AWARENESS OF VALUE MANAGEMENT AMONG CONSTRUCTION PROFESSIONALS WORKING ON CORRECTIONAL SERVICES

Submitted By:

Nomnikelo Nikita Mangquku

Student No. 1810705

A RESEARCH REPORT SUBMITTED IN FULLFILLMENT OF THE REQUIREMENTS FOR THE M.S.C IN BUILDING DEGREE AT THE SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT, UNIVERSITY OF THE WITWATERSRAND

Supervisor:

Oluwayomi Babatunde, PhD

October 2020

DECLARATION

I declare that this research report is my own original work. It is submitted in partial fulfilment of the degree of Master of Science in Building at the School of Construction Economics and Management, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

…….

(*Signature of Candidate*)

October 2020

ACKNOWLEDGEMENT

I wish to acknowledge the massive support from people who have made me to achieve this research report from commencement until completion. Firslty, to God Almighty for giving me the strength and power when I wanted to drop the module. Secondly, my supervisor Dr. Oluwayomi Babatunde for his massive guidance: he has taken me from zero to something. My family members, for being understanding during the difficult times throughout my study and their tolerance throughout my research study. To my participants, who took time to respond to questionnaires in particular. Without any support from everyone, I could not have made it this far.

ABSTRACT

Purpose: Research has shown that the use of value management has been linked to improve performance of construction projects. This research report aimed at investigating the level of awareness of value management (VM) among construction professionals working on Correctional Services in Gauteng region, South Africa. The survey explored the awareness and understanding of VM, VM critical success factors, and VM methods and tools among construction professionals.

Design/methodology/approach: A structured online questionnaire survey was employed to investigate VM level of awareness among construction professionals working within the Department of Correctional Services (DCS). The survey targeted 50 construction professionals working for DCS. Consequently, the purposive, non-probability sampling technique was employed in this study and the response rate was 74%. Descriptive statistics is then employed in analysing the survey response data.

Findings**:** The top-five outcomes and or objectives of a VM study are effective risk management, enhance project functionality, enhanced project worth, reduced project operating costs and reduced project capital cost. The top-five VM methods and tools are time, cost and quality triangle, life cycle costing, value analysis, REDReSS, and process flow charting. The top-five critical success factors for VM are client support and active participation, plan for implementation, cooperation from related departments, clients' support, and active participation, and, lastly, interaction among participants.

Research limitations/implications: Overall, the construction professionals were somewhat aware of VM, however, VM is not being employed on DCS projects. Valued support and funding from government and government departments, awareness campaigns to be conducted within DCS. In addition, government to enforce regulations and policies for VM implementation on their projects.

Originality/ Value: The originality of the research is based on specifically investigating the level of awareness of VM among construction professionals working on and with DCS.

Key words: Awareness, Construction Professionals, Correctional Services, South Africa, Value Management

Table of Contents

LIST OF ABBREVIATIONS

Abbreviation	Description
CI:	Construction Industry
DCS:	Department of Correctional Services
CSF:	Critical success factors
DPW:	Department of Public Works
MS:	Mean Score
SA:	South Africa
SACAP:	South African Council for Architectural Profession
SACPCP:	South African Council for Project and Construction Management
SACQSP:	South African Council for Quantity Surveying Profession
SAVE:	The Society of American Value Engineers
USA:	United States of America
VA:	Vale Analysis
VE:	Value Engineering
VM:	Value Management
FAST:	Function Analysis System Technique
SD:	Standard Deviation
SMART:	Simple Multi-Attribute Rating Technique

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE –INTRODUCTION

1.1 Background of the study

Nowadays, nearly every project is undertaken in instances where the stakeholders assume a noteworthy part in the achievement of project objectives (Bowen, Edwards, Cattell, and Jay, 2010). Project ventures are sensitive to the decisions and choices made by the different stakeholders of a project which in many instances results in project failure (Ruparathna and Hewage, 2015). VM can create strong and healthy stakeholder relationships in all the stages of a project undertaking, from the design phase, implementation, operational and the completion phases (Pillay *et al*., 2013). Stakeholder partnerships can help to integrate consumers, end users, temporary workers, specialists, worker's guilds, exposed experts, money related establishments, indemnity assistances, directing relations, and competitors (Pillay, Steyn and Sommerville, 2013; Jaapar, Maznan and Zawawi, 2012). Rugenyi (2015) suggests that the project manager should ensure that projects are delivered within the time, cost, and scope triangle while ensuring quality of the product.

Value Management (VM) is a concept that is important and relevant for stakeholder engagement. VM is multidisciplinary and seeks to exploit the creative potential of all the project participants working together. Venkataraman and Pinto (2008) are of the view that the key to effective VM is to involve all the appropriate stakeholders in the process of structured team thinking, so that the needs of the main parties can be accommodated wherever possible.

Moreover, VM creates clear focus on the project objectives by discovering the main issues, constraints and risks involved and then, providing an authoritative review of the project (Aigbavboa, Oke and Mgele, 2016). It is an important cost management tool which deals with all the concepts that can ensure the delivery of projects at the least possible cost while upholding their value and function (Aigbavboa, Oke and Mgele, 2016). Furthermore, Perera, Karusena and Selvadurai (2003) are of the view that the philosophy of VM is based on the fact that there are certain costs which are unnecessary but disguised as inevitable in a project due to the complex nature of the project's process. Therefore, major savings can be achieved through the systematic and iterative identification and elimination of these unnecessary costs.

The same can be said on the importance of VM implementation in South Africa's department of correctional services (DCS). The DCS in Pretoria, South Africa, is given the mandate by the government to oversee the execution of some capital projects together with the repairs and maintenance of projects that are critical to South Africa's economic development (DCS, 2017). The DCS consists of six (6) regional offices including the Eastern Cape, Free State/Northern

Cape, Gauteng, KwaZulu-Natal, Limpopo/Mpumalanga/North West (LMN), and the Western Cape. DCS contains 46 organisations or areas, 234 centres, and four (4) service delivery line-ups including incarceration, rehabilitation, care, and social reintegration to address the spate of violence in South Africa.

Consequently, the DCS is faced with challenges of overcrowding in their facilities compounded by insufficient accommodation stemming from old infrastructure together with a high and increasing level of imprisonment. On the one hand, the DCS strategy to overcome overcrowding has been but not limited to additional bed space. On the other hand, the DCS has deviated from the planned 945 additional bed spaces to the erstwhile 455 bed spaces (DCS, 2017). The reason being that the contractors were liquidated which resulted in a long wait for the procurement of replacement contractors, which also resulted in overspending of the allocated budget for the project (DCS, 2017).

VM is a technique that is also implemented within the construction industry with the objective of ensuring that projects are delivered at the best possible cost, by engaging various stakeholders both external and internal in the initial stages of the project to achieve the intended results (Rangelova and Traykova, 2014). A little wonder that VM is widely accepted as a best practice in project control (Pillay *et al*., 2013). According to Yekini *et al*. (2015), VM was first initiated by Lawrence D. Miles, a purchasing engineer with the company "General Electric" (GEC) in the United States of America. In this case, VM was developed with the intention of improving the product, called "value analysis" (VA) which was then, subsequently, termed "value engineering" (VE) and, eventually, morphed into what is most commonly referred to as "value management" (VM) (Yekin *et al*., 2015). Currently, VM is practised by various countries internationally.

Moreover, VM practices have made major progress in the construction industry over the past few years (Yekini *et al*., 2015). Notable progress emanating from the adoption of VM has led to efficient use of resources, reduction of waste, scheduling of tight stages, and greater competition in the marketplace (Rangelova and Traykova, 2014). Furthermore, the application of VM has also enhanced decision making (Rangelova and Traykova, 2014). However, while the benefits of VM are well documented, its level of awareness among construction professionals is mixed. Bowen (2009) revealed that 60% of the South African Quantity Surveyors interviewed were aware of VM concept followed by 49% of Project Engineers with only 26% of the Architects being aware of VM. Aigbavboa *et al*., (2016) have alluded to the low level of awareness of VM among Project Managers in South Africa. This creates an

important empirical knowledge gap since the project managers bring the other parties together to achieve the project objectives within the constraints.

1.2 Problem Statement

South African project managers lack awareness and in-depth knowledge of VM and are, therefore, reluctant to implement VM and, as a result, forgo the potential benefits of VM to achieve the project objectives, including the positive outcomes in all the three tiers of sustainable development in construction projects (Aigbavboa *et al*., 2016). This has contributed to the continuous occurrence of construction project failure, arising from poor stakeholder engagement in the planning stages of the project, budget overruns, a lack of innovation, environmental issues and a hinderance to achieving sustainable development objectives (Waghmare *et al*., 2016). Awareness of VM among construction professionals acting in the capacities of project managers needs to be assessed for the necessary intervention to ensure increase the chances of construction project success.

1.3 Substantiation of the problem

According to Ofori (2014), projects remain the instrument of choice for policymakers in most developing countries. However, poor project performance coupled with the disappointment of stakeholders and beneficiaries seem to have become the rule and not the exception in contemporary reality. Although VM awareness and recognition standards are on the rise amongst construction professionals, projects continue to fail with a detrimental effect on budgetary allocation (Al-Zwainy, 2018). VM enables a system of governance aimed at pursuing continuous improvement and modernising practices, encouraging people, development of skills, and promoting innovation for the overall performance of an organisation (Ofori, 2014). However, project leadership has a crucial role to play by being aware of VM so that these benefits can be realized.

It is important to note that, even though contributions have been made by many scholars on VM, it has become apparently evident that within the South African context, there are yet to be research studies that shed light on VM awareness, attitudes, benefits and challenges of VM practices by construction professionals working as project managers for DCS. Many scholars in South Africa have scrutinised VM in various contexts by focusing on the awareness and practice of VM by South African consulting engineers (Bowen *et al*., 2010). Moreover, Ncube and Rwelamila (2017) stated that, not much has been carried out in determining the presence of VM training and has resulted in various project managers being unwilling to implement.

Other scholars have interrogated the contributions of VM to the improvement of construction performance in the South African construction industry (Lourens and Aigbavboa, 2016), the VM awareness and practice by South African architects (Bowen *et al*., 2010), VM expertise in the South African construction industry using Gauteng as a case study (Ncube and Rwelamila, 2017), the implementation of VM in the South African construction industry (Lourens, 2016) and the identification of value conflicts between stakeholders in corporate travel management by applying the soft VM model. However, a project-specific (e.g., correctional services) VM awareness has not been studied for the necessary intervention, which can, subsequently, serve as a case study or lessons learned for other similar projects.

According to Aigbavboa, Oke and Mgele (2016), VM has not been fully adopted and utilised for construction projects due to lack of awareness, insufficient information about the discipline, wrong perception of the discpline, unwillingness on the part of clients to adopt and pay for the exercise as well as lack of motivation from other concerned stakeholders. Moreover, Coetzee (2009) supports this argument by stating that, the level of awareness, adoption and utilization of VM in SA is still very low which has resulted in low values of construction projects. Similarly, the values of DCS projects are not being realized, which can be attributed to the awareness of VM for the necessary stakeholder involvement. However, this awareness needs to be investigated empirically, in the first instance.

1.4 Research Aim

This research aims to assess the awareness of VM among construction professionals working for the DCS in Gauteng, South Africa, as a measure of the readiness to implement VM.

1.5 Research Objectives

The three objectives that are linked to the preceding aim include investigating the level of awareness of the:

OBJ1: Outcome/objectives of VM among construction professionals working for the DCS;

OBJ2: VM methods and tools among construction professionals working for the DCS; and

OBJ3: Critical success factors for VM among construction professionals working for the DCS.

1.6 Research Questions

Linked to the preceding three research objectives, the three research questions to be answered include:

RQ1: What is the level of awareness of the outcome/objectives of VM among construction professionals working for the DCS?

RQ2: What is the level of awareness of the different VM methods and tools among construction professionals working for the DCS? and

RQ3: What is the level of awareness of the critical success factors for VM among construction professionals working for the DCS?

1.7 Significance of the study

This study explores the level of understanding of VM that currently exists among construction professionals working on public projects. Researchers and academics could use this study as a yardstick for further studies on how best to create an awareness of VM in other projects and industries apart from construction. Students and academics could use this study as a reference point and try to improve on the areas that are not covered by the researcher in the future within the VM field. Moreover, it is anticipated that the findings will be of value to future researchers and scholars who may use this study as a basis to conduct further studies. The result derived from this study has the potential to assist in revising current policies and generating new policies within DCS.

1.8. Limitations

Influenced by the scope, this study was limited to construction project team working on DCS facilities in South Africa. Following, the data collection was restricted to construction professionals (construction project managers, architects, quantity surveyors, and engineers) working for the DCS.

1.9. Assumptions

It is assumed that construction professionals working for the DCS are not adequately aware of the VM concept. To that end, it is assumed that the data collected from the participants will be accurate and truthful, since the researcher has little control over how the participants will respond to the questionnaires.

1.10. Overview of chapters

Chapter one **–** This chapter covers the introduction, background of VM, research problem, research aim, research objectives, and research questions. Furthermore, this chapter also discusses the limitations, assumptions, and chapter overview.

***Chapter two* -** This chapter reviews literature from previous scholars that have conducted studies on the levels of awareness of VM, different VM methods and tools, and the critical success factors for VM.

Chapter three – This section covers the research methodology, including the research design and method employed in this study. It also covers the techniques employed for collecting and analysing the data.

***Chapter four* –** This chapter presents the data collected and their analyses, leading to the main findings and their discussions including of the implications.

***Chapter five* –** Chapter five presents the conclusion of this study and gives recommendations for future studies.

1.11 Summary

This Chapter has discussed the background of VM with regards to what it entails along with the beneficial characteristic of adding value to stakeholder engagement within the construction industry. The problem statement of the study has also been outlined in addition to the significance of the study, the research aim, research objectives, research questions, and the foreseeable limitations of the research study. The research assumptions and overview of the main topics of each of the proposed chapters have also been discussed. Importance of VM and its place and benefit in forging strong partnerships in the area of stakeholder engagement has been discussed. VM can create strong stakeholder relationships across all the stages of construction projects from the design phase to and the operational phase. Since the practice of VM is gaining momentum in South Africa, the importance of VM implementation on DCS projects is an avenue in which more research can be conducted. This avenue is what this current research project seeks to interrogate.

CHAPTER TWO - LITERATURE REVIEW

2.1 Introduction

This chapter presents a discussion on the existing literature that deals with the three aspects of Value management (VM) that are central to this study. These three aspects are related to investigating the level of awareness of the outcomes/objectives of VM, the level of awareness of the different VM methods and tools together, and the level of awareness of the critical success factors of VM. The first section focuses on providing a global overview of VM, followed by a section on the objectives of VM, VM methods and tools and lastly, the critical success factors for VM.

2.2 Global Overview of VM

According to Karim *et al*., (2014), developed countries are at the forefront in terms of the acceptance and adoption of VM. The USA government for instance, requires all projects worth at least USD 2 million to conduct a VM study. According to Kaur (2012), the Department for Transport in USA is even more strict as it makes VM obligatory to projects worth at least USD 100,000.00. Additionally, the South Korean Ministry of Land, Transport and Maritime affairs has mandated VM for all projects worth at least KRW10 billion (USD10 million).

Moreover, the Japanese government requires the use of VM on projects costing at least JPY175 million (USD2 million) while the Australian government has necessitated VM for its federal project costing at least AUD5 million (USD4.5 million) (Karim *et al*., 2014). Kelly *et al*. (2004) observed that VM in the UK construction industry has evolved to become an established service with commonly understood tools, techniques, and styles. Ellis, Wood and Keel (2005) describe VM as being widely accepted as an important tool in the management of projects. While this may be so for construction industries in the developed countries, the situation is by no means the same for the developing nations (Bowen et al., 2010).

Rangelova and Traykova (2014) opined that the best time to implement VM is in the early development phases of a project and that optimal benefits will be obtained if utilized on larger and more complex projects. The most common stages or phases of a VM include pre-study phase, information stage, creative phase, evaluation phase, development phase, presentation phase, and post-study phase (Rangelova and Traykova, 2014). The VM common stages or phases can be identified with five keywords or phrases (Rangelova & Traykova, 2014):

Systematic process: this is alternatively referred to as a job plan consisting of the various steps guiding the VM team throughout the problem-solving procedure. This process has a certain

commencement and finish and is unique when compared to other cost reduction exercises, which are usually unstructured and conducted in an informal way.

Multi-disciplinary effort: This calls for a team of individuals working together to examine all aspects of the project under study. These individuals work together as a team under the headship and supervision of the VM organizer. Since there is no expert in every area of the construction project, many projects make use of several disciplines.

Functions: Function analysis is at the root of VM and this is what separates VM from other cost-cutting programs. Additionally, in VM questions of what it does and what is the function that it seeks to achieve are asked. It is key to note that, the undertaking of VM should be without compromising of client requirements of the value, dependability, security, and appealing features.

Value: Without a doubt, the main function of VM is to improve value and not to necessarily reduce costs. Product/Project value is achieved through the balancing of cost, time, and function/quality. Value can also be the benefit the client or the inhabitants of such a building or structure enjoys.

Life cycle costs: This is the current worth of the full cost of a building/asset through its whole operational 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.

2.3 Outcomes/Objectives of VM

Research conducted by Bowen *et al*., (2009) on awareness reveals that, VM awareness is not widespread among engineers and its practical application is at its minimum. Bowen *et al*., (2009) also indicate that most of the employees that know about VM learn about VM from their employer. Interestingly the employees that learned about VM through their employer are likely to continue practising VM.

This study seeks to discover if the results found by Ncube and Rwelamila (2017) apply to the engineers and the low management involved in project implementation. The study emphasizes that when VM is employed in projects, it always minimises costs; hence, employers are the principal enforcer of VM practice. According to Yekini *et al*. (2015), VM is mostly adopted in projects to ensure that the challenges such as budget limitations, security issues, environmental impact, and value for money are achieved. Yekini *et al*., (2015) also highlighted the importance of understanding the extent to which employees are aware of VM and its practical application.

The current literature focuses on adoption and applies VM to measuring the performance and decision-making by top management. Studies have shown that VM in South Africa is mostly implemented in the manufacturing industry, to a greater extent, as compared to the construction industry. Furthermore, in the manufacturing industry, VM has been affected by the non-existence of national standards, knowledge, and qualified facilitators (Karunasena *et al*., 2016).

Research conducted by Ncube and Rwelamila (2017) showed that, 60% of the employers were not practising VM because they did not know about it, and it confirms that those who practice VM sometimes have not embraced VM as a tool that can be used to optimise value to the firm. In South Africa, most organisations do not believe that construction professionals have yet accepted VM as a knowledge base in construction projects and there is a major lack of awareness or understanding on how best they can benefit from practising VM (Rangelova and Traykova, 2014). The success of a project is likely to be more achievable when VM is implemented in every stage of a project as stated by Leung and Yu (2014).

In the study by Oke and Ogunsemi (2015), it is stated that those practising VM do it because of the fact that it enjoys a prestige of being an international standard requirement as evidenced by only a tiny proportion, which belongs to international VM associations such as SAVE International and the Institute of Value Management (IVM). According to the IVM (2015), in South Africa, VM is mainly practised by private organisations and has spread between large and medium firms.

The study conducted by the IVM sought to find whether construction professionals in the built environment were aware of VM and its importance. The IVM (2015) also found that most employees are not aware of VM practices in a firm. When the project stakeholders such as project managers and engineers are aware of VM, it is most likely that they practice the application of VM. According to the IVM, the more the team is aware of VM, the more it creates the desire to implement and put into practice VM in various stages of projects.

2.3.1 Advantages of VM

Related to the outcomes or objectives of VM are the advantages. According to Akram, Minosowicz, Kostrzewa, Mukherjee and Nowak (2011) and IVM (2015), the benefits of adopting the VM approach on projects include: firstly, value definition, which helps in understanding what value meant to the owners and users of the project. Secondly, balancing expectation by serving as a means of optimising the balance between the different stakeholders' needs and expectations. Thirdly, enhancing project brief by serving as the basis for improving the project brief to reflect the sponsors priorities and expectations expressed as a function.

Fourthly, VM serves as a communication tool by providing an opportunity for communication so that all the stakeholders are aware of constraints, limitations, and requirements for making appropriate trade-offs. Fifthly, VM helps with design development by allowing for the improvement of design and performance enhancement in a collaborative environment. Lastly, VM helps with value measurement by providing a functional mechanism for measuring value by considering monetary and non-monetary benefits, which is a good way to evaluate value for money. Overall, Table 2.1 presents the different outcomes/objectives/advantages of VM.

Table 2.1: Summary of VM outcomes/objectives

Reduced project capital costs
Enhanced project functionality
Clarification of the brief and/or effective brief management
Enhanced project worth
Optimization of value over the life of the project
Minimization of environmental impact
Enhanced project usability in terms of convenience and comfort
Greater flexibility offered by the project
Effective risk management
Shorter project duration
Realization of project execution efficiencies
Reduced project operating costs
Other

(Akram et al., 2011 & IVM, 2015)

2.4 VM Methods and Tools

The usage of VM methods and tools varies considerably among different organisations. Luvara and Mwemezi (2017) state that, VM practice plays a vital role and has been proven as a successful tool for reducing cost, improving a product and its performance. Also, Maes *et al*. (2012) defines VM practices as the organisational processes, structures, and relational

mechanisms situated on the individual, portfolio, and enterprise level information systems priorities which deploy and evaluate information systems of the enterprise.

The research goes on to explain that the VM practitioner has become aware of these challenges and they have implemented some techniques to reduce them in the functional analysis such as SWOT analysis, value chain, SMART and gap analysis. These techniques allow VM practitioners to be competent in making sense of the needs of the client and what is expected of stakeholders involved in a project.

VM practice requires that practitioners to follow project framework blindly merely because of their tradition, or the fact that it is a set of tools that have existed for a long time. Practitioners of VM use the most appropriate tools and techniques available to reduce cost and increase the productivity of the projection. VM practices also carry some risks, though practitioners are required not to follow its framework blindly, it is important also for them to understand the sense-making issues. This will allow them to bring together new combinations of thoughts from the client view and VM view. There is currently a gap in the market where the VM practitioners have not yet learnt and understood the process and at the same time not allowing them to be ruled by the process (Oke and Ogunsemi, 2015).

There are other various VM methodologies, notably amongst others Function Analysis System Technique (FAST) and Life Cycle Cost (LCC).

2.4.1 FAST

The word function is commonly used and has many definitions. Kaufman (2001) defined function as an intent or purpose that a product or service is expected to perform. The classifications of functions as they relate to product performance are basic function and secondary function. Kitamura and Mizoguchi (1999) suggested that, a function of a component can be represented by a transitive verb of which grammatical subject is the component and of which grammatical object are the entities coming in and going out of the component. It can be concluded that function depends on the context but should be local in description.

Basic function is defined as the principal reasons for the existence of the product or service, operating in its normally prescribed manner. Secondary function is the method selected to carry out the basic function or those functions, and features supporting the basic functions (SAVE International, 1998). Kaufman (2001) gave four rules that govern the basic functions and once defined, a basic function cannot be changed. Kaufman (2001) and Sato and Kaufman (2005) also states that the cost to satisfy a basic function is usually less than 5% of the total product

cost. The loss of the basic function causes the loss of the market value and worth of the product or service.

Miles (1972) emphasized that VM has one specific purpose, which is the identification and elimination of unnecessary cost. Function analysis is the systematic process of identifying functions and their associated costs and assessing the necessity of those functions based on established criteria for the product or service. The concept of function analysis is clearly fundamental to the process of VM (Barton, 1991; Davis and Yeomans, 1996; Zackrison, 1997). Function analysis enables a systematic identification and clear definition of client requirements and improved understanding of various stakeholders' objectives and the effective accomplishment of those functions (Shen, 1993). It means that function analysis should include identification of functions, classification of functions, functional models, establishing function worth, cost functions, establishing value index and selection of function for study (SAVE International, 1998).

FAST permits people with different technical backgrounds to effectively communicate and resolve issues that require multi-disciplined considerations. FAST diagrams are used to prioritize the objectives or functions of the product. Once the objectives are prioritized, the options that would return the most value based on predetermined value criteria can be evaluated.

2.4.2 LCC

The term `life cycle cost' (LCC) means a process for evaluating the total economic worth of a usable project segment by analyzing initial costs and discounted future costs, such as maintenance, user costs, reconstruction, rehabilitation, restoring, and resurfacing costs, over the life of the project segment (Kirk and Dell ‘Isola, 1995; Barringer, 2003). LCC is an essential design process for controlling the initial and future cost of building ownership. LCC can be implemented at any level of the design process and can be an effective tool for evaluation of existing building systems. LCC can be used to evaluate the cost of a full range of projects, from an entire site complex to a specific building component. As defined earlier, LCC is the total discounted cost of owning, operating, maintaining, and disposing of a building or a building system over a period. LCC equation can be broken down into three variables: the pertinent costs of ownership, the period of time over which these costs are incurred, and the discount rate that is applied to future costs to equate them with present day costs (Bull, 1993; Landers, 1996; Seo *et al*., 2002).

As the total cost of ownership, LCC are summations of cost estimates from inception to disposal for both equipment and projects as determined by an analytical study and estimate of total costs

experienced in annual time increments during the project life with consideration for the time value of money (Liu *et al*., 2008). The objective of LCC analysis (Barringer, 2003) is to choose the most cost-effective approach from a series of alternatives to achieve the lowest long-term cost of ownership. LCC is an economic model over the project life span. Usually the cost of operation, maintenance, and disposal costs exceed all other first costs many times over.

From the preceding discussions, Table 2.2 presents the methods, tools, and methodologies used for VM.

Table 2.2.: VM Methods and Tools

Functional analysis systems technique (FAST)
Simple multivariate-attribute rating technique (SMART)
Kano model
Lever of value
Quality function deployment (QFD) technique
REDReSS
Spatial adjacency programming
Time, cost and quality triangle
Value analysis
Life cycle costing
Facility walk through maps
Process flow charting
Functional space analysis
Element function analysis
Component analysis
Supply chain analysis (mapping and planning)

(IVM, 2015)

Some other studies have attempted to link the different VM objectives with the VM methods and tools across the VM stages. According to Perera, Hayles and Kerlin (2011), there are six stages or phases in adopting VM practice environment. These stages include information phase, function analysis phase, creative phase, evaluation phase, development phase and presentation phase. Drawing from the research conducted by Mehmet and Arditi (2013), only three stages

(information, development, and presentation) are more effective and efficient in the implementation of the project.

VM has its unique combination of methods and tools implemented by both organisations and stakeholders during VM study. However, some tools are generic and mostly used by the organisations that subscribe to VM implementation. Most notably, the execution job plan hugely depends on several factors but not limited to complexity of the project, attributed to the size, the stage of the project development and the budgeted amount for the project. Table 2.3 presents the VM stages, objectives, and most commonly adopted VM methods and tools.

Table 2.3: VM phases, objectives, methods, and tools used

VM phases	**Objective**	**VM method and tool**
Information phase	Team members bring about identifying and benchmark alternatives and gender setting for innovations. Table critical information, common understanding of project information relating to start of project and understanding by various stakeholders involved.	Quality Function Deployment, voice of customers.
Function analysis	Check if the project will satisfy the intended purpose which is to satisfy the needs of the client. Understanding from a practical perspective.	Function analysis system technique (Fast)
Creative phase (Also referred as Speculation phase)	Different ideas are put in place relating in performing function by various stakeholders. Table down rules that protect the creation in environment being developed.	Brainstorming
Evaluation phase	Evaluating all ideas identified and shortens them with greatest potential to improve project. Looking at the idea's worth spending quality time to further develop.	Life cycle costing
Development phase	Further analyse and develop the short list of identified ideas those with high quality into significance choices. All various stakeholders need to understand the intent of the alternatives and how they benefit the project. Identify negative	Life cycle costing

VM phases	Objective	VM method and tool
	factors that may impact alternatives and come with innovative solutions. Once the team selects the best alternatives, they are fully developed through sketches, cost estimates.	
Presentation phase	As the name suggest, assist various stakeholders together with senior management to make informed decision in selecting concepts that can zoom their strategic plans.	Risk analysis

(Adapted from Perera *et al.*, 2003 & IVM, 2015)

2.5 Critical success factors for VM

VM tool is aligned in ensuring that client requirements are met and conforms to the clients' intentions for the project. Subsequent to that, clear objective from client and is considered very imperative factor to VM study. In addition, employ skilled and knowledgeable VM facilitator to lead the team with clear leadership skill roles and be able to communicate and transfer knowledge to team members, someone very patient to understand and take other people's advice, modify and come with neutral outcome. That can be achieved in highlighting and identifying some critical success factors and what must be done to achieve a project. Participants must be willing to participate and be creative to share ideas with other external and internal stakeholders during the VM workshop, which the critical success factors revolve around.

2.5.1 VM Workshop

Workshops grant opportunity to all internal and external stakeholders to gather in a structured workshop to share project information such as a clearly articulated VM objective with the help of either external or internal qualified facilitator. Furthermore, client and end user should form part of the workshop for needs clarification, scrutinizing the drawings with the team members and the designers, and providing the necessary critical information in reaching common agreement on what needs to be done. Another critical success factor is that of a conducive environment for the facilitated workshop, which typically covers the six stages as follows and further depicted under Figure 2.1:

- Information phase
- Function analysis phase

- Creative phase
- Evaluation phase
- Development phase
- Presentation phase

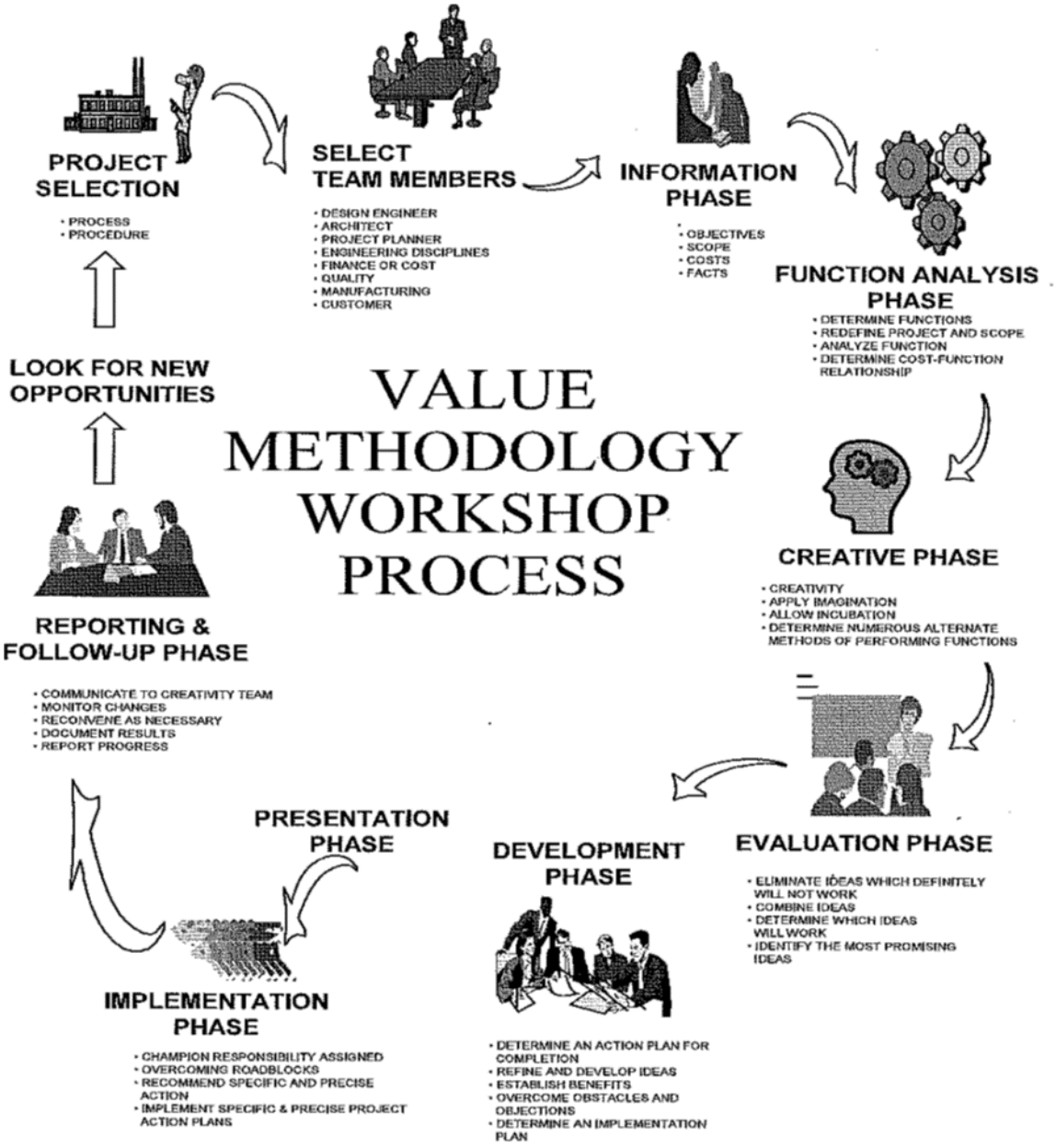

Figure 2.1: Value methodology workshop process (Rains, 2008:29)

As discussed earlier, VM concept has gained popularity in most developed countries as the potential mechanism to manage and deliver construction projects effectively and efficiently. Furthermore, VM deals with proper clarification in design phases and construction phase and

that can yield better improvement in design by identifying problems at infant stages, avoiding unwanted design propositions, and eliminating waste altogether to ensure a smooth project delivery that is also cost effective (Aghimien *et al*., 2018).

According to Oke and Ogunsemi (2013), a major critical success factor for VM in the US is VM being mandatory for general service administration contract; thus, making it part of the country's culture to result in success in its utilization rate. Similarly, in Malaysia, the government has made the concept mandatory as well for all projects exceeding R500 Million by economic planning unit (Jaapar *et al*., 2012).

For construction projects, VM uses group-based facilitated workshop to improve the chances of obtaining good results on behalf of the client. Another critical success factor revealed by Surlan *et al*. (2014) is the measurement of the workshop performance. VM success does not come to one individual but rather to the group. As such, the need to incorporate a multidisciplinary representative group of people collaborating to follow a prescribed work plan. VM decisions affect everyone associated with the project such as the:

- Clients, whose intention, or interest is to achieve best value for money;
- End users, who want the project to meet their needs as effectively as possible;
- Designers, striving to meet the clients' and/or end users' needs in making sure that the planning and design requirements for the project are understood, evaluated, and appropriately applied;
- Project managers, who are constantly seeking to ensure that the project is managed within the triple constraints of time, quality and budgetary; and
- Contractor's, with the main objective of providing quality services that meet the client's objectives at a tolerable profit.

Rangelova and Traykova (2014) affirm that, with VM, those who learned from their employer are likely to continue practicing the concept than those who learned about it form academic institutions and later joined a company that does not implement VM. That clearly shows that employers are the key drivers and enforcers of the use of VM. Akram *et al*. (2011) point out that VM should be constituted as a requirement in the procurement process and be legally enforced for certain public contracts. From the preceding discussions, Table 2.4 presents the critical success factors for VM.

Table 2.4: VM critical success factors

Clear objective of VM study
Qualified VM facilitator
Multidisciplinary composition of VM team
VM experience and knowledge of participants
Professional experience and knowledge of participants in their own disciplines
Personalities of participants
Preparation and understanding of related information
Timing of VM study
Structured job plan
Control of workshop
Attitude of participants
Presence of decision takers
Interaction among participants
Function analysis
Use of relative skills and techniques (or methods and tools)
VM proposal selection and development
Plan for implementation
Follow-up training and support for implementation
Client's support and active participation
Cooperation from related departments
Adequate time for study
Client support and active participation

Cooperation from related departments

Akram *et al*. (2011)

2.6 Summary

A literature review has been conducted based on previous related studies on VM. Based on the findings of the literature review, negotiation in VM is seen to be a complex and dynamic process in which all stakeholders aim to get the best solution. The VM objectives, methods and tools, and critical success factors were identified from the literature. Additionally, there appears to be three schools of thoughts concerning negotiation on value-based design decision. The first considers the teamwork process in VM, the second considers group decision theory, and the third considers automated negotiation theory. From the literature, it is evident that the practical application of VM is not as frequent as it should be. The reason for this is that employees in organisations do not appear to be exposed to VM knowledge and the benefits regarding its capabilities of eliminating unnecessary costs as well as creating effective partnerships amongst stakeholders. They are, therefore as a result of the lack of knowledge, unable to implement what they do not know. Employers should be the key enforcers of VM practice within their organisations. The research methodology for the present work is explained in the next chapter.

CHAPTER THREE - RESEARCH DESIGN AND METHOD

3.1. Overview

This section comprises of the research philosophy, research methods, research design, and data analysis. A description of the methods and design applied is provided under research design while the technique with which the data were analysed in addition to an account of the process is described under data analysis.

3.2. Research Onion

According to Saunders *et al*. (2016), there are five (5) research philosophies as a choice of data collection methods. These are positivism, critical realism, interpretivism, postmodernism and pragmatism. Of the five, two choices of data collection methods namely research philosophy and approach to theory development are to be peeled as the outermost layers. These are the two research methods that influence the way to answer research questions, followed by the next three layers, which are methodological choice, research strategies and time horizon. The research onion serves as most the effective chronological way through which a research methodology can be designed and discussed as presented in Figure 3.1.

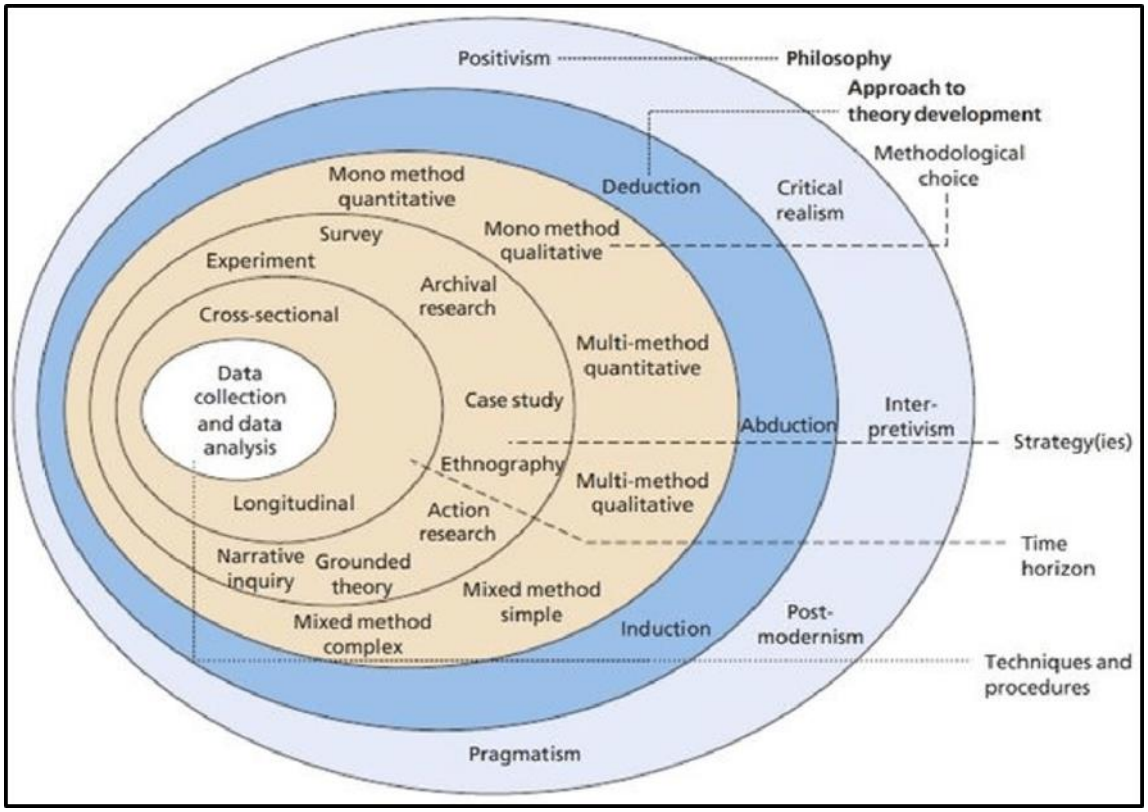

Figure 3.1: Research 'onion' for research design (Adapted from Saunders *et al*., 2016:164)

3.2.1. Research Philosophy

Based on the first layer of the onion model, the research philosophy implemented in the study is positivism. Saunders et al. (2016) assume positivism as relating to "the philosophical stance of the natural scientist and entails working with an observable social reality to produce law-like generalisations." Evidently, the DCS struggles to deliver projects within the triple constraint and as such the positivism philosophy helps the researcher in achieving the aim to assess the awareness of VM among construction professionals working for the DCS in Gauteng, South Africa, as a measure of the readiness to implement VM.

Murdoch (2013) stated that the philosophical aspect of research is as important as the method since it helps the researcher to reflect more clearly and thoroughly about the reason(s) behind what is being done. Saunders *et al*. (2016) defines philosophy as the study or the investigation of nature, knowledge from logical reasoning and observation. Bhaskar (2013) describes philosophy as an activity which encompasses the creation of concepts. The created concepts are made and adapted in the course of the history of philosophy. Strauss (2018) postulates that positivism is based on knowledge extension, observation, reality, and existence in the understanding of human behaviour. Saunders *et al*. (2016) posits that, positivism is generally associated with quantitative research than qualitative more when used on a highly structured data collection technique.

3.2.2 Research Approach

This study will employ a deductive research approach. The deductive approach is mainly concerned with testing existing theory than the inductive approach that produces new theories from various researchers. Furthermore, a deductive study is associated with quantitative research, whereas inductive research is generally associated with qualitative research. Concerning the deductive approach, the researcher begins with a conceptual model, then establishes the realistic relationship among constructs, then proceeds towards establishing concrete empirical evidence (Creswell and Creswell, 2017).

3.2.3. Research Methodological Choice

Brannen (2017) discusses two methods to be followed when conducting research such as qualitative and quantitative research. On the one hand, Pooe *et al*. (2015) points out that qualitative research deals with collecting data, analysing and interpreting data that are not reduced to numbers. Gray (2013), on the other hand, is of the view that the quantitative research deals with statistical, mathematical, and numeric analysis collected using polls, questionnaires, and surveys, or controlling previously existing statistical data using computational techniques.

Denscombe (2014) posits that there is no formula to perfect research because there are numerous options that can be considered. Quantitative study improves its exactness of results by using statistical analysis to avoid the elements of bias often associated with the qualitative approach (Berndt and Petzer, 2011).

This study adopts a quantitative method using a structured questionnaire to collect data from construction professionals working for DCS. The target respondents were in various regions; hence, the use of questionnaires was regarded as the best cost-effective approach for data collection. According to Saunders *et al*. (2016), the main two advantages of quantitative approaches and methods are as follows:

- The ability to generalise findings to a larger population; and
- Consumes less time when analysing data.

Nonetheless, based on the positivist paradigm, the main two disadvantages of quantitative research approaches and methods are:

- The positivist paradigm fails to ascertain deeper underlying meanings and explanations; and
- Some questions are difficult to analyse.

3.2.4. Research Strategy

There are various strategies that can be adopted by a researcher and these include but may not be limited to experiment, survey, archival research, case study, ethnography, action research, grounded theory, and narrative inquiry (Saunders *et al*., 2016). Furthermore, in quantitative research, a survey research is usually conducted using questionnaires or structured interviews. The survey strategy is adopted in this study as explained in detail in the following sections.

Saunders *et al*. (2016) associate the survey strategy with the deductive research approach, which could also allow collecting data using quantitative and qualitative means for subsequent analyses using descriptive and inferential statistics.

3.2.5. Research Time Horizon

According to Melnikovas (2018: 34), "the research time horizon layer describes the time frame for the research – cross-sectional or short-term study, involving collection of data at a specific point of time; longitudinal – collection of data repeatedly over a long period of time in order to compare data". Based on the fifth layer of the onion model, the research strategy implemented in this study is the cross-sectional survey.

3.2.6. Research Techniques and Procedures

3.2.6.1. Primary Data

The data collection techniques employed in this research comprise of primary and secondary data collection techniques. Primary data refers to original data that is collected for a specific research purpose (Fallon, 2016).

3.2.6.2. Secondary Data

The secondary data is data that is collected for a purpose different from its originally intended purpose and reused for another research question (Palinkas, *et al*., 2015). The survey questionnaire was distributed to construction professionals working for the DCS including professional Construction Projects Managers, Construction Managers, Architects, Quantity Surveyors, Engineers, and Clients.

3.3. Research Instrument

3.3.1 Questionnaire Structure

The questionnaire was divided into four sections as outlined next:

Section A: Consists of questions aimed at obtaining the demographic details of all the respondents including the professional background, age, academic qualification, job positions, work experience, and gender.

Section B, C, D: Consists of three sets of questions targeted to construction professional teams such as architect, construction project managers, quantity surveyors, engineers, and land surveyors with regard to the three objectives of this study. Respectively, these three sets of questions relate to the level of awareness of the outcomes/objectives of VM study, the level of awareness of the different VM methods and tools, and, lastly, the level of awareness of the critical success factors for VM.

3.3.2 Questionnaire Design

This section provides an extensive discussion on the questionnaire design. The study made use of questionnaire distributed to participants based on an adaptation of the original items from other existing similar studies (Bowen *et al*., 2010; Ncube & Rwelamila, 2017; Shen & Liu, 2003). A questionnaire is a group or sequence of questions designed to draw out information from the respondent when asked by an interviewer or completed the respondent.

The questions set up in the questionnaires are usually closed-ended and open-ended questions. However, there should be open-ended questions to explore the answers of the respondents. Structured questionnaire may be open- ended or closed- ended questions and that is determined

on how the questions are framed and asked. Open - ended questionnaire are best used for sensitive issues and in-depth investigation mostly on attitudes and practices topics. A structured questionnaire is one in which the questions asked precisely and decided in advance. Furthermore, the questions are asked exactly as they are written, in the same sequence, using the same style, for all interviews. Structured questionnaire can be left open a bit for the interviewer to improve to suit that context.

The use of the questionnaire in this study was justified because of its characteristic comparative low-cost approach to reach a wider spectrum of participants (Ruparathna and Hewage, 2015). A questionnaire was developed by the researcher and administered to construction professionals within DCS to collect the necessary data related to the three objectives of this study. Using 5-point Likert scale, the target respondents were requested to rate from 1 to 5 (1 = Not at all aware, 2 = Slightly aware, 3 = Somewhat aware, 4 = Moderately aware, 5 = Extremely aware) on the level of awareness of the outcomes/objectives of a VM, the tools and methods of VM, and the critical success factors of a VM. A copy of the questionnaire used in this study can be found under Annexure 1.

3.3.3 Administration Of Questionnaire

Saunders *et al*. (2016) affirm that delivery and collection of questionnaires could be done by the researcher. It is of importance that the questionnaires should be accompanied with a cover letter indicating the time for collection. The advantage of the questionnaire is that the response rate is relatively high and can achieve 98% (Saunders *et al*., 2016). Saunders *et al*. (2016:477) suggest that "within organization research, questionnaires can be easily delivered as a hyperlink with an email to employees, provided all of the samples have access to and use the email". Hayman and Sierra (2016) affirm that mailed questionnaires are more complex in comparison to telephone administered questionnaires where response choices are few and to the point.

The advantages of using a self-administered mail questionnaire according to Regmi *et al*. (2016) are as follows:

- Provides the participants time to respond on their schedule;
- They are less costly and more self-explanatory; and
- Consume less time filling them out.

Still, the disadvantages of using a mailed questionnaire according to Hayman and Sierra (2016) are as follows:

- Response takes longer when compared to a telephone interview;

- Questions are too long leading to respondents responding differently; and
- Other considerations such as prior introductory email, easier self-administration, and follow-up emails.

3.4. Population, Sampling Technique and Size

The population for the study was limited to construction professional project team members within the DCS. The procedure throughout which a sample is extracted from a population is called sampling (Bryman and Bell, 2011). A good sample has two characteristics namely descriptive and competence (Burns, Bush, and Sinha, 2017). Choosing the sample size is of significance in any study (McNeish and Stapleton, 2016). According to Kenny (2014), producing a quality research study is not only determined by selecting appropriate methodology but an appropriate sampling method to be employed. Figure 3.2 presents the map used as a guide on the population and sample for this study.

Figure 3.2: Gauteng Province, South Africa

Sampling means selecting a group to represent the entire population. In research, sampling methods are divided into two categories namely probability and non-probability sampling. In probability sampling all individuals get an equal chance of becoming part of the sample whereas in non-probability, the population and selection relies on the researcher. Probability sampling was employed in the study to collect data from a known target population. Simple random sampling is perceived to be an easy method of assigning individuals (Denscombe, 2010). Saunders *et al*. (2016) posits that sampling is employed because it is difficult to research a large population within a limited time but easier to research a small population.

Saunders *et al*. (2016) posits that a sample size greater than 30 and less than 500 is most suitable for a research study. Generally, large sample size can help minimise sampling errors and improve the generalizing of research findings (Singh and Masuku, 2014). The DCS works with the department of public works which is responsible for implementing projects on behalf of the DCS. As such, the DCS employs less workers with a construction related background resulting in the researcher targeting 50 respondents. For this research data will be collected until saturation is reached.

3.5. Data Analysis

Data collected were progressively coded using excel spreadsheet prior to the detailed analysis. Collecting data is a means of information seeking (Silverman, 2018). Data represents information gathered from various aspects that denote a phenomenon of a study (Cox, 2018). When coding is conducted, each number is aligned to each survey question (Sayood, 2017). It is a process that organises the data into manageable pieces of collected information and noting each work that belongs to a category (Theron, 2015). Coded data represents quantitative valuation (Jacinto *et al*., 2016).

Data analysis is a statistical process that interprets the summarised data collected using logical reasoning to determine patterns and their relationships (Schabenberger and Gotway, 2017). For this research study, the collected data were coded using excel spreadsheet before analysis. To gain an understanding of the characteristic of each variable, descriptive information analysis was employed to show the mean and standard deviation. Descriptive statistics enable the researcher to critically analyse the findings, examine the data and provide meaningful completion (Denscombe, 2014). Collected and completed data for this study were examined using the Statistical Package for Social Science (SPSS). Collected data were cleaned to trim down errors. The justification for employing this program is that it can summarise the data score and assessment in various ways (Green and Salkind, 2016).

Table 3.1 presents the summary of the research design, research data collection method, and data analysis technique for the three objectives of this study.

Table 3.1: Research Methodology Summary

Research Objectives	Research Questions	Research Design	Data Collection Technique	Data Analysis Technique
Objective 1 Investigate the level of awareness of the outcome/objectives of VM among construction professionals working for the DCS.	**Question 1** What is the level of awareness of the outcome/objectives of a VM among construction professionals working for the DCS?	Survey	Questionnaire	Quantitative Data – and excel spread sheet
Objective 2 What are the levels of awareness of the different VM methods and tools among construction professionals working for the DCS?	**Question 2** What are the levels of awareness of the different VM methods and tools among construction professionals working for the DCS?	Survey	Questionnaire	Quantitative Data – and excel spread sheet
Objective 3 Investigate the level of awareness of the critical success factors for VM among construction professionals working for the DCS.	**Question 3** What are the levels of awareness of the critical success factors for VM among construction professionals working for the DCS?	Survey	Questionnaire	Quantitative Data – and excel spread sheet

3.6. Reliability and Validity

Without a doubt, reliability and validity are key when deliberating on the research quality (Cohen et al., 2013). As such, these two were closely guarded against to the best ability of the researcher. Reliability refers ability of a device to measure what it is intended to measure (Saunders, Lewis, and Thornhill, 2016). As the name suggests, reliability and validity exist to test the precision and justification, reliability and consistency of the data. Mohajan (2017) points out that, reliability and validity are two fundamental tools in ensuring or measuring the quality of a research study. However, it is revealed that based on the comparison, reliability refers to persistent results while validity focuses on the real factor of results (Mohajan, 2017). Furthermore, in quantitative research, validity is the extent to which any measuring instrument measures what it is intended to measure. However, in qualitative research validity is where a researcher uses the certain procedure to check for the accuracy of the research findings. The researcher conducted face or logical validity to validate the developed questionnaire.

3.7. Research Ethics

Ethical considerations are important in all steps of the research process. On the part of the researcher, care should be taken when dealing with information provided by others, especially information that is personal. Before embarking on a research topic, it is important to ensure that the topic has never been researched before. This can be verified by conducting a thorough literature search and review. Ethical consideration refers to the protection of the participants' rights, obtaining informed consent and the institutional review process of ethical approval (Harris and Atkinson, 2015).

Once a researcher embarks on undertaking a research project, there are many ethical issues that the researcher needs to consider such as making participants aware of their voluntary participation to the study, and their right to withdraw from the study at any point in time if they wish. Furthermore, it is suggested that the researcher inform the research participants of their anonymity and confidentiality regarding the information provided. It is the responsibility of the researcher to ensure data protection and avoid giving the research respondents any incentives. A copy of the ethics clearance certificate for the study can be found under Annexure 2.

3.8. Summary

VM concept has been adopted and implemented in the United States of America (USA), Japan, Australia, China, and other countries. The VM concept is generally regarded as a useful technique in cost reduction, especially if employed in the initial stage(s) of the project. From the developing countries' perspectives, including South African, VM is still yet to be fully

embraced because organisations seem to be reluctant to deviate from traditional ways of delivering construction projects. Subsequently, the responsibility lies with construction professionals to drive the concept to be able to educate the whole industry about VM and the necessary push to apply VM from an informed perspective. From the previous scholars and researchers (Bowen et al., 2010; Ncube & Rwelamila, 2017), it is evident that the VM concept has been adopted but less practised by construction professionals in the built environment in the South African construction industry. By gaining deeper understanding concerning VM as this study intends to investigate, it can be reasoned that all professional construction bodies such as SACPCMP, SACQSP, ECSA and SACAP would be able to encourage VM as part of the continuous professional development (CPD) points for their members.

CHAPTER FOUR - DATA ANALYSIS

4.1 Overview

The previous chapter focused on the research methodology adopted in this research. This chapter discusses issues relating to data presentation and analysis of the findings on VM among construction professional working within the department of correctional services (DCS). The chapter seeks to answer the research questions and to achieve the research objectives asked in the first chapter.

4.2 Response Rate

Research survey questionnaire were emailed using a link to construction professionals working within the DCS in Gauteng region, South Africa. 50 questionnaires were sent to the targeted respondents via a link. This gave rise to 37 participants returning their completed questionnaires, giving a response rate of 74%. The 74% response rate was higher than the 20-30% response rate for a questionnaire survey that was conducted in the construction industry as cited by Ramly *et al*. (2015).

4.2.1 Approaches to Improving Survey Response

According to Groves et al. (2011), a high response rate to the questionnaire by potential respondents in a sample is referred to as completion rate or return rate. Response rate is hugely dependent on the survey instrument employed. The 74% response rate for this study was made possible by the questionnaire design and follow-up emails.

Prior to sending the questionnaire link to the participants, an introductory email on the objectives of the study and requesting their consent for participation was sent a week prior. In addition, it was mentioned on the consent letter that respondents' names would be kept anonymous and findings on the research report would be shared with the participants upon request.

Respondents were initially given two (2) months (June to August 2019) to respond, during which 27 responses were obtained and a 54%-response rate. Subsequent to that, an email reminder was sent after a week, leading to an increase to the final 37 overall respondents and a final 74%-response rate.

One of the major challenges experienced during the data collection was the link denying opening since, google forms work better with g-mail accounts. Some participants, however, provided their departmental email addresses, making it difficult for them to respond until the link was resent to their personal accounts.

4.3 Results on Respondents Profile

The results extracted from four (4) sections of the survey questionnaire are discussed separately. The first section A emphasizes on collecting data about respondents' profile while the subsequent Sections B, C and D focus on the three objectives of this study as discussed earlier under Chapter 1.

Section A sought respondents' demographic information, their age category, highest academic qualification, current position and number of years of working for the department and the justification of asking this question is to check those who have an appreciable experience in value management and lastly gender. Figure 4.1 shows the various professions of the respondents. Most of the respondents were CPMs (41%), followed by Engineers (22%) and then other unmentioned professions (16%). Lastly, the Architects and Quantity Surveyors made up the least of the respondents (11% each). Without a doubt, the findings in figure 4.1 greatly support the general findings of the research since most of the respondents are construction professionals.

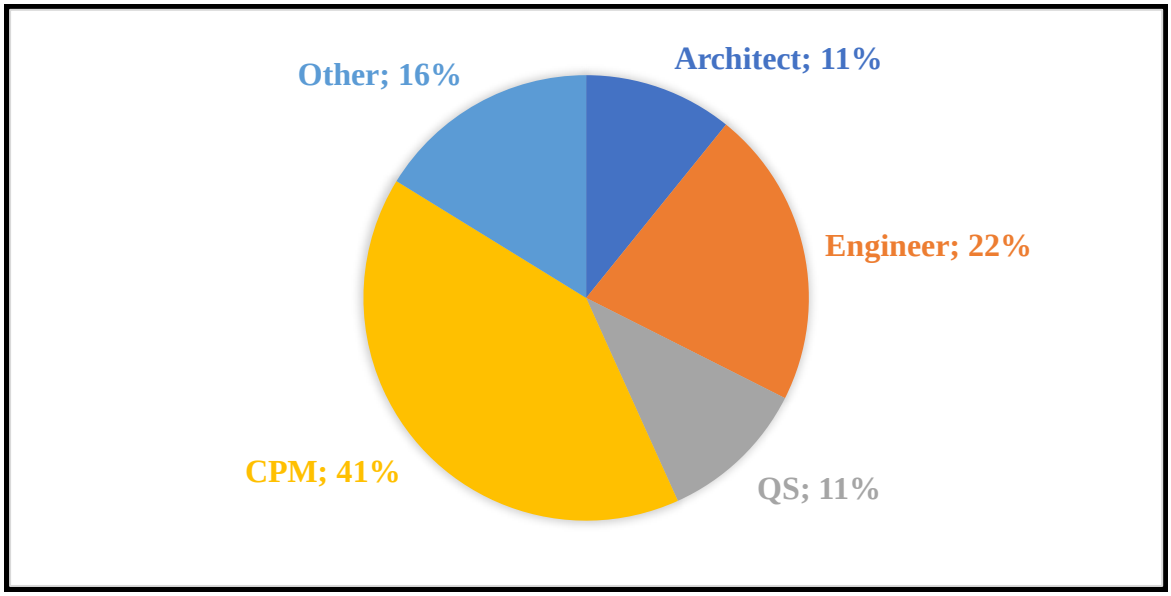

Figure 4.1: Respondents Professions

Figure 4.2 illustrates the age categories of the respondents. Findings show that a majority (44%) of the respondents were aged between 35 and 44 years, followed by the age category of 25 to 34 years (36%), and, lastly, the age category of 45 to 54 years (20%). Of the 37 completed surveys received, only 1 respondent did not indicate the age category. Interestingly, there was no respondent aged above 55 years, which attests to the increasing number of the younger generations in the government workplaces.

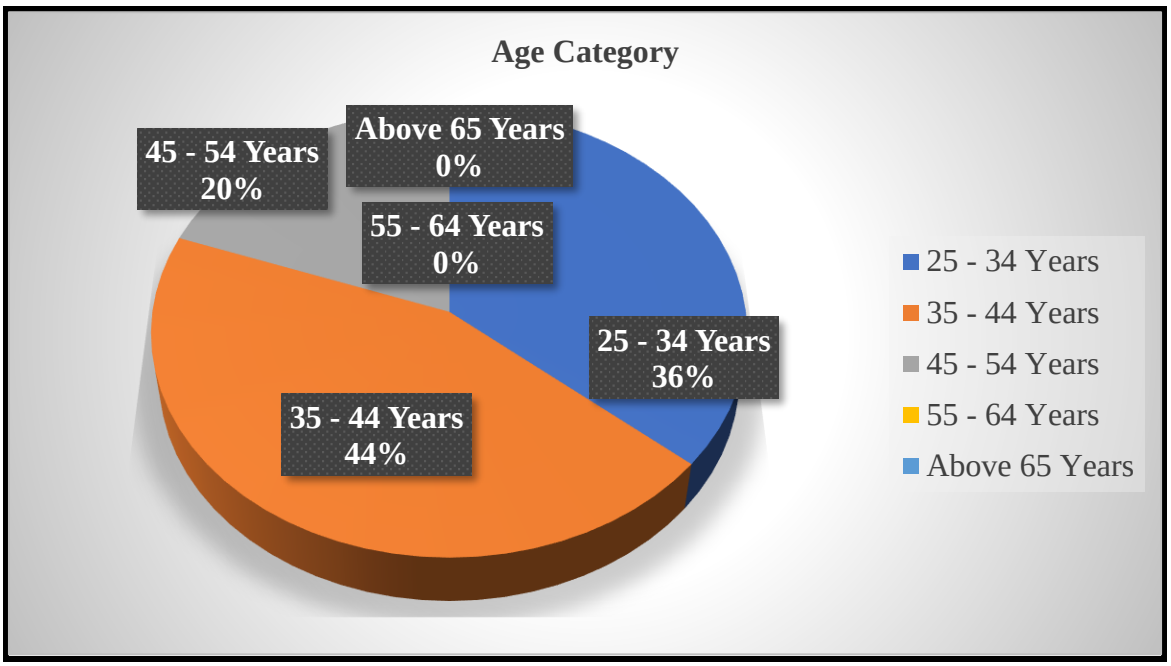

Figure 4.2: Respondents Age Categories

Figure 4.3 shows the various qualifications of the respondents. Majority of the respondents (51%) hold a B-Tech qualification, followed by honors degree holders (19%), master's degree holders (16%), and other degrees (14%).

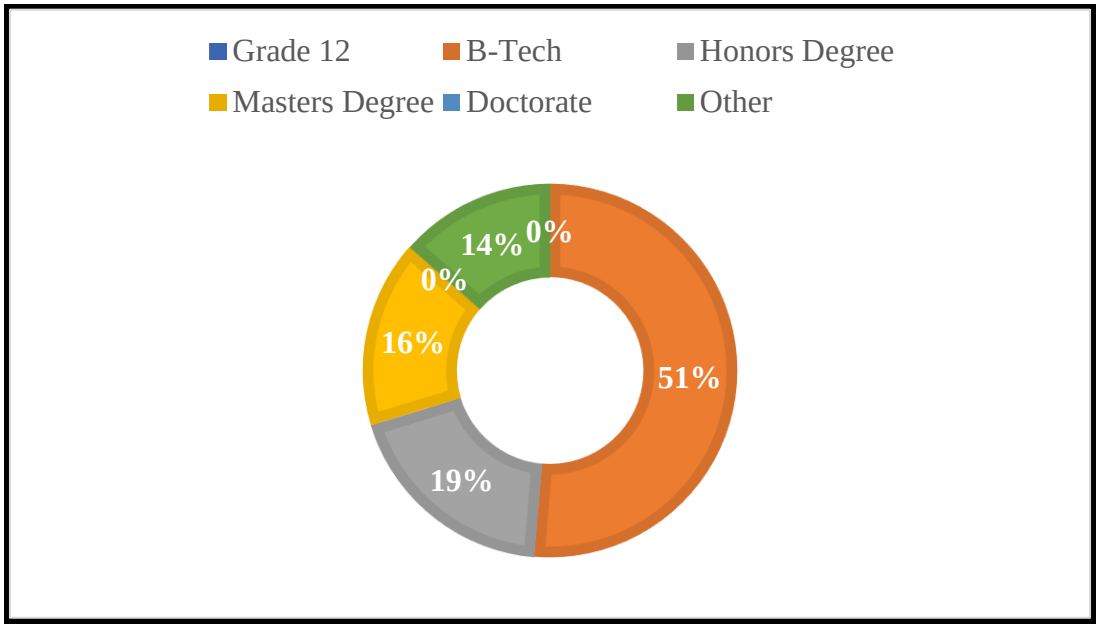

Figure 4.3: Respondents Qualifications

Figure 4.4 shows the composition of the respondents based on their years of experience working for the current employer (i.e., DCS). 54% of the respondents have less than 5 years working for the current employer while 32% of the respondents have between 5 and 10 years of experience

with DCS. Lastly, 14% of the respondents have more than 10 years of experience with the same employer.

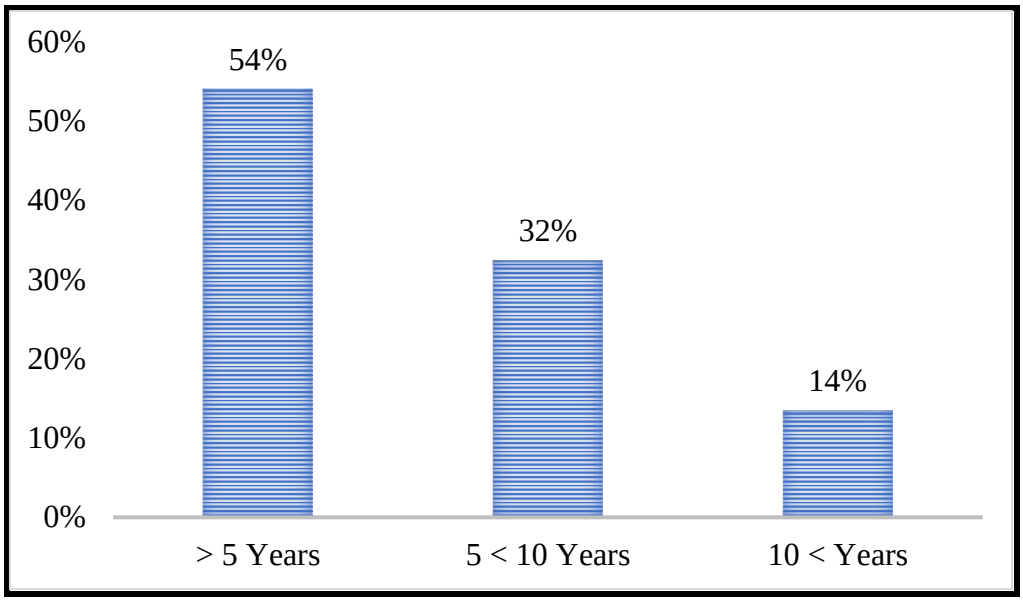

Figure 4.4: Respondents Years of Experience Working for the Current Employer

Figure 4.5 shows the total years of work experience for the respondents. 62% of the respondents have experience in excess of 10 years, followed by 32% of the respondents who have between 5 to 10 years of total experience, while 5% of the respondents have less than 5 years of total experience.

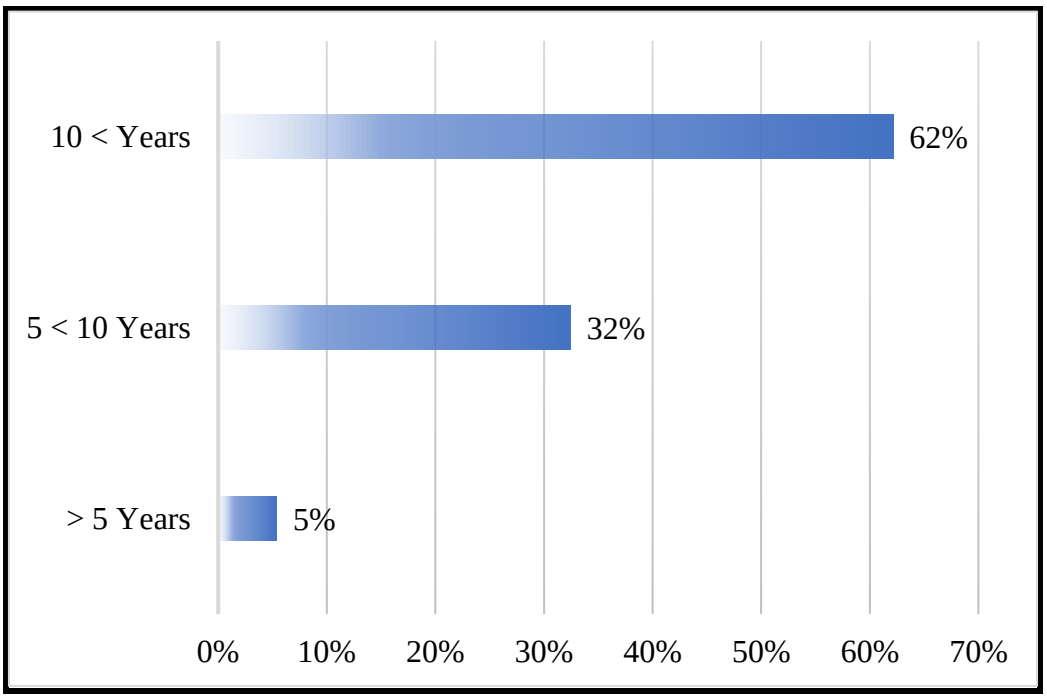

Figure 4.5: Respondents Total Years of Work Experience

Figure 4.6 shows that more of the respondents (57%) are males while 43% are females. The respondents' gender distribution revealed the closing gender imbalance in the workplaces, especially in the construction industry. It is key to note that the DCS has embraced the concept of gender-based equality as evidenced by the number of females who were employed by the department and were able to participate in the survey during the fieldwork.

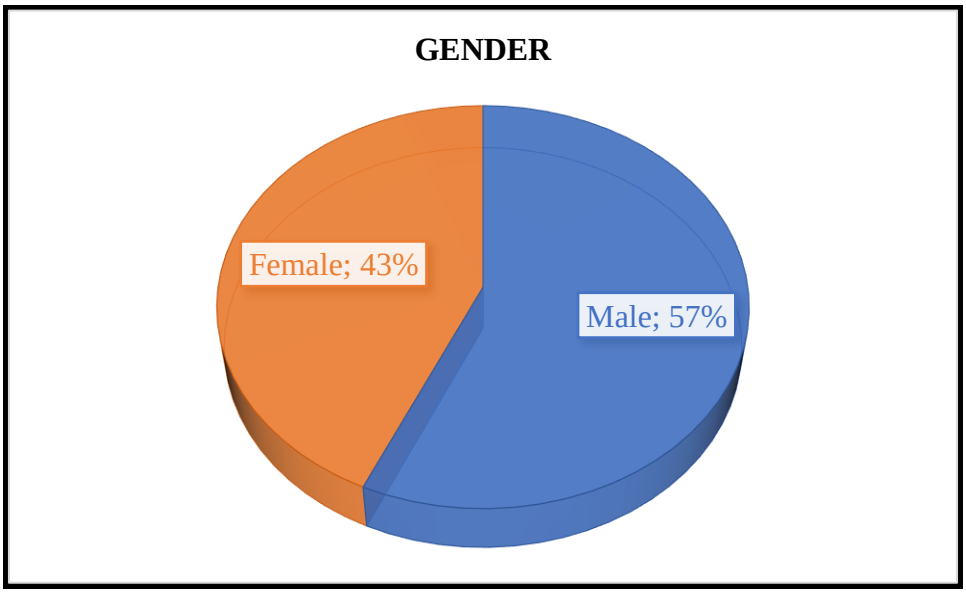

Figure 4.6: Respondents Gender Profile

The objective of the following section is to investigate the level of awareness of the outcomes/objectives of a value management (VM) study.

From the quantitative ordinal data obtained through Section B of the questionnaire, relating to first objective of the study, Table 4.1 presents the results of the Mean Item Score (MIS), Standard Deviation (SD), and coefficient of variation (CV). The MIS, SD and CV were used in ranking the level of awareness of the outcomes and objectives of VM. In a circumstance where two or more items or variables share the MIS, the lower or lowest SD would be assigned the higher or highest importance ranking. Factors with the highest MIS score were given the highest ranking in the analysis.

Table 4.1: Outcomes/Objectives of a VM Study

Level of awareness (Factor)	**MIS**	**SD**	**CV**	**Rank**
Effective risk management	3.972	0.971	0.244	1
Enhanced project functionality	3.892	0.966	0.248	2
Enhanced project worth	3.784	1.058	0.280	3

Level of awareness (Factor)	MIS	SD	CV	Rank
Reduced project operating costs	3.784	1.084	0.286	4
Reduced project capital costs	3.757	1.011	0.269	5
Clarification of the brief and/or effective brief management	3.757	1.038	0.276	6
Realization of project execution efficiencies	3.676	1.156	0.314	7
Optimization of value over the life of the project	3.639	1.099	0.302	8
Shorter project duration	3.541	1.12	0.316	9
Minimization of environmental impact	3.371	1.14	0.338	10
Greater flexibility offered by the project	3.333	1.069	0.321	11
Enhanced project usability in terms of convenience and comfort	3.306	1.117	0.338	12

MIS = Mean Item Score; SD = Standard Deviation; CV = Coefficient of Variation

From Table 4.1, *effective risk management* had the highest MIS of 3.972 (in the range of somewhat aware) and was ranked topmost amongst the 12 constructs. This was followed by *enhanced project functionality* 3.892 (somewhat aware) and thirdly, *enhanced project worth* with a tied MIS of 3.784 (somewhat aware) but a lower SD of 1.058. By and large, the lowest-ranked item was *enhanced project usability in terms of convenience and comfort*, with a MIS of 3.306 (somewhat aware). The twelve constructs measured under the outcomes/objectives ranged from 3.306 to 3.972 corresponding to the high level of agreement.

Attached in Annexure 3 is a further detailed analysis and discussion of the distribution of the responses with respect to this first objective of this study. In summary, the findings show that the respondents were somewhat aware of all the objectives/outcomes of VM.

From the quantitative ordinal data obtained through Section C of the questionnaire, relating to second objective of the study, Table 4.2 presents the MIS, SD, and CV used in ranking the level of awareness of the methods and tools of VM.

Table 4.2: VM Methods and Tools

Constructs	MIS	SD	CV	Rank
Time, cost and quality triangle	4.108	1.048	0.255	1
Life cycle costing	3.676	1.082	0.294	2
Value analysis	3.514	0.989	0.281	3
REDReSS	3.083	1.442	0.468	4
Process flow charting	2.861	1.376	0.481	5

Constructs	MIS	SD	CV	Rank
Component analysis	2.833	1.320	0.466	6
Functional space analysis	2.824	1.336	0.473	7
Supply chain analysis (mapping and planning)	2.811	1.309	0.466	8
Element function analysis	2.750	1.381	0.502	9
Simple multivariate-attribute rating technique (SMART	2.595	1.279	0.493	10
Functional analysis systems technique (FAST)	2.541	1.325	0.521	11
Facility walk through maps	2.486	1.261	0.507	12
Quality function deployment (QFD) technique	2.361	1.268	0.537	13
Lever of value	2.297	1.266	0.551	14
Spatial adjacency programming	2.162	1.214	0.562	15
Kano model	1.838	1.140	0.620	16

Preference was given to traditional quantity surveying/cost engineering practice such as time, cost and quality triangles. Moreover, the rankings presented in Table 4.2 show that the top-three ranked VM methods and tools were, respectively, *time, cost and quality triangl*e with MIS of 4.108 (moderately aware), *life cycle costing* with MIS of 3.676 (somewhat aware), and value analysis with MIS of 3.514 (somewhat aware). However, unlike the preceding level of awareness on the outcomes and benefits of VM, *Kano model* was the lowest ranked of the VM methods and tools with MIS of 1.838 (not at all aware). The other non-top-3-ranked VM methods and tools, except for REDRess (Re-organization, Expansion, Demolition, Refurbishment and Maintenance, Safety, Security), were in the MIS range of 2 to 3 (slightly aware). It can be concluded that the respondents were not as aware of the VM tools and methods as compared to the VM objectives and outcomes.

Attached in Annexure 4 is a further detailed analysis and discussion of the distribution of the responses with respect to this second objective of this study.

From the quantitative ordinal data obtained through Section D of the questionnaire, relating to third and last objective of the study, Table 4.3 presents the MIS, SD, and CV used in ranking the level of awareness of critical success factors of VM among the construction professionals working for the DCS.

22 constructs were identified as critical success factors (CSFs) having imperative influence on the success of VM. The CSFs adopted in this study were taken from Shem and Liu (2003). The

top-three findings revealed by Shem and Liu (2003) differs from the current study based on the responses from the construction professionals working within DCS. The current study shows *client support and active participation* ranked the topmost with MIS 3.892 (somewhat aware), followed by *plan for implementation* with MIS 3.752 (somewhat aware). The plan is in line with the problem statement that read as lack of engagement of professionals from the initial stages of project (planning). The third CSF identified is *cooperation from related departments* with MIS 3.732 (somewhat aware).

Overall, the respondents' level of awareness of the 22 CSFs for VM ranged from a highest of 3.892 to a lowest of 3.171, all in the range of somewhat aware. Additionally, 19 of the 22 CSFs were rated as having a moderate effect on the success of VM with MIS of greater than 3. Attached in Annexure 5 is a further detailed analysis and discussion of the distribution of the responses with respect to this third objective of this study.

Table 4.3: Critical Success Factors for Value Management

Constructs	**MIS**	**SD**	**CV**	**Rank**
Client support and active participation	3.892	1.286	0.330	1
Plan for implementation	3.750	1.204	0.321	2
Cooperation from related departments	3.730	1.326	0.355	3
Financial support	3.730	1.367	0.366	4
Interaction among participants	3.657	1.235	0.338	5
Use of relative skills and techniques (or methods and tools)	3.649	1.274	0.349	6
Adequate time for study	3.622	1.277	0.353	7
Clear objective of VM study	3.622	1.341	0.370	8
Multidisciplinary composition of VM team	3.595	1.166	0.324	9
Preparation and understanding of related information	3.556	1.107	0.311	10
Cooperation from related departments	3.541	1.406	0.397	11
Attitude of participants	3.528	1.23	0.349	12
Personalities of participants	3.486	1.193	0.342	13
Follow-up training and support for implementation	3.486	1.283	0.368	14
Presence of decision takers	3.457	1.314	0.380	15
Timing of VM study	3.444	1.206	0.350	16
Qualified VM facilitator	3.417	1.339	0.392	17

Constructs	MIS	SD	CV	Rank
VM experience and knowledge of participants in their own disciplines	3.405	1.212	0.356	18
VM proposal selection and development	3.333	1.21	0.363	19
Structured job plan	3.278	1.301	0.397	20
Function analysis	3.222	1.267	0.393	21
Control of workshop	3.171	1.248	0.394	22

4.4 Discussions

With regards to the rankings presented in Table 4.1, the top-five outcomes and or objectives of a VM study are *effective risk management*, *enhance project functionality*, *enhanced project worth*, *reduced project operating costs* and *reduced project capital cost*. These outcomes and or objectives have a MS ranging between 3.757 and 3.972, SD ranging between 0.966 and 1.084 and a CV ranging between 0.244 and 0.286. Moreover, the rankings presented in Table 4.2 show that the top-five VM methods and tools are *time, cost and quality triangle*, *life cycle costing*, *value analysis*, *REDReSS*, and *process flow charting*. These methods and tolls have a MS ranging between 2.861 and 4.108, SD ranging between 0.989 and 1.442 and a CV ranging between 0.255 and 0.481. Lastly, according to findings presented in Table 4.3, the top-five critical success factors for VM are *client support and active participation*, *plan for implementation*, *cooperation from related departments*, *clients' support, and active participation*, and, lastly, *interaction among participants*. These success factors have a MS ranging between 3.657 and 3.892, SD ranging between 1.204 and 1.367 as well as a CV ranging between 0.321 and 0.366.

Emanating from Miles, the VM concept was originally developed to replace the shortage of material. However, it has gone beyond its originated strategic decision of cost saving, enhanced communication, and reaching common agreement among the stakeholders. This ranges from planning through project setting and alignment of scope of works as well as priorities or requirements from client side. Notably, these strategic intensions align with the second highest CSF as mentioned by the DCS professionals. Generally, the findings from this research are in agreement with the findings cited by Shen and Liu (2003) that show the need for the government concerned to work in collaboration to achieve the best in their projects and also to put in place mandatory policies on VM implementation on their projects.

4.5 Summary

This chapter presented and analysed the quantitative data collected for the three objectives of this study. Based on the response, effective risk management ranked topmost as the outcome/objective of a VM, with a mean score of 3.972 (somewhat awareness) and a standard deviation of 0.971. Time, cost and quality triangle ranked topmost as the VM method and tool, with a mean score of 4.108 (moderate awareness) and a standard deviation of 1.048. Client support and active participation ranked topmost as the critical success factor for VM, with a mean score of 3.892 (somewhat awareness) and a standard deviation of 1.286. The following chapter covers the conclusion and provides recommendations based on the findings of this study.

CHAPTER FIVE - CONCLUSION

5.1 Overview

The previous chapter presented and analyzed the results of the study in order to achieve the objectives set out in the first chapter. This chapter brings about the findings on the data analysis in relation to three objectives of this study. The assumptions made and recommendations for future studies and conclusion based on the findings are presented.

5.2 Achievement of Study Objectives

From data analysis point of view, with respect to three objectives and questions sent out to participants, it will be possible to draw up findings, recommendations, and conclusion for this chapter.

5.2.1 Investigating Awareness Level of the Outcomes/Objective of VM

For the first objective, taken from VM definition that project success can be dependent more on client support, active participants, and qualified facilitator as concerns and priorities in the successful implementation of VM. From literature perspective, where VM can be employed it can yield the favourable results with cost saving. In principle, based on assumptions made for the study, it is evident that respondent's level of awareness on VM objective is very low and not widely understood. In addition, that alone catches attention for raising awareness campaigns and workshops within the department. To answer the first research question, the level of awareness of the outcomes and objectives of VM was in the range of somewhat aware, which gives credence to the necessary initial impetus for VM implementation.

5.2.2 Investigating The Level of Awareness of the Different (VM) Methods and Tools

Respondents on VM methods and tool (time, cost, and quality) triangle, life cycle costing and redress table / section C rated the highest and reflect on Architects preference on VM implementation. Drawn from finding also confirmed by literature that Architects are familiar with the concept, but their knowledge is minimal. To answer the second research question, the levels of awareness of the tools and methods of VM range from moderately aware (time, cost, and quality triangle) to not at all aware (Kano model). This rather heterogenous levels of awareness underscore the need for education and training to build on the appreciable level of awareness of the objectives/outcomes of VM.

5.2.3 Investigating on the Level of Critical Success Factors in the Implementing VM

Generally, respondents are aware of the various critical success factors for value management. To answer the third and last research question of this study, the level of awareness of the critical success factors of VM was in the range of somewhat aware, which again fact that gives credence

to the necessary initial impetus for VM implementation. Most importantly, it validates the need to prioritize education and training in VM tools and methods, where the respondents vary in their level of awareness and can potentially be a source of conflict.

5.3 Implications

With the low budget allocated for government departments by treasury, it is imperative for government departments to regulate policies and culture in enforcing the implementation of VM methods in public projects. In addition, findings reveal that when VM concept is adopted, best results are achieved with respect to completing construction projects.

Based on the analysis, it can be concluded that a concept such as VM needs urgent intervention through government support (financial) and regulatory policy enforcement. Future studies should focus on reporting on designing and putting in place the necessary implementation plan for VM implementation within the public sector.

5.4 Recommendations

Drawn from the definition of VM, the process of stakeholder engagement must be open and transparent to the extent that everyone has access to information and are also able to influence decisions made. New creative solutions need to be devised to ensure creative solutions for issues through engaging the clients and end users together with the entire project team, including the contractor, right from the beginning of the project.

5.5 Limitations

The current study focused on the construction professionals working with the Department of Correctional Services (DCS) within the Gauteng region; hence, the results are not readily generalizable. A future study should explore the levels of VM awareness in the other government departments within South Africa. The scope of this current study was to “temperature check” VM awareness among construction professionals working within DCS in Gauteng region, South Africa.

REFERENCES

Aigbavboa, C., Oke, A. and Mojele, S., 2016. Contribution of value management to construction projects in South Africa.

Akram S., Minosowicz A., Kostrzewa, B., Mukherjee A., and Nowak, P. (2011) Value Management in Construction" in Common Learning Outcomes for European Managers in Construction.

Berndt, A. and Petzer, D. J. (2011). International Retail and Marketing Review – *Marketing Research.* (Eds.): book review

Bhaskar, R., (2013) *A realist theory of science.* Routledge

Bowen, P., Edwards, P., Cattell, K., & Jay, I. (2010). The awareness and practice of value management by South African consulting engineers: Preliminary research survey findings. *International Journal of Project Management.* 28 (3), 285-295

Bowen, P., Edwards, P.J., Cattell, K., (2009) Value Management Practice in South Africa

Bowen, P., Jay, I., Cattell, K., & Edwards, P. (2010). Value management awareness and practice by South African architects: an empirical study. *Construction Innovation.* 10(2), 203-222

Brannen, J., (2017). *Mixing methods: Qualitative and quantitative research*. Routledge

Bryman, A., & Bell, E. (2011) Ethics in business research. *Business Research Methods*.

Burns, A.C., Bush, R.F. & Sinha, N. (2014). Marketing research (Vol. 7). Harlow: Pearson

Cox, D.R., (2018) Analysis of survival data. Routledge

Creswell, J.W. & Creswell, J.D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications

Denscombe, M. (2014). *The good research guide: for small-scale social research projects*. McGraw-Hill Education (UK)

Department of Correctional Services vote no. 18. *Annual report.* (2016/2017) financial year.

Fallon, M., (2016). Primary Data Collection. In Writing up Quantitative Research in the Social and Behavioral Sciences. 147-155). SensePublishers, Rotterdam

Gray, D. E. (2013) *Doing research in the real world*. Sage

Green, S.B. and Salkind, N.J. (2016). Using SPSS for Windows and Macintosh, Books a la Carte. Pearson

Groves, R.M., Fowler Jr, F.J., Couper, M.P., Lepkowski, J.M., Singer, E. and Tourangeau, R., s2011. *Survey methodology* (Vol. 561). John Wiley & Sons.

Harriss, D.J. and Atkinson, G., (2015). Ethical standards in sport and exercise science research: 2016 update. Int. J Sports Med, 36(14), 1121-1124

Hyman, M.R. and Sierra, J.J (2016). Open –versus close –ended survey questions: *Business outlook*. 14 (2), pp.1-5

Jaapar, A., Maznan, N.A. and Zawawi, M. (2012). Implementation of value management in public projects. *Procedia-Social and Behavioral Sciences*, *68*, pp.77-86.

Jacinto, C., Santos, F.P., Soares, C.G. and Silva, S.A. (2016). Assessing the coding reliability of work accidents statistical data: how coders make a difference. *Journal of safety research*. 59, 9-21

Karunasena, G. and Amaratunga, D. (2016). Capacity building for post disaster construction and demolition waste management: A case of Sri Lanka. Disaster Prevention and Management, 25(2), 37-153

Karunasena, G., Rathnayake, R.M.N.U. & Senarathne, D., (2016). Integrating sustainability concepts and value planning for sustainable construction. *Built Environment Project and Asset Management*. *6*(2), 125-138

Kenny, D.A. (2014) Measuring model fit.

Leung, M., Yu, J.Y. and Liang, Q. (2014). Analysis of the relationships between value management techniques, conflict management and workshop satisfaction of construction participants, Journal *of Management in Engineering, ASCE*. 30(3): 04014004-1-11

Lop, N.S., Apandi, M.A.M., Kamar, I.F.M., Salleh, N.M., Mamter, S. and Hamdan, N.A.M., 2014. Identifying the Level of Awareness on Value Management Practice amongst Construction Developers. In MATEC Web of Conferences (Vol. 15, p. 01029). EDP Sciences

Lourens, W. (2016) *Implementation of value management in the South African construction industry* (Doctoral dissertation, University of Johannesburg)

Lourens, W., & Aigbavboa, C. O. (2016). The contributions of value management to the improvement of construction performance in the South African construction industry.

Luvara, V. G., & Mwemezi, B. (2017). Obstacles against Value Management Practice in Building Projects of Dar es Salaam Tanzania. *International Journal of Construction Engineering and Management*. 6(1), 13-21

Maes, K., De Haes, S., & Van Grembergen, W. (2012). The Identification and Definition of Value Management Practices Used to Deploy IS Investiments. *In Mediterranean Conference on Information Systems*

McNeish, D.M. & Stapleton, L.M. (2016). The effect of small sample size on two-level model estimates: A review and illustration. *Educational Psychology Review*. *28*(2), 295-314

Mehmet, N. H., & David, A. (2013) Teaming/timing sequences in hotel development projects. Construction Management and Economics. 31:4, pages 369-385

Melnikovas, A. (2018) Towards an Explicit Research Methodology: Adapting Research Onion Model for Futures Studies, Journal of Future Studies, 23(2): 29 - 44

Mohajan, H. (2017). Two criteria for good measurement in research: validity and reliability. *Munich Personal RePEc archive*. 17(13), pp.58-82

Murdoch, I. (2013). *The sovereignty of good*. Routledge

Ncube, M., & Rwelamila, P. D. (2017) Value Management Expertise in the South African Construction Industry–A Case Study of Gauteng. *Mega Journal of Business Research*. 2017(1), 1-25

Ofori, D. (2014) "An exploratory study of project management competency in Ghana." Journal of African Business 15 (3) 0197-210

Oke, A. E. & Ogunsemi, D. R. (2011) Value Management in the Nigerian Construction Industry: Militating factors and perceived benefits. Proceeding of the second international conference on advances in engineering and technology. Faculty of Technology, Makerere University, Uganda, 30 January – 1 February, 353-359

Oke, A. E., Aghimien, D. O., & Olatunji, S. O. (2015) Implementation of value management as an economic sustainability tool for building construction in Nigeria. *International Journal of Managing Value and Supply Chains.* 6(4), 55-64

Oke, A.E. and Aigbavboa, C.O., (2017) *Sustainable value management for construction projects*. 75-86, Switzerland: Springer

Omoregie, A.D., Emmanuel, O.A. & Ohis, A.C. (2018). Value Management for Sustainable Built Environment in Nigeria. *Proceedings of the International Conference on Industrial Engineering and Operations Management Bandung*, Indonesia, March 6-8

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. & Hoagwood, K., (2015) Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Administration and Policy in Mental Health and Mental Health Services Research, 42(5), 533-544

Perera, S., Hayles, C.S. and Kerlin, S., 2011. An analysis of value management in practice: the case of Northern Ireland's construction industry. *Journal of Financial Management of Property and Construction*, *16*(2), pp.94-110

Pillay, D., Steyn, H. & Sommerville, J. (2013). The application of Earned Value Management to manage project costs within the South African municipal infrastructure sector, African Journal of Public Affairs. 6(1), 108-121

Pooe, D.r., Mafini, C. & Makhubele, D.T., (2015) Investigation municipal procurement challenges in South African: a qualitative study. *The International Business & Economics Research Journal* (Online). 14(1), 67

Rangelova, F. & Traykova, M. (2014) Value Management in Construction Project. First Scientific-Applied Conference with International Participation" Project Management in Construction" University of Architecture. Civil Engineering, and Geodesy

Regmi, P.R., Waithaka, E., Paudyal, A., Simkhada, P. and Van Teijlingen, E., 2016. Guide to the design and application of online questionnaire surveys. *Nepal journal of epidemiology*, *6*(4), p.640

Rugenyi, F. (2015). Assessment of the ripple Constraints in Projects in Nairobi: The Project Managers Peceptive. *International Journal of Academic Research in Business and Social Sciences.*5, (11), pp 1-16

Ruparathna, R. & Hewage, K. (2015) Sustainable procurement in the Canadian construction industry: current practices, drivers and opportunities. *Journal of Cleaner Production*. (*109*) 305-314.

Saunders , M., Lewis, P. and Thornhill, A. (2016). *Research methods for business students:* 7 ed. Essex: Pearson Education Limited.

Sayood, K., (2017) *Introduction to data compression*. Morgan Kaufmann.

Schabenberger, O. & Gotway, C.A. (2017). Statistical methods for spatial data analysis. CRC press.

Shen, Q. and Liu, G. (2003). Critical Success Factors for Value Management Studies in Construction. *Journal of Construction Engineering and Management*, 129(5), pp.486-491.

Silverman, B.W. (2018) Density estimation for statistics and data analysis. Routledge.

Singh, A.S. and Masuku, M.B., (2014) Sampling techniques & determination of sample size in applied statistics research: An overview. *International Journal of Economics, Commerce and Management.* 2(11), 1-22.

Strauss, L. (2018) Leo Strauss on Political Philosophy: Responding to the Challenge of Positivism and Historicism. University of Chicago Press

The Institute of Value management (2015) what is value management? Retrieved June 7, 2015 from http://www.ivm.org.uk/what_vm.htm

Theron, P.M. (2015). "Coding and data analysis during qualitative empirical research in practical theology". *Original Research.* 49 (3). pp. 1-9

Yekini, A.A., Bello, S.K. and Olaiya, K.A. (2015) Application of value engineering techniques in sustainable product and service design. *Science and Engineering Perspectives*. (*10*)120-130.

ANNEXURE 1

QUESTIONNAIRES

AWARENESS OF VALUE MANAGEMENT (VM) AMONG CONSTRUCTION PROFESSIONALS WORKING ON CORRECTIONAL SERVICES

SECTION A: DEMOGRAPHIC INFORMATION

A1. Please indicate your professional background (*Tick as applicable***)**

☐ Architect

☐ Engineer

☐ Quantity Surveyor

☐ Construction Project manager

☐ Other (*please specify*)

A2. Please indicate your age category (Years) (*Tick applicable*)

☐ 25-34 years

☐ 35-44 years

☐ 45-54 years

☐ 55-64 years

☐ 60 and above years

A3. Please indicate your highest academic qualification (*Tick applicable*)

☐ Grade 12

☐ B - Tech

☐ Honors degree

☐ Master's degree

☐ Doctorate degree

☐ Other **(***please specify***)**

A4. Please indicate your current position in the organization.

_____

A5. Please indicate the number of years you have been employed by your current employer.

☐

A6. Please indicate the total years of working experience as a whole.

☐

A7. Please indicate your gender (*Tick as applicable***)**

☐ ☐

Male **Female**

SECTION B – The objective of this section is to investigate the level of awareness of the outcomes / objectives of a value management (VM) study.

Please rate the level of awareness of the following outcomes/objectives of a VM on a scale of 1-5 on VM practice on a scale of 1 - 5. *(1 – Not all aware, 2 – slightly aware, 3 – somewhat aware, 4 – moderately aware, 5 – extremely aware)*

VM study objective	***Level of awareness***				
	1	***2***	***3***	***4***	***5***
Reduced project capital costs					
Enhanced project functionality					
Clarification of the brief and/or effective brief management					
Enhanced project worth					
Optimization of value over the life of the project					
Minimization of environmental impact					
Enhanced project usability in terms of convenience and comfort					
Greater flexibility offered by the project					
Effective risk management					
Shorter project duration					
Realization of project execution efficiencies					
Reduced project operating costs					
Other					

If other, please indicate: _____

SECTION C – The objective of this section is to investigate the level of awareness of the different value management (VM) methods and tools.

Please rate your level of awareness of the following VM methods and tools on a scale of 1 - 5. *(1 – Not all aware, 2 – slightly aware, 3 – somewhat aware, 4 – moderately aware, 5 – extremely aware)*

VM method and tool	***Level of awareness***				
	1	***2***	***3***	***4***	***5***
Functional analysis systems technique (FAST)					
Simple multivariate-attribute rating technique (SMART)					
Kano model					
Lever of value					
Quality function deployment (QFD) technique					
REDReSS					
Spatial adjacency programming					
Time, cost and quality triangle					
Value analysis					
Life cycle costing					
Facility walk through maps					
Process flow charting					
Functional space analysis					
Element function analysis					
Component analysis					
Supply chain analysis (mapping and planning)					

If other, please indicate: _____

SECTION D – The objective of this section is to investigate the level of awareness of the critical success factors for value management (VM).

Please rate your level of awareness of the following VM critical success factors on a scale of 1 - 5. *(1 – Not all aware, 2 – slightly aware, 3 – somewhat aware, 4 – moderately aware, 5 – extremely aware)*

VM critical success factors	***Level of awareness***				
	1	***2***	***3***	***4***	***5***
Clear objective of VM study					
Qualified VM facilitator					
Multidisciplinary composition of VM team					
VM experience and knowledge of participants					
Professional experience and knowledge of participants in their own disciplines					
Personalities of participants					
Preparation and understanding of related information					
Timing of VM study					
Structured job plan					
Control of workshop					
Attitude of participants					
Presence of decision takers					
Interaction among participants					
Function analysis					
Use of relative skills and techniques (or methods and tools)					
VM proposal selection and development					

VM critical success factors	***Level of awareness***				
	1	***2***	***3***	***4***	***5***
Plan for implementation					
Follow-up training and support for implementation					
Client's support and active participation					
Cooperation from related departments					
Adequate time for study					
Client support and active participation					
Cooperation from related departments					

If other, please indicate: _____

End of questionnaire. Thank you!

ANNEXURE 2

School of Construction Economics & Management

University of the Witwatersrand, Johannesburg -PO Box 20, Wits 2050, South Africa • Tel: +27 (0)11 717 7602/77669 • Fax: +27 (0)11 717 9729 Email:CEM@wits.ac.za

SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER** CEM/19/05/MN1/MSC
PROJECT TITLE:	Awareness of Value Management Amonf Professonals Working on Correctional Services
INVESTIGATOR	Nomnikelo Mangquku (1810705)
SCHOOL/DEPARTMENT	**SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT**
DATE CONSIDERED	01/05/2019
DECISION OF THE COMMITTEE	Approved conditionally with respect to the declaration
EXPIRY DATE	1st May 2020
DATE	1st May 2019

CHAIRPERSON

Dr. Kola Ijasan

cc: Supervisor: Dr. Oluwayomi Babatunde

DECLARATION OF INVESTIGATOR (S)

To be completed in duplicate and **ONE COPY** returned to the Secretary Mrs. M. Sithole at the CEM reception desk.

I fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the committee. **I agree to completion of a yearly progress report.**

Signature

Date 06 / 05 / 2019

correctional services

Department:
Correctional Services
REPUBLIC OF SOUTH AFRICA

Private Bag X136, PRETORIA, 0001 Poyntons Building, C/O WF Nkomo and Sophie De Bruyn Street, PRETORIA
Tel (012) 307 2770

Ms NN Mangquku
358 Steve Biko Road
0109 Duke Court
Acardia
0083

Dear Ms Mangquku

RE: APPLICATION TO CONDUCT RESEARCH IN THE DEPARTMENT OF CORRECTIONAL SERVICES ON: "AWARENESS OF VALUE MANAGEMENT AMONG PROFESSIONALS WORKING IN CORRECTIONAL SERVICES"

It is with pleasure to inform you that your request to conduct research in the Department of Correctional Services on the above topic has been approved.

Your attention is drawn to the following:

- This ethical approval is valid from **29 July 2019 to 28 July 2021**.
- The relevant Regional and Area Commissioners where the research will be conducted will be informed of your proposed research project.
- Your internal guide will be **Ms M Makhani: Regional Head Facilities, Gauteng Region.**
- You are requested to contact her at telephone number (012) 420 0109 before the commencement of your research.
- It is your responsibility to make arrangements for your interviewing times.
- Your identity document/passport and this approval letter should be in your possession when visiting the Correctional Centres.
- You are required to use the terminology used in the White Paper on Corrections in South Africa (February 2005) and the Correctional Services Act (No.111 of 1998) e.g. "Offenders" not "Prisoners" and "Correctional Centres" not "Prisons".
- You are not allowed to use photographic or video equipment during your visits, however the audio recorder is allowed.
- You are required to submit your final report to the Department for approval by the Commissioner of Correctional Services before publication (including presentation at workshops, conferences, seminars, etc) of the report.
- Should you have any enquiries regarding this process, please contact the REC Administration for assistance at telephone number (012) 307 2770.

Thank you for your application and interest to conduct research in the Department of Correctional Services.

Yours faithfully

ND SHILEZANA
DC: POLICY COORDINATION & RESEARCH
DATE: 23/07/2019

ANNEXURE 3

Level of Awareness on Outcomes and or Objectives of a VM Study

Figure A3.1 shows the respondents views on reduced project capital costs, enhanced project functionality and clarification of the brief and or effective brief management. Many of the respondents are highly aware of these objectives while a small percentage of the respondents are not at all aware of these.

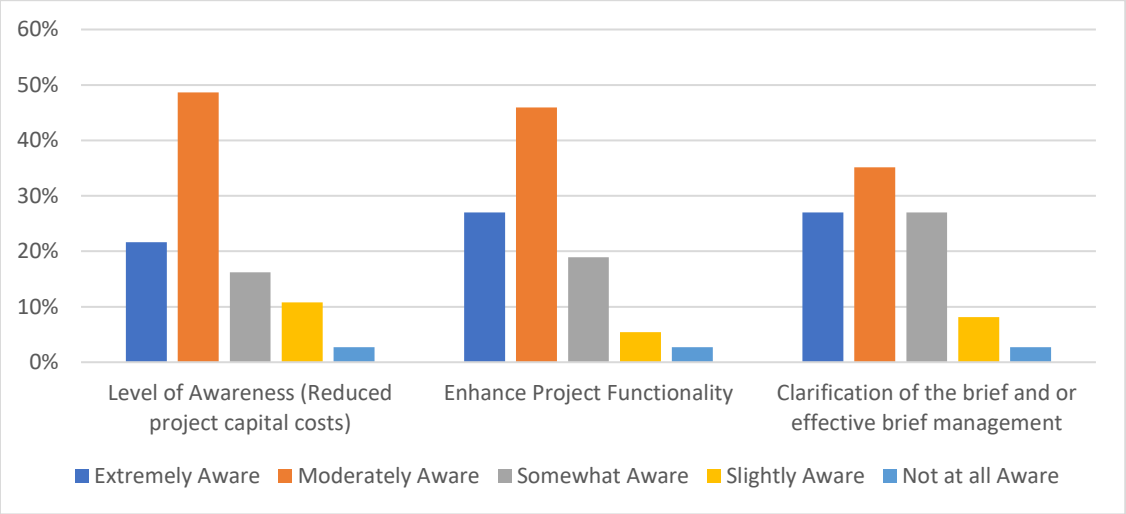

Figure A3.1: Respondents Views on VM Objectives (1)

Figure A3.2 shows that most of the respondents are aware that VM enhances project worth, optimize value over the life of the project and minimize environmental impact. It is also key to note that out of the 37 overall responses received, 36 respondents were able to provide feedback on the optimization of value over the life of the project while 35 respondents provided feedback on the minimization of environment impact.

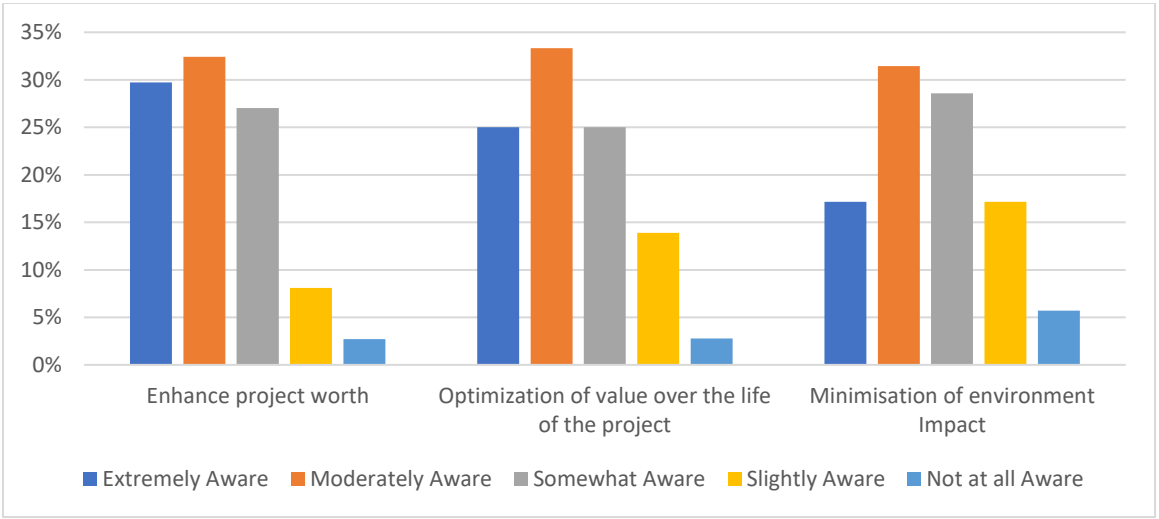

Figure A3.2: Respondents Views on VM Objectives (2)

Figure A3.3 shows that most of the respondents were aware that VM implementation leads to enhanced project usability in terms of convenience and comfort, greater flexibility being offered by the project and effective risk management. However, of the 37 total responses, 36 respondents were able to provide feedback on these outcomes.

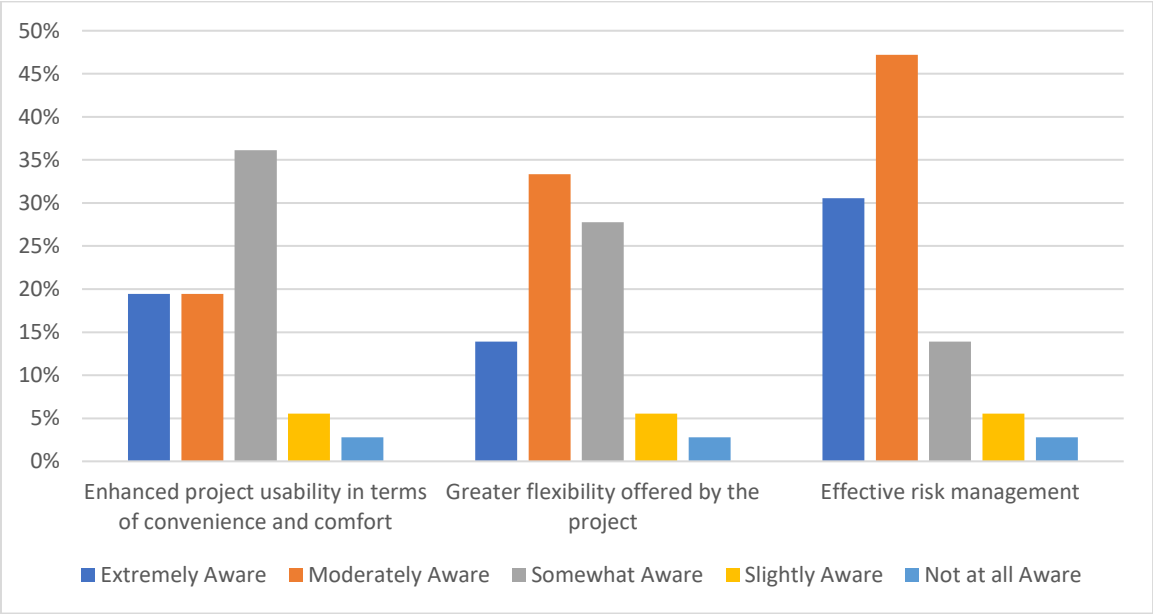

Figure A3.3: Respondents Views on VM Objectives (3)

As shown in Figure A3.4, most of the respondents were aware that VM leads to shorter project duration, realization of project execution efficiencies and reduced project operation costs. On other, only 3 respondents completed the survey on extremely aware, moderately aware and somewhat aware respectively.

Figure A3.4: Respondents Views on VM Objectives (4)

ANNEXURE 4

Level of Awareness on VM Methods and Tools

Figure A4.1 shows that most of the respondents were generally not aware of the functional analysis system technique, simple multivariate attribute rating technique and the kano model being the most unknown.

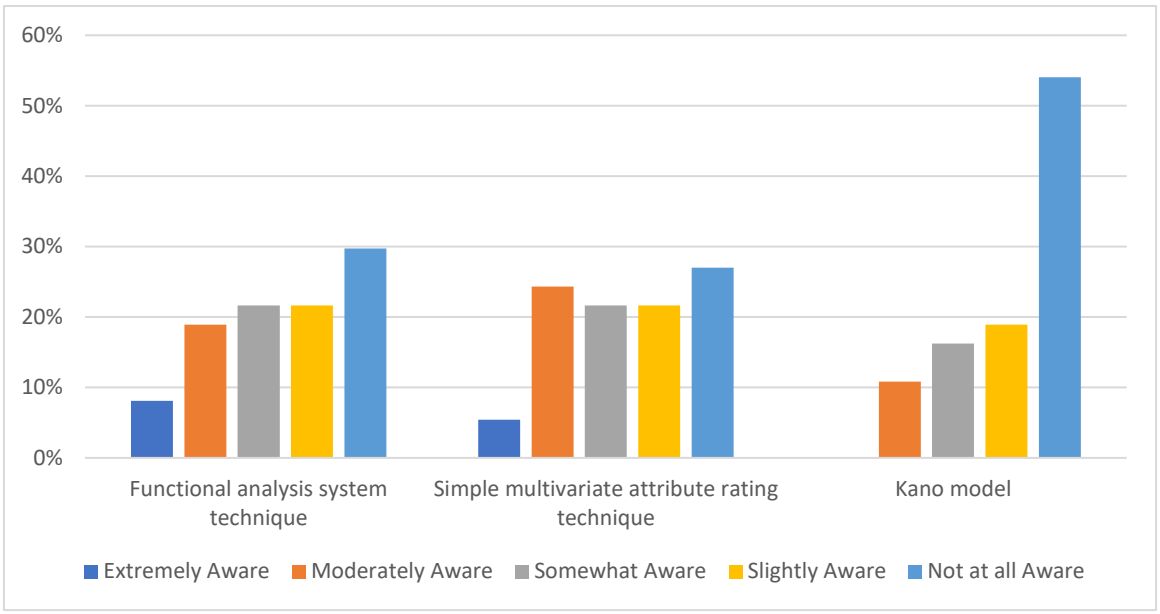

Figure A4.1: Respondents Views on VM Methods and Tools (1)

Figure A4.2 shows that many of the respondents were not aware of the lever of value, quality function deployment (QFD), REDReSS, and spatial adjacency programming. Nonetheless, of the 37 respondents, 36 respondents were able to provide feedback on QFD and REDReSS.

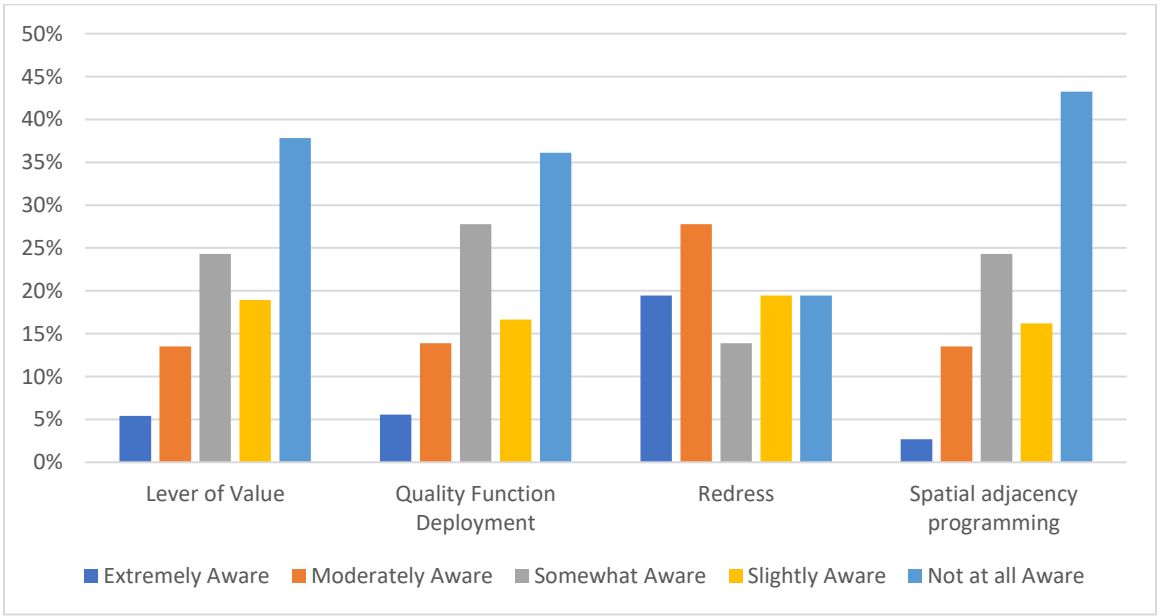

Figure A4.2: Respondents Views on VM Methods and Tools (2)

Figure A4.3 shows that most of the respondents were generally aware of the time, cost and quality triangle, value analysis and life cycle costing while most of the respondents were not aware of facility walk through maps.

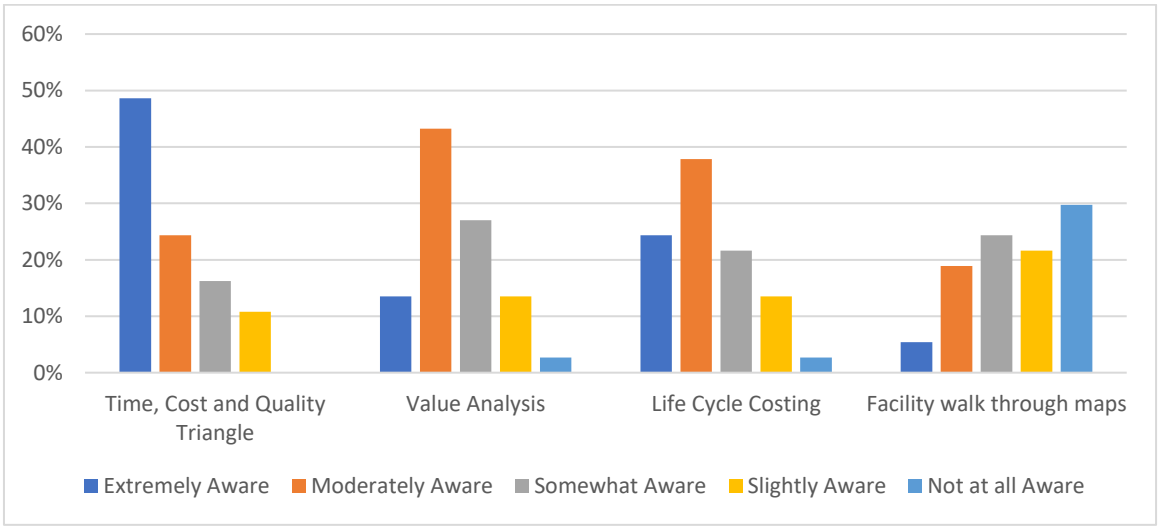

Figure A4.3: Respondents Views on VM Methods and Tools (3)

Figure A4.4 shows that most of the respondents were aware of process flow charting, functional space analysis, element function analysis and component analysis. This is further buttressed by the 36, 34, 36 and 36 responses respectively.

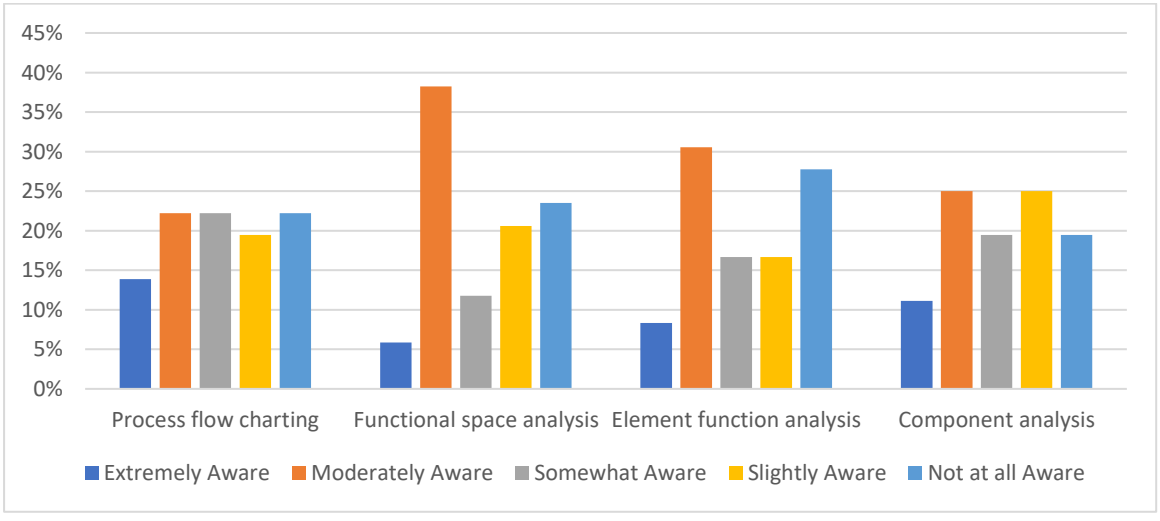

Figure A4.4: Respondents Views on VM Methods and Tools (4)

With respect to Figure A4.5, most of the respondents were aware of the supply chain analysis (mapping and planning) while only two (2) respondents rated the item as extremely aware.

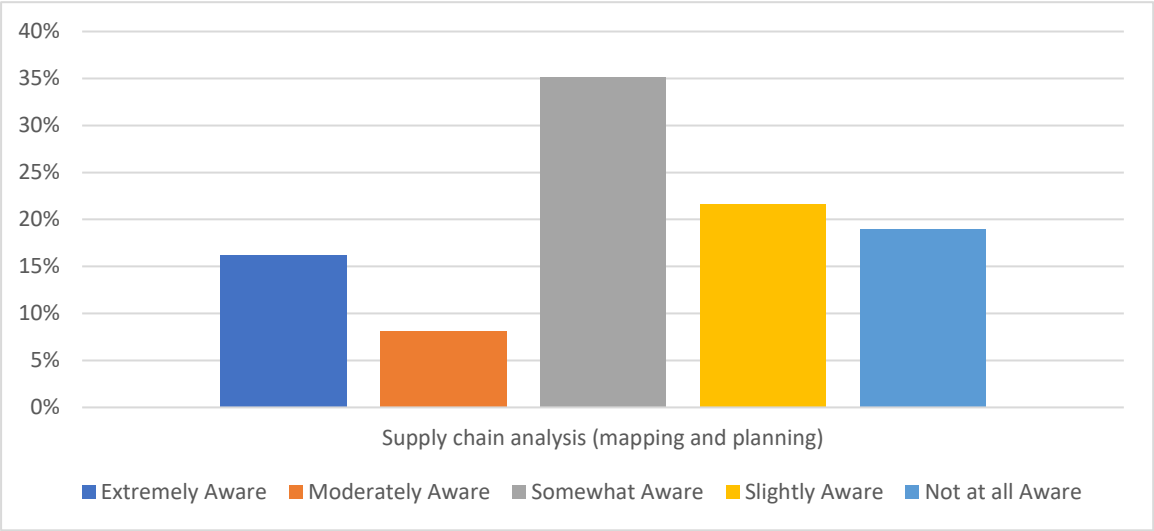

Figure A4.5: Respondents Views

ANNEXURE 5

Level of Awareness on Critical Success Factors

Figure A5.1 shows that most of the respondents were aware of the clear objective of VM study, qualified VM facilitator and Multidisciplinary composition of VM team. Consequently, 36 out of the possible 37 respondents were able to complete the survey on the qualified VM facilitator.

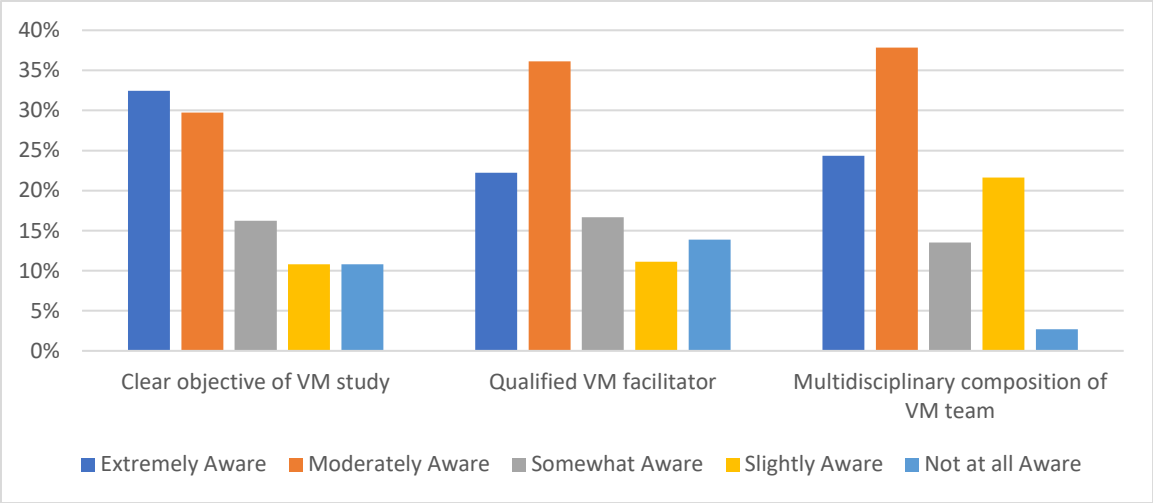

Figure A5.1: Respondents Views on VM Critical Success Factors (1)

Figure A5.2 shows that most of the respondents were generally aware of VM experience and knowledge of participants in their own disciplines, personalities of participants and preparation and understanding of related information. This is further buttressed by the fact that only one (1) respondent did not complete the survey on preparation and understanding of related information.

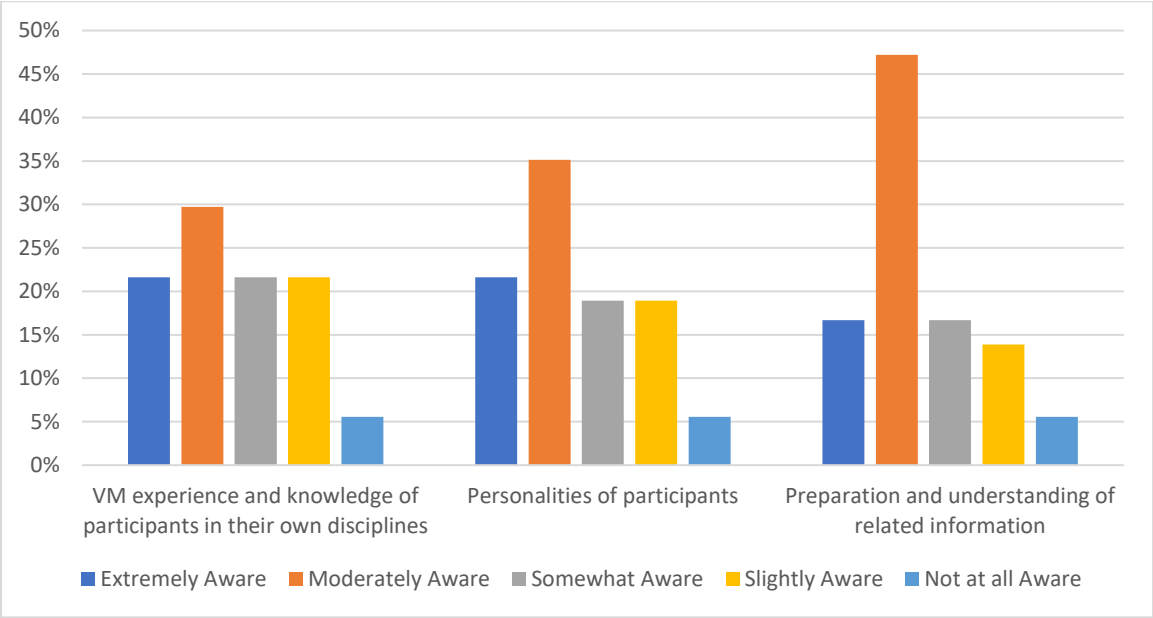

Figure A5.2: Respondents Views on VM Critical Success Factors (2)

Figure A5.3 shows that most of the respondents were aware of the timing of VM, control of workshop and attitudes of participants. However, the respondents were indifferent when it comes to structured job plan.

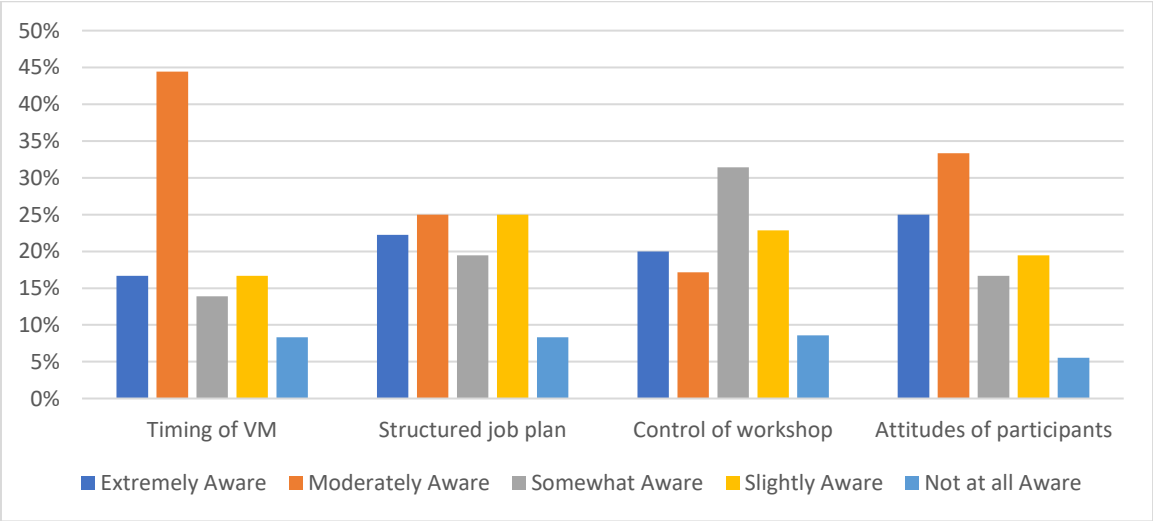

Figure A5.3: Respondents Views on VM Critical Success Factors (3)

Figure A5.4 shows that most of the respondents were aware of the presence of decision takers, interaction among participants and functional analysis.

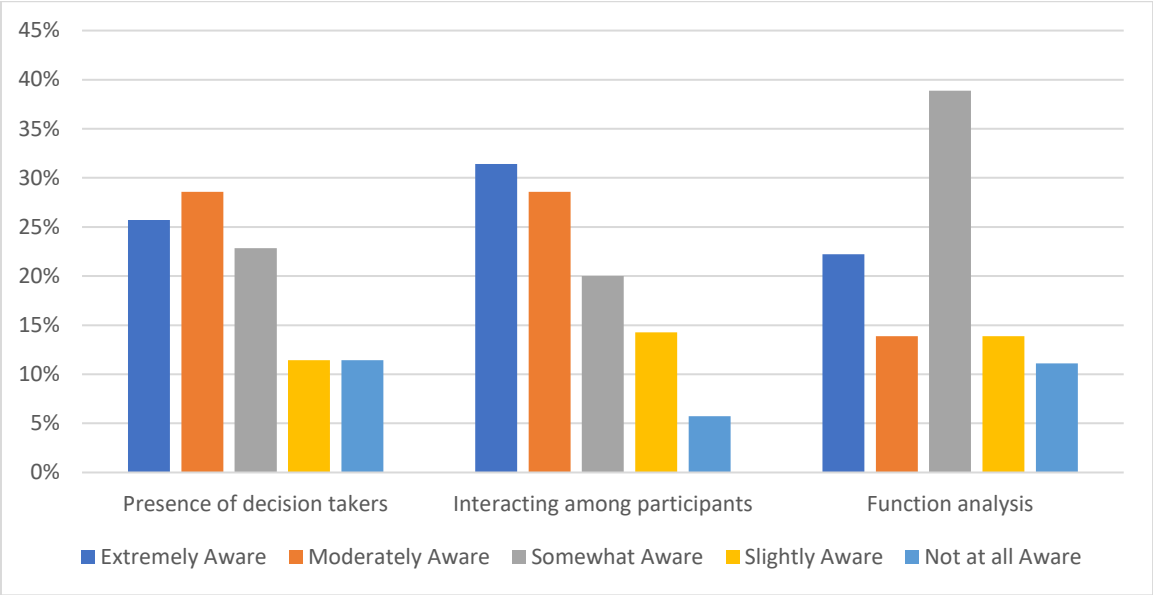

Figure A5.4: Respondents Views on VM Critical Success Factors (4)

Figure A5.5 shows that most of the respondents acknowledged the use of relevant skills and techniques (or methods and tools), VM proposal selection and development and planning for implementation.

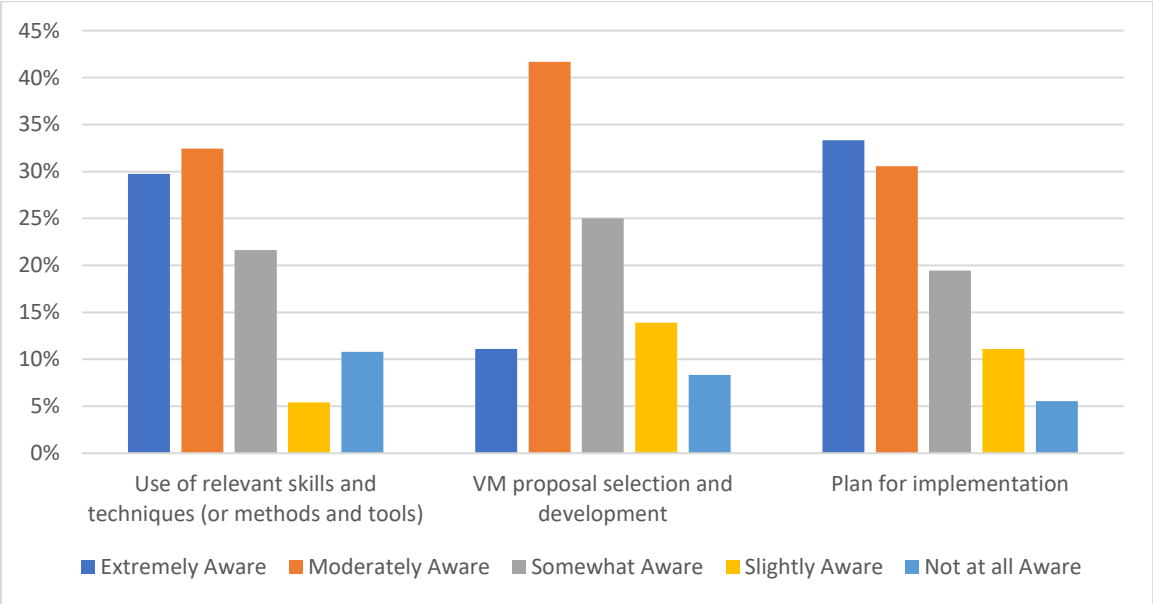

Figure A5.5 Respondents Views on VM Critical Success Factors (5)

Moreover, Figure A5.6 also shows that most of the respondents were aware of the need for follow up training and support for VM implementation, clients support and active participants and cooperation among related departments.

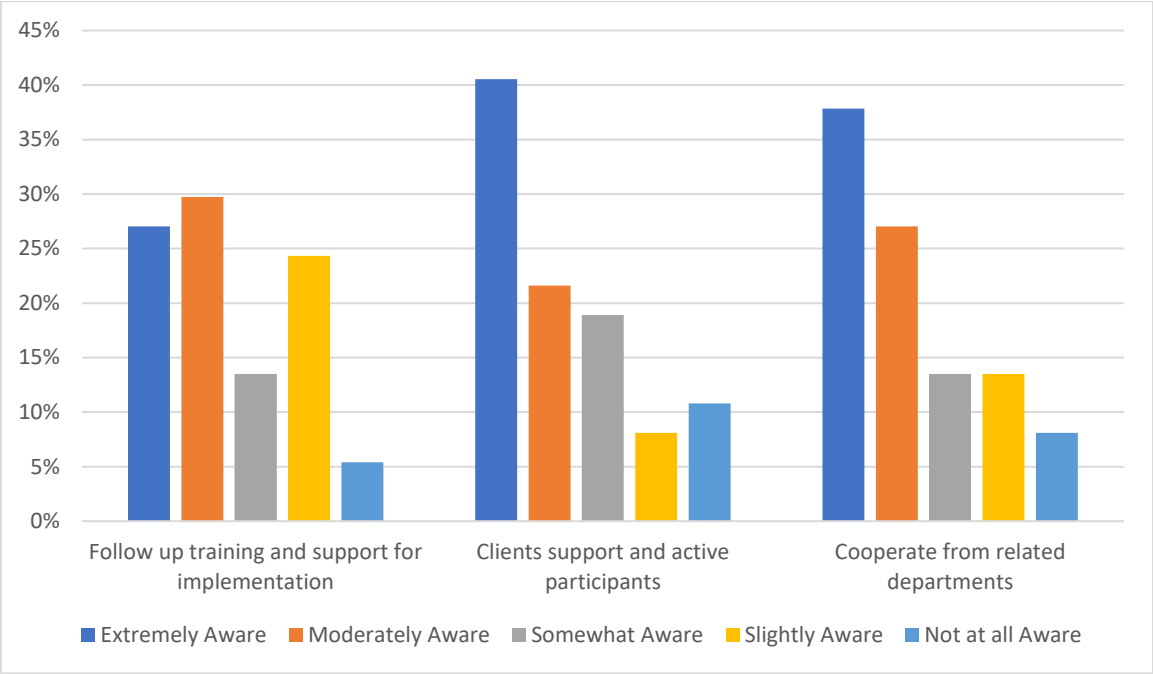

Figure A5.6: Respondents Views on VM Critical Success Factors (5)

Lastly, Figure A5.7 shows that most of the respondents were aware that VM implementation requires adequate time for study, financial support and logistics support. Notably, only two (2) respondents rated the item as extremely aware.

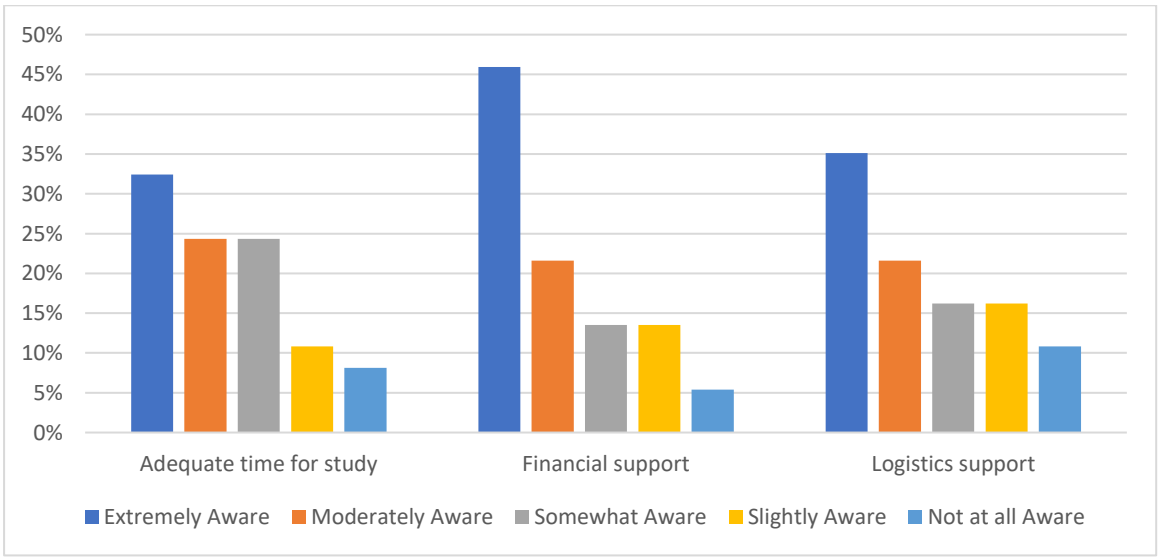

Figure A5.7: Respondents Views on VM Critical Success Factors (6)