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Developing A Framework for Enhancing Value Management Adoption in Conception of Construction Projects in Rwanda

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Abstract

In Rwanda, big and complex infrastructure projects executed so far have not been done in consideration of the requisite value analysis at any stage of their implementation, resulting in notable frivolous scope changes, redundant facilities, and huge and unjustifiable costs in the projects. This calls for scrutiny of the practice of value management (VM) in the construction industry. VM is a structured approach that aims to maximize the value of a project while minimizing its costs. In the context of construction projects, value management can be used to ensure that the project meets the client's needs and objectives, while also achieving value for money. This paper explores the application of VM in the conception of construction projects in Rwanda. The study examined the current state of VM practices in Rwanda and highlighted factors promoting effective adoption of VM in construction projects. It also looked at the challenges associated with the VM adoption in Rwanda. Additionally, it explored the possibility of making VM use a mandatory requirement in the design of large and complex infrastructure projects in the country. The researchers aimed to develop a framework to foster adoption of VM in the construction industry of Rwanda. A questionnaire was used to collect data from professional practitioners in construction industry in Rwanda, and statistical data analysis was done. The study findings are that the respondents were aware of VM and its benefits in construction projects in Rwanda, but their application of VM in the projects was poor. Consequently, the VM-associated benefits – i.e. improved project outcomes, increased client satisfaction, and reduced project costs – which have been observed elsewhere, are not found in the industry. From the data analysis results, a schematic framework was formulated to promote the adoption of VM in the construction industry of Rwanda. The framework underlines VM training and awareness campaigns, institutional and legal support, and continual monitoring and evaluation of the endeavour.

Keywords: Value Engineering (VE), National Institute of Statistics of Rwanda (NISR), Life Cycle Cost (LCC), Value Engineering Change Proposals (VECP), Department of Transport (DfT).

INTRODUCTION

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, 1992). 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,

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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.

THEORY

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.

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 (2012) emphasizes the importance of VM in construction projects and requires its use in all public sector projects, (UK Government, 2012). 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 uses VM to improve the

production of cement resulting in the reduction of costs and improvement in quality (Misganaw, 2021). Overall, the continent's adoption of VM techniques is expected to increase in the future as organizations strive to remain competitive in the global market.

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. **Table 1** highlights the critical factors for value management successful implementation (Shen, 2003).

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.

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 & Oke, 2018).

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 itsDepartment 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 & Danuri, 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, 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

TABLE 1
Nominated critical factors for value management

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

Source: Shen 2003

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).

RESEARCH METHODS

In this research, a quantitative research strategy was adopted and a survey research design. Data on VM application in construction projects in Rwanda were collected from various professionals in construction industry. The target population for the study was construction industry professionals engaged in construction companies, consultancy firms and government institutions; they are the experts in charge of conception, design and implementation of large and complex construction projects. A representative sample of respondents from this population was selected.

A semi-structured questionnaire was used to bring out the respondents' feelings, motivations and views regarding VM practice in the construction industry of Rwanda, at whatever point the concept may be entered into the project. Fundamentally, there are two points of entry of VM into a construction project. 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. Finally, data analysis was done using the Statistical Package for Social Sciences (SPSS for Windows, Version 25), coupled with thematic analysis of responses from the open-ended questions in the data collection tool.

RESULTS AND DISCUSSION

Out of the target sampler size of 170 respondents, 113 subjects responded, giving a response rate of 66.50%, which should suffice to give the picture of the VM practice situation on the ground. Majority of the respondents were engineers and architects. As for professional experience, 31.0% of the respondents had 11-15 years of experience, while 29.2% had over 15 years of experience. Only a small portion, 15.0% had 1-5 years of experience.

Respondents' Level of Awareness on the Benefits of VM Adoption in Construction Projects

As shown in **Figure 1**, Twenty-nine respondents' out of 113 being 25.7% of the target population were aware of the application of value management on project management. Majority at 74.3% were not aware of VM approach as used/applied in construction projects. 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. In regard to 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%) seemed to have applied the VM approach.

Barriers to Value Management Practice in Rwanda

As shown in **Figure 2**, the top three barriers against use of VM in construction projects are lack of awareness with a weighted score of 4.6 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.

Expert Views on Making VM Use a Mandatory Requirement in Rwanda

Value Engineering (VE) workshop adoption in the Rwandese project development is still at the preliminary stage. In as much as practitioners are aware of the concept and the associated benefits, the implementation is rather slow. However, efforts by the Rwandan government are promising having placed a high emphasis on infrastructure development, which requires cost-effective and efficient project planning and execution. Additionally, there is a growing awareness of the importance of value engineering among construction professionals in Rwanda. As a result, many organizations, including the Rwanda Housing Authority, the Rwanda Transport Development Agency, and the Rwanda Energy Group, are considering the value engineering five-step job plan as a key tool in their project development process. Moreover, the Rwandan government has also made efforts to promote value engineering through capacity building programs and training for professionals in the construction industry. Therefore, the use of value engineering workshops is becoming more widespread in Rwandese project development, and it is likely to continue to gain traction in the future.

Regarding the effectiveness of VE nominated critical factors in Rwandese design projects, these depend on various parameters including the specific project's scope, complexity and budget. In addition, majority of the experts held the opinion that the expertise and experience of the design team and their ability to identify and implement cost saving measures without compromising the project's quality and performance as crucial.

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 should make it a requirement for public infrastructure projects to incorporate VM approach in

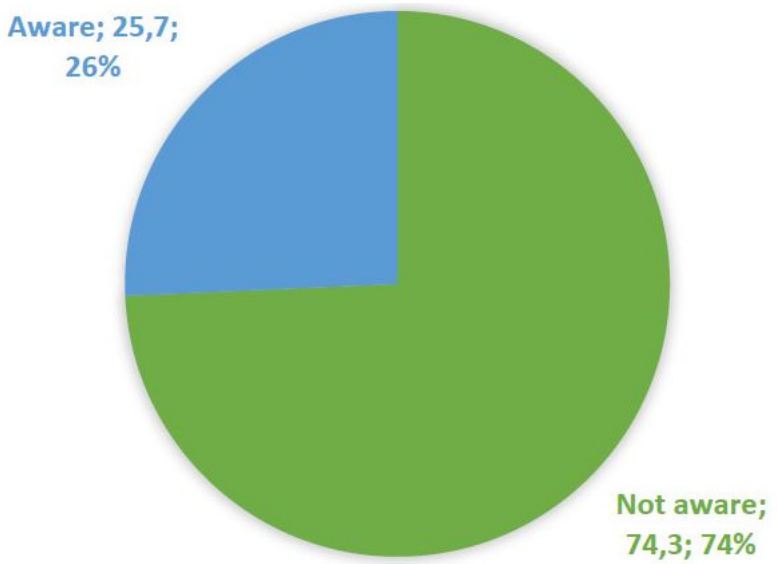

FIGURE 1
Respondents' Awareness of VM
Source: Author; Data Analysis Results 2022

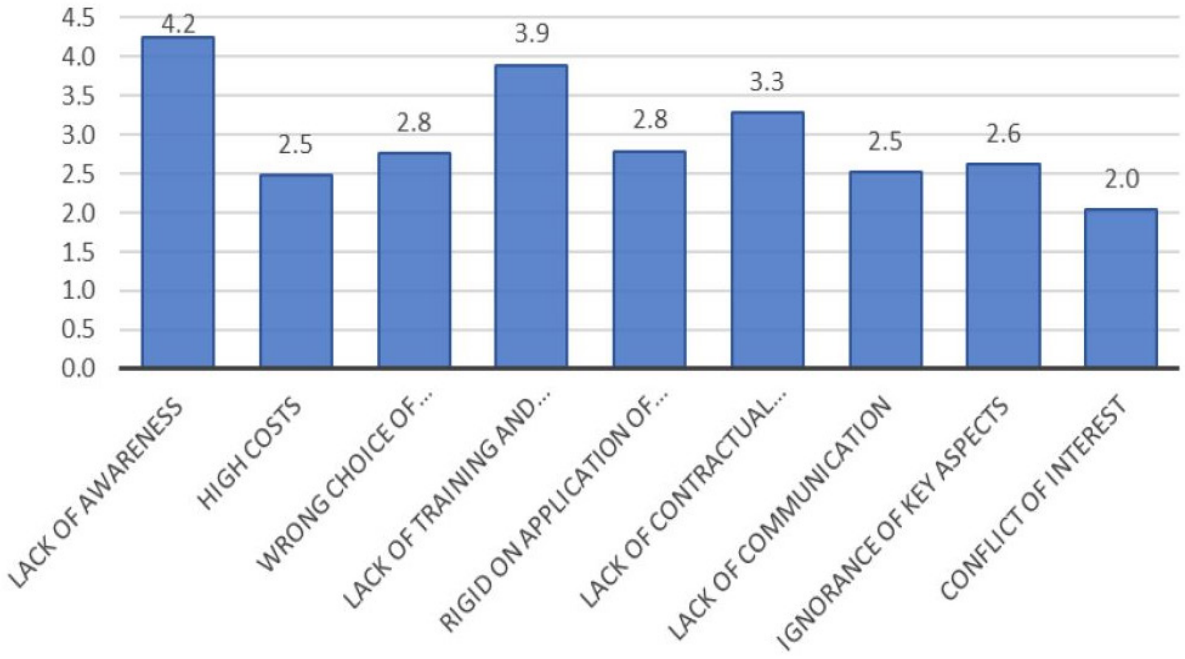

FIGURE 2
Barriers to Value Management Practice
Source: Author; Data Analysis Results 2022

their conception and design stages. This can be enforced through relevant institutions such as the districts' one stop centers, in order 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.

Framework for Enhancing VM Use in Complex Projects in Rwanda

In the light of the foregoing, increased adoption of VM in Rwanda's construction, especially in complex projects, is interplay of: VM training and awareness campaigns; institutional and legal support; establishment of local cases of best practices in VM applications; and continual monitoring and evaluation of the VM adoption enterprise. A framework for enhancing VM use in complex projects in Rwanda in a structured way is formulated in this study, as a schematic model shown in **Figure 3**.

Firstly, training and awareness campaigns are essential in raising the awareness about the benefits of value management, while providing structured and advanced training on VM principles and techniques should improve the atmosphere for adoption of the concept. Secondly, institutional support can help create an environment where VM is encouraged and supported. This includes policy and practice guidelines that promote the use of VM, incorporation of VM activity in the conditions of contract – main contracts and consultants' contracts. Thirdly, establishment of centres of VM excellence and/or cases (projects and firms) of best practices in VM applications should be a game changer. Best local cases can help demonstrate the benefits of VM in specific contexts and provide examples of successful VM projects. This helps to build confidence in the VM approach and encourage its adoption by other stakeholders in the industry. Finally, continual monitoring and evaluating of the VM initiatives adoption initiatives needs to be instituted at the micro and macro levels of the construction industry of Rwanda, for assessment of the organizational effectiveness and refinement of the VM policy.

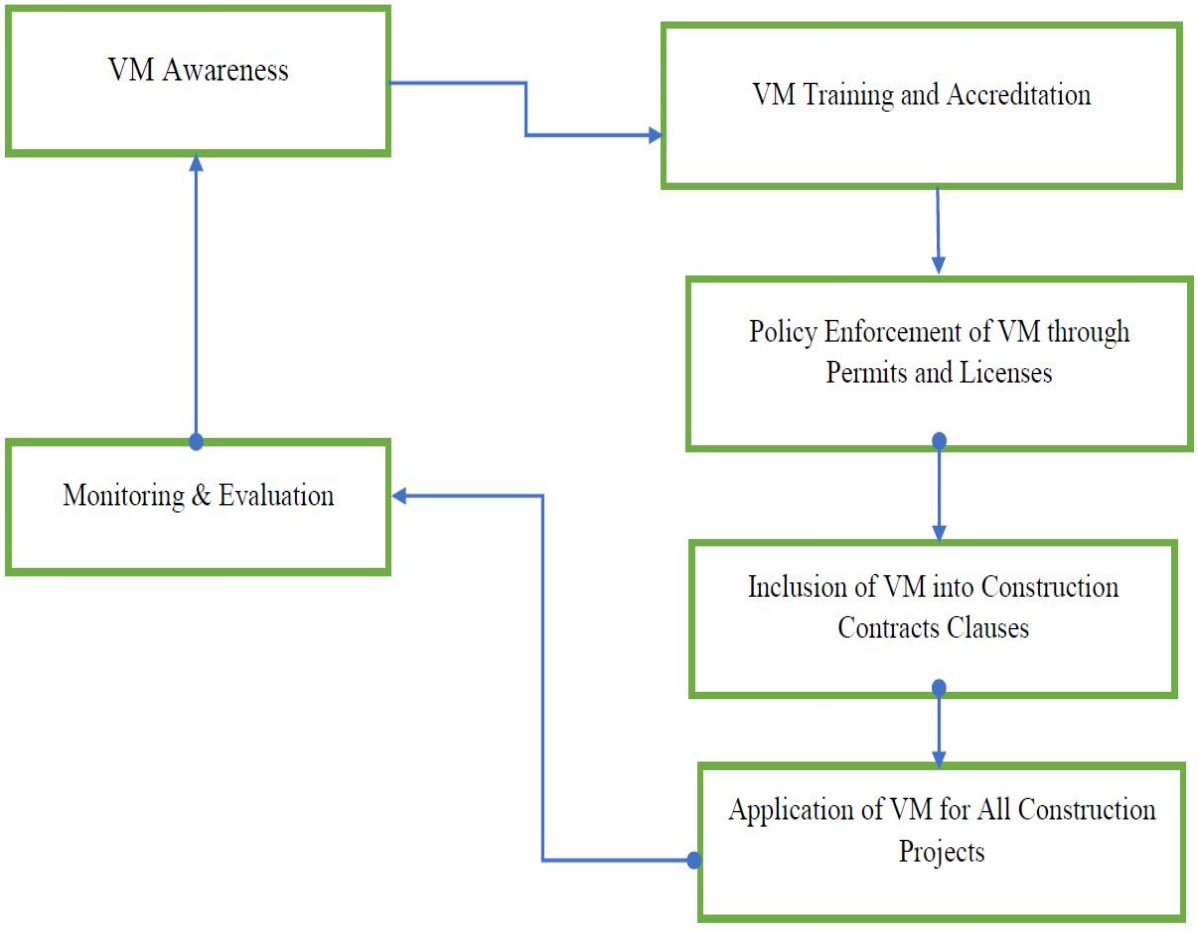

FIGURE 3
A Framework for Enhancing VM adoption in Complex Projects in Rwanda
Source: Author; Synthesis from Data Analysis Results, 2022

Key:

Communication line

Monitoring and Evaluation should promote open discussions and collaborations amongst the stakeholders - project managers, contractors, policy makers and regulators – to exchange knowledge and expertise in this field and identify opportunities for VM in envisioned mega projects.

CONCLUSION AND RECOMMENDATIONS

Although professionals in the construction industry of Rwanda appreciate the benefits of VM adoption in construction projects, practice of VM in the country is poor because of inadequate training of the industry practitioners on the VM method. Additionally, there are no contractual provisions to support VM incorporation in the construction project contracts. All the same, expert views support the idea of making use of VM in large and complex infrastructure projects in Rwanda a mandatory requirement, through two ways: Government to make it a requirement for public infrastructure projects to incorporate VM approach in their conception and design stages; and, promotion of VM through national policy and legal frameworks (standards, laws and regulations). Increased adoption of VM in the conceptualization and design process of large and complex construction projects in Rwanda can be achieved through a framework of industry policy and practice activities and

institutions, a schematic model of which was formulated in this study. It is a multifaceted approach that involves education, training, institutional support and collaboration amongst VM stakeholders in the construction industry.

The overall recommendation from this study is implementation of the framework developed in the study. Accordingly, government involvement is critical in promoting VM, or any other process innovation in industry practice. In this regard, the Government of Rwanda should provide political goodwill and funding - for the institutions, policies, laws, regulations, incentives [for excellence in VM usage], in order to support the VM enhancement framework. Findings in this study offer the baseline for further initiatives towards improvement of delivery of mega projects in Rwanda.

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