM) in construction projects in Rwanda as lack of awareness, lack of training and education, and lack of contractual provisions. Lack of awareness was found to be the most significant barrier, indicating that many industry practitioners are unfamiliar with VM and its benefits. This highlights the need for educational outreach and knowledge dissemination through targeted awareness campaigns, seminars, and workshops. The second most significant barrier, lack of training and education, underscores the necessity of integrating VM into construction-related degree programs and offering practical training and certification programs for professionals. The third barrier, lack of contractual provisions, suggests that standard construction contracts need to be revised to include VM clauses, supported by policy advocacy and government initiatives.

The least significant barriers were identified as conflict of interest, high costs, and lack of communication. Although these were less impactful, addressing them can still facilitate VM adoption. Clear guidelines to manage conflicts of interest, cost-benefit analyses to demonstrate VM's cost-effectiveness, and improved communication practices are recommended strategies. Overall, the research provides a roadmap for enhancing VM adoption in Rwanda by focusing on increasing awareness, providing adequate training, and ensuring contractual support, which can lead to more efficient and value-driven project management practices in the construction industry.

### 5.2.3 Objective 3: Expert Views on Making VM a Mandatory Requirement in Rwanda

Experts in the construction field recommend that the Rwandan government mandate the incorporation of Value Management (VM) in the conception and design stages of public infrastructure projects. This requirement should be enforced by relevant institutions, such as Districts' one-stop centers, which would introduce VM into the design criteria for public and complex projects as a condition for obtaining construction permits. Additionally, the policy and legal framework should include VM

in the Terms of References and key clauses for procuring public infrastructure projects. The Rwanda Public Procurement Agency (RPPA) should integrate VM into the specific conditions of contracts for these projects to ensure its application.

### 5.2.4 Objective 4: Framework for Enhancing VM Use in Complex Projects in Rwanda

To enhance the adoption of Value Management (VM) in Rwanda's construction industry, particularly for complex projects, several key strategies are required: training and awareness campaigns, institutional support, development of local case studies, and monitoring and evaluation. Training and awareness campaigns are crucial to educate industry professionals on the benefits and techniques of VM, promoting best practices and widespread adoption. Institutional support involves creating a supportive environment through policies and guidelines that encourage VM, establishing frameworks for evaluating its effectiveness, and providing necessary resources. Government incentives can further bolster VM adoption by offering tangible benefits for its implementation.

Additionally, developing local case studies showcasing successful VM projects can demonstrate its practical benefits in specific contexts, thereby building confidence and encouraging other stakeholders to adopt VM. Monitoring and evaluation play a vital role by facilitating open discussions and collaboration among all industry stakeholders, from project managers and contractors to policymakers and regulators. This process helps identify opportunities for VM, share knowledge, and improve practices. Together, these strategies form a comprehensive framework, aimed at increasing VM adoption in Rwanda's complex construction projects.

## 5.3 Conclusions

The following general conclusions were made from the summary of findings'

a) The first objective was to find out the level of awareness of construction industry professionals on benefits of VM adoption in construction projects. Results indicate that majority of the respondents were not aware of VM approach and only two of them indicated that they were involved in one construction project worth $20M in Rwanda where VM approach was applied during the conception stage. This implies that VM approach is practically not used in construction industry in Rwanda.

b) The second objective was to examine the barriers of the adoption of VM approach in the early stages of conception in construction projects in Rwanda. As derived, the most hindering blocks to application of VM which need to be addressed were found to be lack of awareness about VM by construction industry practitioners, lack of training and/or education in VM among industry practitioners and lack of contractual provisions to support value management in construction projects contracts.

c) The third objective was to explore the possibility of making use of VM in the design of large and complex infrastructure projects in Rwanda a mandatory requirement. Expert views pointed out that this can be achieved through two ways; the Government to make it a requirement for public infrastructure projects to incorporate VM approach in their conception and design stages. Additionally, inclusion of VM through policy and legal framework (standards, laws and regulations) in terms of Terms of reference and key clauses for procurement of public and complex infrastructure projects in Rwanda.

d) The fourth and final objective was to develop a framework that will guide the conceptualization and design process of large and complex construction projects in Rwanda. As discussed, increased adoption requires an interplay of training and awareness campaigns, institutional support, development of local case studies and finally monitoring and evaluation. Overall, promoting the adoption of VM in construction requires a multifaceted approach that involves education, institutional support and collaboration among stakeholders. By working together, the industry can maximize the value of construction projects and deliver better outcomes for all stakeholders.

## 5.4 Recommendations of the Study

In order to increase the uptake of VM in the conception of construction projects in Rwanda, the following recommendations can be made from this study;

a. Awareness Campaigns: Launch extensive awareness campaigns through professional associations, industry bodies, and educational institutions. Utilize industry conferences, seminars, workshops, and publications to inform construction professionals about the principles and benefits of VM.
b. Educational Integration: Integrate VM principles into the curricula of construction-related degree programs. Universities and technical colleges should incorporate VM modules into their engineering, architecture, and project management courses.
c. Professional Development: Offer continuous professional development courses and certification programs focused on VM. This can be achieved through partnerships with professional bodies and training institutions.
d. Training Programs: Develop and deliver comprehensive training programs that focus on VM techniques and their application in the construction industry. Ensure these programs are accessible to a broad range of professionals, including project managers, architects, engineers, and contractors.
e. Policy Advocacy: Advocate for the inclusion of VM in construction industry standards, laws, and regulations. Policymakers should work with industry stakeholders to develop guidelines and frameworks that support the integration of VM into construction contracts and project management practices.
f. Contractual Provisions: Revise standard construction contracts to include VM clauses. This will provide a formal requirement and incentive for project teams to implement VM.
g. Documentation: Document and share successful VM projects within Rwanda. Use these case studies to illustrate the practical benefits of VM and provide tangible examples of its application and outcomes.
h. Stakeholder Engagement: Engage stakeholders at all levels in the VM process, including project managers, contractors, policymakers, and regulators. This will foster collaboration and ensure diverse perspectives are considered.

## 5.5 Areas for Further Research

The following areas are suggested for further study: -

(1) Comparative Studies of VM Practices: Investigate the application of Value Management (VM) in construction projects across different countries or regions to provide a comparative analysis. This could help identify best practices and adaptable strategies that could be implemented in Rwanda.
(2) Longitudinal Studies on VM Implementation: Conduct longitudinal studies to assess the long-term impact of VM practices on construction project outcomes in Rwanda. This could include evaluating changes in project efficiency, cost management, and stakeholder satisfaction over time.
(3) Impact of VM on Project Stakeholder Engagement: Explore how the application of VM affects stakeholder engagement and communication throughout the project lifecycle. Understanding this relationship can provide insights into enhancing collaboration and decision-making processes in construction projects.
(4) Training and Education Programs for VM: Examine the effectiveness of various training and education programs in increasing the awareness and application of VM among construction professionals in Rwanda. This could involve developing and testing specific curricula or professional development courses.
(5) Policy and Regulatory Frameworks for VM: Investigate the role of policy and regulatory frameworks in promoting the adoption of VM in Rwanda. This research could focus on identifying necessary legislative changes and the impact of government incentives on VM adoption rates.

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# APPENDICES

## Appendix I: Introduction Letter

Dear Respondent

I am a student at Jomo Kenyatta university of Agriculture and Technology (JKUAT), pursuing Master of Construction Project Management. As part of my master's degree research, I am conducting a survey on Application of Value Management in Conception of Construction Projects in Rwanda. In effect, I request your cooperation to respond to the following questions regarding this subject as may be applicable to your work experience. This work is solely intended for academic purposes and any information obtained in connection with this study is identified with you will remain strictly confidential.

I want to reiterate that that your participation in this study is voluntary and all the efforts to protect your identity and keep the information confidential will be taken.

I have enclosed the consent form for your review. Please feel free to contact me if you have any questions about the study. If you choose to participate sign and date the information consent form and return it to me with completed questionnaire. I look forward to learning from your experiences in value management approach in formulation and development of construction projects in Rwanda. Your participation will be greatly appreciated.

Yours Sincerely,

RWAMUHINDA DICK

**Appendix II: Informed Consent Form**

1. Title of the research project: Application of Value Management Conception of Construction Projects in Rwanda
2. Objective of the study: To examine the merits of applying value management approach during the conception of construction projects for effective achievement of value for money in Rwanda.
3. I ……hereby accept to participate in this research as per explanation given to me by RWAMUHINDA Dick as a post graduate student from Jomo Kenyatta University of Agriculture and Technology.
4. The nature and objective of the research was explained to me and I understand them.
5. I understand the right to choose whether or not to participate in the research and that the information furnished will be handled confidentially. I understand that the results of the investigation will be published for academic purpose.

Signed _____Date_____

**Appendix III: Research Questionnaire**

**SECTION A: Personal Particulars of the Respondent**

Name ……Education……

**SECTION B: Level of involvement in construction project management**

(*Please tick in the box that suits your response)*

1. What is your role in project implementation?

| Code | Individual roles in project | Tick |
|---|---|---|
| IP 1 | Client | |
| IP2 | Architect | |
| IP3 | Engineer | |
| IP4 | Quantity Surveyor | |
| IP5 | Project Manager | |
| IP6 | Others (please specify) ……..… | |

2. How many years of experience do you have in implementation of construction projects?

| Code | Number of Years with Buyers | Tick |
|---|---|---|
| NYE1 | 1 – 5 Years | |
| NYE2 | 6 - 10 Years | |
| NYE3 | 11 15 Years | |
| NYE4 | Above 15 years | |

3. How many construction projects of $20m and above have you participated in their conception and/or implementation in Rwanda in the last 3 years?

| Code | Number of projects | Tick |
|---|---|---|
| NP1 | 1 | |
| NP2 | 2 | |
| NP3 | 3 | |
| NP4 | More than 3 | |

4. What is your level of understanding of Value Management application to construction projects?

| Code | Level of understanding | Tick |
|---|---|---|
| LU1 | Very Good | |
| LU2 | Good | |
| LU3 | Poor | |
| LU4 | Very poor | |

**SECTION C: Application of Value management in construction project**

*The table below shows the alternative responses and the number assigned to each response. Please evaluate the statement by ticking in the box with the number that suits your response.*

| Totally Disagree | Strongly Disagree | Disagree | Agree | Strongly agree | Fully agree |
|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |

| Drivers of value management application in construction project | | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| VA1 | Application of Value Management approach to construction projects achieves improved designs, construction and overall value for money. | | | | | | |
| VA2 | Application of Value Management approach to construction projects in Rwanda, done at conception stage eliminates or reduces unnecessary reviews during implementation of the project | | | | | | |
| VA3 | Application of Value Management approach to construction projects in Rwanda, done at the conception stage improves functional performance of the project. | | | | | | |
| VA4 | Application of Value Management approach to construction projects in Rwanda, done at conception stage minimizes delays in their implementation | | | | | | |
| VA5 | To achieve maximum benefits, value management should be carried out from the | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | early stage of a project, not simply introduced when the problems occur. | | | | | | |
| VA6 | | Others (Please specify) …… | | | | | |
| | **Barriers to application of Value Management in construction projects in Rwanda** | | | | | | |
| BA1 | Lack of awareness about VM by construction industry practitioners | | | | | | |
| BA2 | High cost associated with VM workshops | | | | | | |
| BA3 | Wrong choice of procurement system | | | | | | |
| BA4 | Lack of training and/or education in VM among industry practitioners | | | | | | |
| BA5 | Rigid application of standards and traditions without consideration of changing function, technology and value. | | | | | | |
| BA6 | Lack of contractual provisions to support value management | | | | | | |
| BA7 | Lack of good communication among project stakeholders | | | | | | |
| BA8 | Failure to admit ignorance of certain specialized aspects of project development | | | | | | |
| BA 9 | Conflict of interest among stakeholders | | | | | | |
| BA10 | | Others (Please specify)…… | | | | | |

**SECTION D:** General perspective of the respondent to the study

| | | |
|---|---|---|
| QN1 | Based on your knowledge and experience what is your comment/opinion on this study regarding application of value management in construction project? | **Please write your comment here** |

I will appreciate a lot for your time to respond to my questions above.

Thank you.