Sudan University of Science and Technology
College of Graduate Studies

Implementation of Value Management as an Architectural Design Tool in Sudan

تطبيق الاداره القيميه كأداه من أدوات التصميم المعماري في السودان

A Thesis Submitted in Partial Fulfillment of the Requirements for Master of Design in College of Architecture and Planning

By:

Selwa Ali Abuelgasim Ahmed

Superviser :

Dr. Awad Saad Hassen

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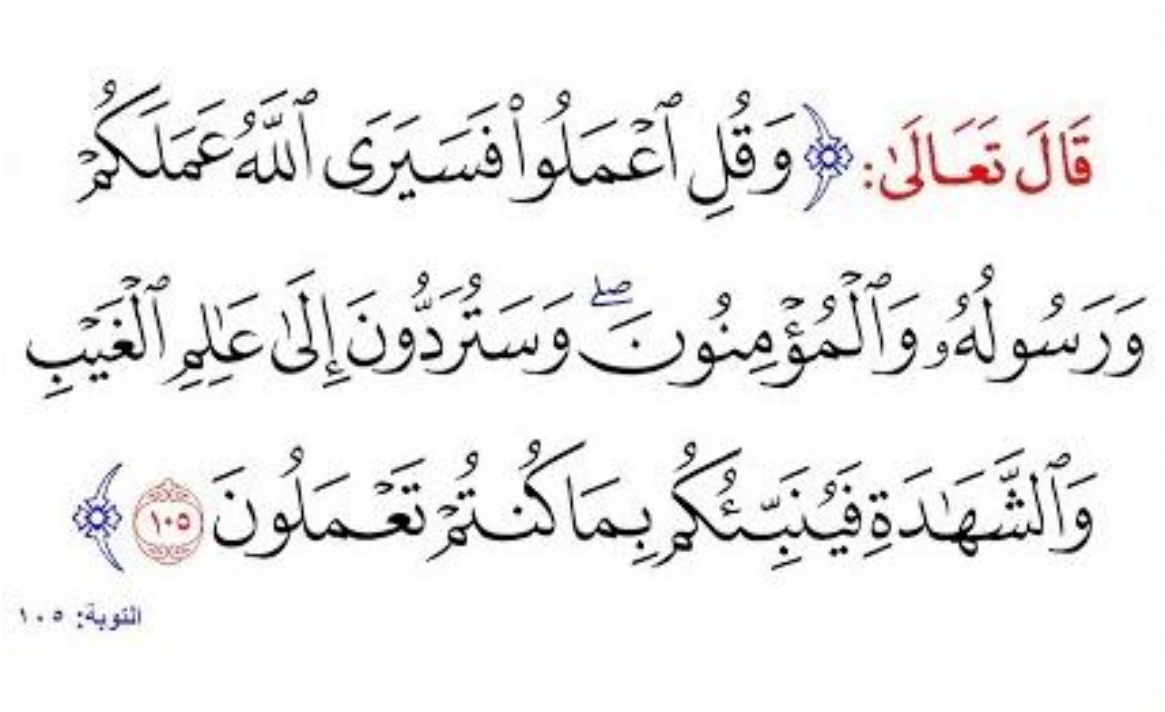
الاستهلال


قَالَ تَعَالَىٰ: ﴿وَقُلِ ٱعۡمَلُواْ فَسَيَرَى ٱللَّهُ عَمَلَكُمۡ
وَرَسُولُهُۥ وَٱلۡمُؤۡمِنُونَۖ وَسَتُرَدُّونَ إِلَىٰ عَٰلِمِ ٱلۡغَيۡبِ
وَٱلشَّهَٰدَةِ فَيُنَبِّئُكُم بِمَا كُنتُمۡ تَعۡمَلُونَ ١٠٥﴾
التوبة: ١٠٥

Dedication

To my mother, who raised me and my kids, may Allah bless her and give her all the best.

To my colleague architect and engineers hoping that this work will add some knowledge and help to develop construction management practice in Sudan.

To my supporting husband Ashraf, and my loving kids Smaa, Khalid and Raghad.

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Alhamdulillah the most gracious and merciful for all the blessings, may Allah give me the knowledge, the strength and the chance to make a difference in construction management practice in Sudan.

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Thanks to everybody who helped me with an effort, a word or a prayer.

ABSTRACT:

Value management is a systematic multidisciplinary effort which maximizes the functional development from concept to completion, through the comparison and analytical process of all decisions against a value system determined by the client to achieve successful projects. Value management is an integrated, organized, innovative and structured process, led by an experienced facilitator and broken down into various stages to enhance the value of a construction project, not necessarily only by cutting costs.

This research studies the implementation of value management as a decision making tool in design in construction projects, It aims to achieve the best value for a project by defining those functions required to achieve the value objectives and delivering those functions efficiently at the least cost.

This study aims to present to the reader value management and its concepts and benefits and when to apply it to achieve high performance projects in the lowest possible cost. The study was based on descriptive analytical method, through the literature review and the questionnaire which was distributed and its feedback has been analyzed. The research reflected the lack of knowledge about VM in the construction industry practitioners in Sudan

The researcher concluded that implementing VM at project inception and design stages maximizes the opportunity to improve value of a project is at its greatest, the researcher found out that value management improves the project design and it is a very effective decision-making tool. Implementing Value management will improve the profession and also will help to reduce the effect of inflation and economic crises. Implementing value management in construction industry will set a model and attract the other industries to try it.

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المستخلص:

الإداره القيميه هي طريقة إداريه منهجيه متسلسله تزيد وتطور الأداء الوظيفي للمشروع خلال كل مراحله من الفكره الى الانتهاء من التنفيذ عن طريق المقارنه بين الخيارات وتحليل القرارات وفقاً لموجهات القيمه التي يساعد في وضعها المالك وذلك للحصول على مشروع ناجح. كما أن الإداره القيميه هي عملية متكاملة ، منظمه ، مبدعه و مؤسسه يقودها خبراء ويقسمونها إلى مراحل من الدراسه والتحليل إلى إيجاد حلول إبداعيه وتنفيذها ومتابعتها وكل ذلك لتعزيز قيمة المشروع وتقليل التكلفه مع ضمان الالتزام بمقاييس الجوده.

يدرس البحث إمكانية تطبيق الإداره القيميه كأداة لاتخاذ القرار في مرحلة التصميم لتحقيق القيمه الأكبر للمشروع من خلال تحديد المهام المطلوبه لتحقيق الأهداف بفعالية وأقل تكلفه، يهدف البحث إلى تعريف القارئ على الإداره القيميه ومفهومها وفوائدها وأساليب تطبيقها لتحقيق الأداء الأفضل للمشاريع بالتكلفه الأقل .البحث استخدم طرق التحليل الوصفي عبر فصول تحوي الإطار النظري للدراسه والاستبيان الذي تم توزيعه وتحليله والخروج بنتائج عكست نقص معرفة العاملين في صناعة التشييد ب الإداره القيميه وأهمية تطبيقها وفوائدها.

خلص الباحث إلى أن تطبيق الإداره القيميه في مرحلة التخطيط والتصميم المعماري للمشروع يضاغف قيمة المشروع . ووجد الباحث أن تطبيق الإداره القيميه يطور تصميم المشروع كأداة فاعلة من أدوات اتخاذ القرارات التصميمه والتخطيط للمشروع . كما أن تطبيق الإداره القيميه سيقلل من تأثير التضخم و الأزمه الإقتصاديه ويقدم مثالاً وأنموذجاً رائداً للصناعات الأخرى قد يشجعها على تطبيق الإداره القيميه أيضاً.

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Definition Of Terms

Term	Definition
Construction Industry	**Construction is a broad process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and beneficiation of raw materials, the manufacturing of construction materials and components, and the construction of the project cycle from feasibility to deconstruction and the management and operation of the built environment.**

Value	**Value generally refers to the relationship between satisfying the differing needs of clients (function) and the necessary resources (cost) required in performing it.**
Value Analysis	**The initiation concept of Value Management, Value Analysis is a specific, creative and organized approach to function analysis.**
Value Engineering	**Value Engineering is a more comprehensive and improvised technique where it embodies a systematic approach to seek out the best efficient balance between performance, cost and quality of a product or even a project.**
Value Management	**Value Management is a broad, proactive and inventive approach to deliver value to the requirements of the clients through capitalizing on the functional values central to the clients. The Value Management method emphasizes on decisions appraisal based on values promulgated by the clients from the conception stage to occupancy stage through an orderly and team-oriented approach.**
Cost management	**a service that synthesizes traditional quantity surveying skills with structured cost reduction or substitution techniques using a multi-disciplinary team.**
Risk Management	**is the process of identifying, analyzing and taking actions on risks throughout the life of the project to help ensure it achieves its objectives**
life cycle costing	**is a technique for economic evaluation which considers the costs applicable to the total life of the asset.**
Quality Management	**is a management system that focuses on the quality policy and requirements of an organization.**

CHAPTER 1

INTRODUCTION

1.1 Introduction:

Construction Industry is one of the main engines of growth in any economy it provides the infrastructures for other industries, provides housing and provides employment as well. Sudan is facing economic crisis, inflation and unstable and high prices and shortage in cash .Those difficulties affect Construction Industry and cause major problems such as cost overruns, delays and cost/value problems; Therefor the need for Value Management has increased.

Value management has been practiced all over the world for many decades already, yet in Sudan most professionals in the construction industry are not familiar with value management and do not realize the benefits of this practice and that it can be a value adding service to the construction industry. Sudan is facing very tough economic challenges. It is more important now than ever to work wisely with the resources we have and to optimize value for money and inputs.

This research will introduce the concept of VM to the reader with what value management truly is. It will cover topics like the definition and description of value management, projects that will benefit the most from value management, the stages involved, and which is stage of the project is the best to implement value management. This research aims to prove that value management is a truly beneficial and worthwhile practice and the earlier stage we implement value management the more benefits we gain.

1.2 Problem Statement:

Construction Projects are facing cost/value problems because of many reasons such as: economic crisis, unexpected cost deviations, lack of predesign studies, bad decisions, lack of co-ordination between the team members and prices jump. All the mentioned reasons reduce efficiency and quality produce less valuable projects; therefore more effective and functional managerial methods need to be practiced.

1.3 Aims and Objectives of the Study:

1- To introduce and encourage firms to apply VM concepts from the early stages of projects.
2- To assess the situation of applying VM concepts and strategies.
3- To study and analyze the benefits of applying VM from design stage not lately in construction.

1.4 Importance of the Study:

Value management plays a key role in construction industry looking for continuous improvement and innovation. Nowadays, Sudan is facing very tough economic challenges. It is more important now than ever to work wisely with the resources you have and to optimize value for money and inputs. This is where VM comes into play.

This study spot the lights to the importance of implementing Value Management Techniques from the early stages of designing a construction project and encourage involving VM Professionals as earlier as possible.

VM specialists and design team meeting together earlier will help to avoid major complexities to create innovative designs and take the right decisions.

1.5 Research Hypotheses:

- There is lack of awareness about Value Management.
- There is an increasing need for Value Management.
- Implementing Value Management from design stage maximizes the expected benefits.

1.6 Research Methodology:

It is an inductive approach searching based on scientific published books, internet webpages and site visits to construction companies in Khartoum state. This research was conducted through identifying the problem statement, literature review, collecting data, analyzing the results, concluded the recommendations.

The main method of collecting data for this research is a questionnaire targeting to assess the implementation of VE and VM in the Sudanese construction companies. The research design is quantitative, where the data was collected from clients, consultants and contractors using questionnaire.

1.7 Research Limits:

0. **Subject limit**: The study includes implementation of value management as an architectural design tool.
1. **Geographical limit**: The study is limited to construction companies in Khartoum city.
2. **Time limit:** From November 2015 till November 2018

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction:

Today value management is a well-known practice which is almost deemed to be part of the construction process in the developed countries. But in Sudan it is not a familiar practice yet.

The Literature review for this research will focus on value Management its concepts, history, process, differences between value management and value engineering and value analysis. This chapter will also study the relationship between value management and design and how VM benefits the project, also similar studies and integration between value management, cost management quality management and sustainable design will be reviewed.

2.2.1 Construction Industry:

"Construction is that sector of an economy which plans, designs, constructs, alters, maintains and eventually demolishes buildings of all kinds of civil engineering works, mechanical work, electrical engineering structures and other similar works. He further describes the construction industry as having different sectors producing heterogeneous products which are immobile, complex, durable and costly" (Ofori, 1990)

In other words "Construction is a broad process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and beneficiation of raw materials, the manufacturing of construction materials and components, and the construction of the project cycle from feasibility to deconstruction and the management and operation of the built environment" (Plescis,2002).

The Construction Industry is one of the main engines of growth in any economy. It provides the infrastructure required for other sectors of the economy to flourish, provides housing as the basic human need, and is instrumental in providing national communications network (Palalani, 2000).

- The Contribution of construction to GDP; about 2-3% in developing countries, 5-7% in industrialized countries
- Value added by construction; 3-5% in developing countries, 5-9% in industrialized countries
- Capital formation in construction; Represents 6-9% of GDP in developing countries, 10-15% for industrial countries, with an international average of about 55% of all capital formation
- The Contribution of new construction assets to GDFCF; 45-60% in all countries
- Intermediate inputs from other sectors in the economy;
- Employment share of construction sector; 6-10% of total employment in a majority of industrialized countries, and 2-3% in the less developed countries. When employment in the delivery of materials inputs is included, the share of construction employment can account for as much as 15% and 10% in industrialized and the less developed ones respectively (Hassan, 2006).

2.2.2 Characteristics of Construction Industry:

Construction industry is the back bone for all of industries and d activities. It is often characterized by immobility, custom built nature, high initial expenses, complexity, continuous changing technology. Thus the features of construction products and the broad range activities and stakeholders in the construction industry make construction worth of different consideration (Moavenzadeh, 1978).

There are common features of construction; immobility, uniqueness, heaviness, bulkiness, complexity, long duration of process, high expenses and durability (Turin, 1980).

The construction industry has vital impact on the environment and people. On a global scale, the construction industry and its products contribute to environmental problems through resources depletion energy consumption; air pollution and waste creation (Ngowi 2000).

2.2.3 Construction Industry in Sudan:

The construction industry in Sudan is an important sector due to its enormous contribution to the country's economic development. This in terms of infrastructure provisions and employment opportunities which grossly contributes to the country's GDP. However due to the political, social and financial situation of the country, construction industry is facing a lot of challenges such as the economic crises which caused delays and cost overruns and reduced the projects value.

According to the World Bank, the construction industry of Sudan has been growing over the past decades. In the last years it accounted for 40% of the country's GDP. This sector of the economy continues to drive the economic activities of the country with growth of 10% in 2008.

2.3 Concept of Value:

Value generally refers to the relationship between satisfying the differing needs of clients (function) and the necessary resources (cost) required in performing it (Abidin& Pasquire, 2007; Liu & Leung, 2002).

$$Value = \frac{Function}{Cost}$$

Value Equation

The value of an item is lowered if the function of the item is reduced and / or the cost for producing the item is increased (Alwerfalli & Schaaf, 2010; Hamilton, 2002).

Dell'Isora (1997) took a more bold approach to definition of value. He expounded that value is also directly related to quality apart from factors like

function and cost. Therefore, value is interpreted as the most effective and efficient way to perform functions that will satisfy the specific needs and wants of users.

The value equation proposed by Dell'Isora is:-

$$Value = \frac{Function + Quality}{Cost}$$

Dell 'Isora Value Equation

Value approach to is primarily concerned with substituting materials with distinctive attributes that would enhance the life-cycle of a product by taking advantages of the attributes.

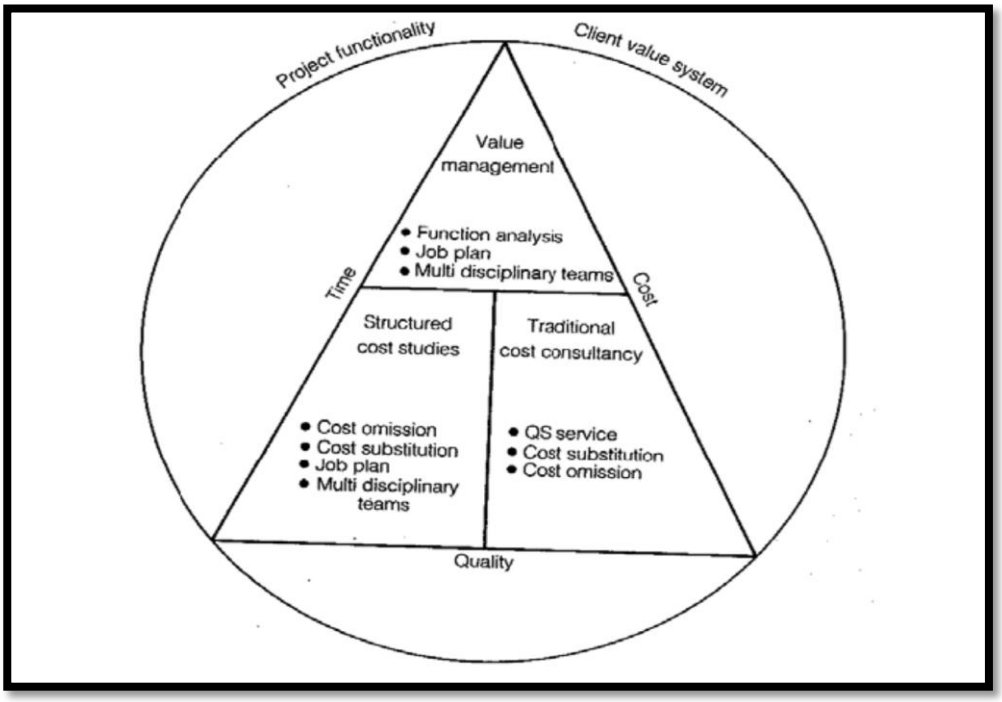

Figure 2-1Elements of Value

Source :Kelly 1993:159

2.4 Value Terminologies:

There are many terminologies and practices related to value management such as: Value Engineering, Value Analysis.
While Value Engineering and Value Analysis are commonly viewed as synonymous to Value Management in the present set-up, both Value Engineering and Value Analysis are indeed subsets of Value Management in strict definition

2.4.1 Value Analysis (VA):

Is the initiation concept of Value Management, Value Analysis is a specific, creative and organized approach to function analysis.

2.4.2 Value Engineering (VE):

Value Engineering is a more comprehensive and improvised technique where it embodies a systematic approach to seek out the best efficient balance between performance, cost and quality of a product or even a project. It can be differentiated that Value Engineering is a wider approach to maximize value as compared to Value Analysis considering that Value Engineering requires broader consideration of the entire project or process rather than specific function required in Value Analysis (Liu, 2003).

2.4.3 Value Management (VM):

Value Management is a broad, proactive and inventive approach to deliver value to the requirements of the clients through capitalizing on the functional values central to the clients. The Value Management method emphasizes on decisions appraisal based on values promulgated by the clients from the conception stage to occupancy stage through an orderly and team-oriented approach (Kelly & Male, 1993; Liu, 2003; Michael, 2002).

2.5 History of Value Management:

According to McElligott and Norton (1995:4) the original concept of Value Engineering originated in the USA during the Second World War at a company named “General Electric Company”.by Lawrence Miles; while he was responsible of manufacturing comparatively low priority products he constantly faced shortages of raw materials as materials were acquired for military grade production. It was necessary to seek substitutes to the materials and processes to ensure that the production of these low priority products at General Electric was not disrupted. Hence, he revolutionized the procurement processes by specifying the materials required according to its intended functions and criteria rather than by the necessity of having specific materials. He focused specifically on the intended functions that the materials are supposed to perform without sacrificing the required quality although cost reduction was not an important factor then.

The exact of these efforts is functional value analysis of the fundamental analysis of materials, processes, parts and other resources that are essential for the

assembly of the final product. Over time it became evident that this value analysis concept resulted in improved product performance and costs were also lower in most instances. This concept was further refined and started to spread throughout the USA manufacturing industry.

Value Engineering subsequently took a more accurate transformation into the present Value Management. It took the form of function-based team approach to enhance the value of the project through analysis of the necessary functions of the product or system, identifying and remove unnecessary costs associated with the project and eventually achieve the intended performance at the lowest costs possible.

2.6 Value Management:

There are a many definitions for VM here is some of them:

Value management (VM) is a service which maximizes the functional development from concept to completion, through the comparison and audit of all decisions **against** a value system determined by the client or customer. (Kelly et.al 1993:1).

Norton (1995:11) describes VM as a systematic, multi-disciplinary effort directed towards analyzing the functions of projects for the purpose of achieving the best value at the lowest overall life cycle costs.

The Value Management method emphasizes on decisions appraisal based on values promulgated by the clients from the conception stage to occupancy stage through an orderly team-oriented approach (Kelly & Male, 1993; Thiry, 2002).

The Australian and New Zealand Standard AZ/NZS 4183:1994 defines VM as a structured and analytical process which seeks to achieve value for money by providing all the necessary functions at the lowest total cost consistent with the required levels of quality and performance

In its simplistic term, it is "A management approach to help in maximizing the overall performance of an organization". Value management is an integrated, organized and structured process, led by an experienced facilitator and broken down into various stages to enhance the value of a construction project, not necessarily only by cutting costs.

2.7 Evolution from VE to VM:

Value management has evolved from Value Analysis (VA) during the Mile's days in the 1940s to Value Engineering (VE) in the 1960s and later to Value Management (VM) in the 1980s.

Value Engineering and Value Analysis focus primarily on improving values in specific stages of the project, commonly during the design and construction stages (Male, Kelly, Fernie, Gronqvist, & Bowles, 1998). Value Management effectively migrated from the traditional hard and static concept of Value Engineering and

Value Analysis through strategic level focus on dynamic, three-hundred-sixty degrees problem solving approach intended to maximize values right from the inception stage to the delivery stage (Liu, 2003).

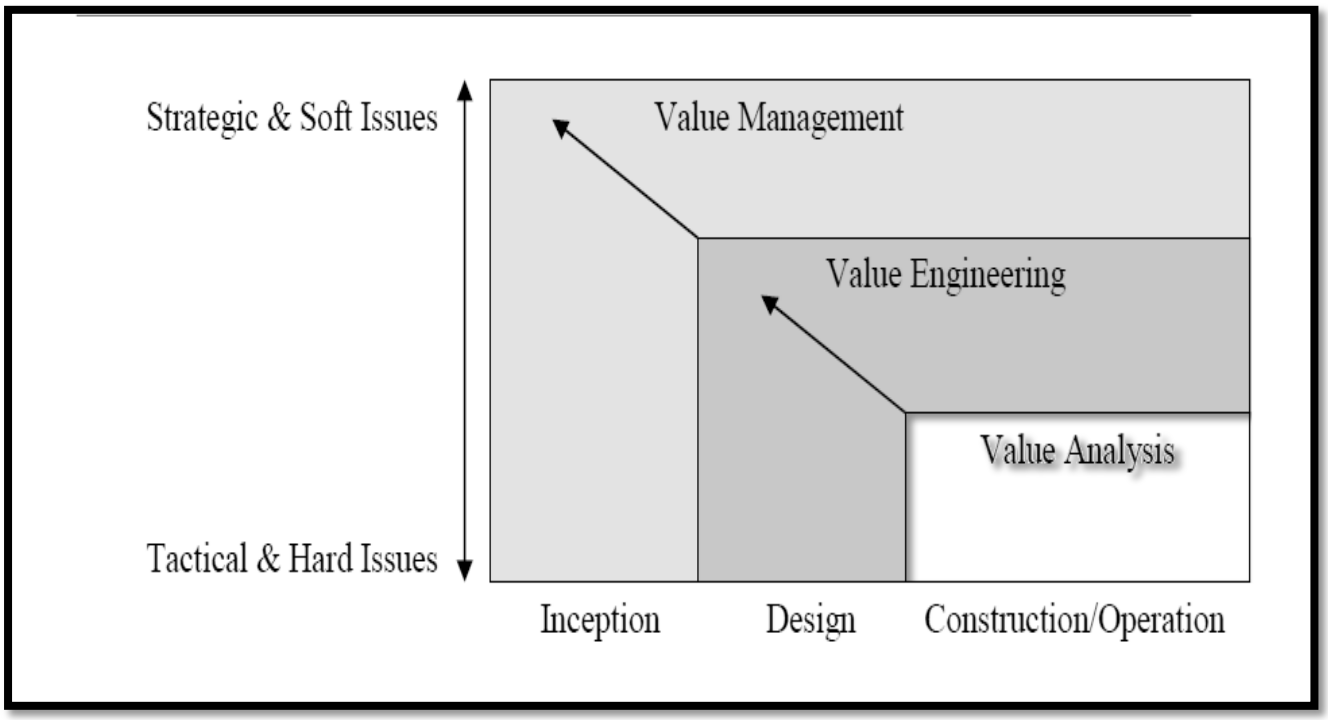

Figure 2-2 Evolution of VM

Dawson (2001) in his presentation to the Hong Kong Institute of Value Management International Conference in 2000 highlighted five (5) major changes that distinguish the evolution from traditional forms of Value Engineering and Value Analysis to the contemporary form of Value Management:

Change 1 - The migration from "process-centered" to "people-centered".

Change 2 - The migration from remedial to preventive.

Change 3 - Broader appliance of VM. The application of Value Management is no longer confined to just addressing technical issues. Value Management is now a more robust and complete management technique extending beyond technical issues, which covers every aspect of the project implementation and project delivery.

Change 4 - From one workshop to several workshops.

Change 5 - From technical participants to managerial participants. In congruent with the shift of Value Management practice from technical-centered to management-centered, the participants of Value Management have also broaden to include every members of the project delivery team. This is contributed by the fact that Value Management involved not only tactical issues but also strategic issues which are the prime factors for the success of a project.

Dawson (2001) further summarizes the comparison between Value Analysis, Value Engineering and Value Management to further improve the simplicity of distinguishing the three concepts. The summary is tabled as Table 2-1.

Table 2-1 Comparison between VA, VE

Item	Value analysis	Value engineering	Value management
Objective	To realize the desired functions with minimum costs of process involved.	To realize the desired functions with minimum costs of process to the project.	To capitalize value of the entire project as expounded by the clients.
Subjective	Existing design or processes.	Existing design or processes.	Existing design or processes.
Timing	Upon completion of the design process.	In the design & construction stages of the project.	From the conception stage until the delivery of the project.
Nature	Remedial action.	A combination of remedial action & preventive approach.	Proactive approach intended at preventive actions.
Levels	Process level.	Process & element level.	Each & every level of the project develop & delivery stage.
Value improving approach	Value is achieved by driving down costs.	Value is achieved by improvisation of designs.	Value is achieved by integrating owner`s requirements into design criteria.
Techniques	Focus on functional analysis.	Implementation of workshops & functional analysis.	Involvement of all stakeholders within the project consensus develop & multi-attribute rating techniques.
Outputs	Focus on functional analysis.	Remedial offers & development of design.	Project objectives, specifications, delivery methods &designs based on owner`s requirements.
Participants	Only technical personnel who are directly involved.	Technical personnel and client`s representative.	Each & every relevant stake holder in the project.

2.8 Value Management Principles and Characteristics:

2.8.1 Principles of Value Management:

The principles behind Value Management are to examine the needs and subsequently develop projects or programs that will drive the probability of achieving the value embodying the use of techniques, skills and knowledge to focus on the specific functions of the process and eliminating unnecessary costs which do not contribute to the function of process (Liu, 2003).

Norton (1995:14) there is three major ways to improve value by applying VM:

- To provide for all the required project functions but at a lower cost;
- To provide additional functions without increasing the cost;
- To provide additional functions and at the same time to lower the cost .

2.8.2 Value Management Characteristics:

Value Management has the following key characteristics:

- A specific methodology
- Based upon a creative problem solving approach
- Involves key stakeholders in a managed team approach
- Focuses on function
- Focuses on achieving value-added solutions
- Based upon on integration
- Focuses on project learning
- Improves the project design.

2.8.3 Value Management is not:

According to the (CP de Leeuw 1998:W1-1) working manual VM is not:

- A conflict orientated design review.
- A cost cutting exercise.
- A standardization exercise.

Table 2-2 Characteristics of VE and VM

Characteristics	Distinguishing between Value Engineering and Value Management *	
	Value Engineering	Value Management
Typical objectives	Reducing capital costs without compromising quality or performance. Selecting the best option (satisfying all requirements at lowest cost) from a range of options. Choosing between component types such as structural steel or reinforced concrete.	Developing guiding principles (including principles to achieve best value for money) for planning and design at the briefing stage of projects. Selecting the best concept design options from a range of options. Developing proposals to enhance value for money at concept or detailed design stage. Resolving planning and design issues.
Typical focus	"Hard" – technical focus – physical building or component parts.	"Soft" – concepts, "people-activities", preferences.
Stage of project development	There is likely to be at least a concept design, and more likely, some detailed design work. In some cases, design work may be complete or nearly complete. Many Value Engineering studies are undertaken during construction stage, especially when projects are running over time and over budget.	Most likely to be at the early stages of project development, even before a project brief has been prepared.
Participants	Strong technical focus.	Broad participation by stakeholders from management, strategic planning to operational.
Number of participants	Normally tighter in numbers, 8 to 15.	Typically 15 to 25 but sometimes up to 40 or 50 people.
Function analysis	Conventional function analysis of individual components.	Primary purposes; beneficial outcomes, important characteristics that must be achieved – at the "whole entity" level. More detailed function analysis where required.
Cost comparisons	Can generally be more precise in terms of capital and recurrent costing and models.	Possibly indicative, generally comparative (greater than/less than) if costs are even conceivable – eg 50% more than this one. There might not even be a budget at the early stages. The Value Management workshop can provide the basis for establishing one.

2.9 Job Plan of Value Management:

The systematic job plan being promoted SAVE International consists of three (3) stages namely, prestudy stage, value study stage and post study stage. The pre-study stage consists of one (1) phase, while the value study stage and post study stage consist of seven (5) phases and one (1) phase respectively (Perera, Hayles, & Kerlin, 2011; Gupta, 2009; Davis, 2004).(figure 2-3)

The various phases are detailed as below.

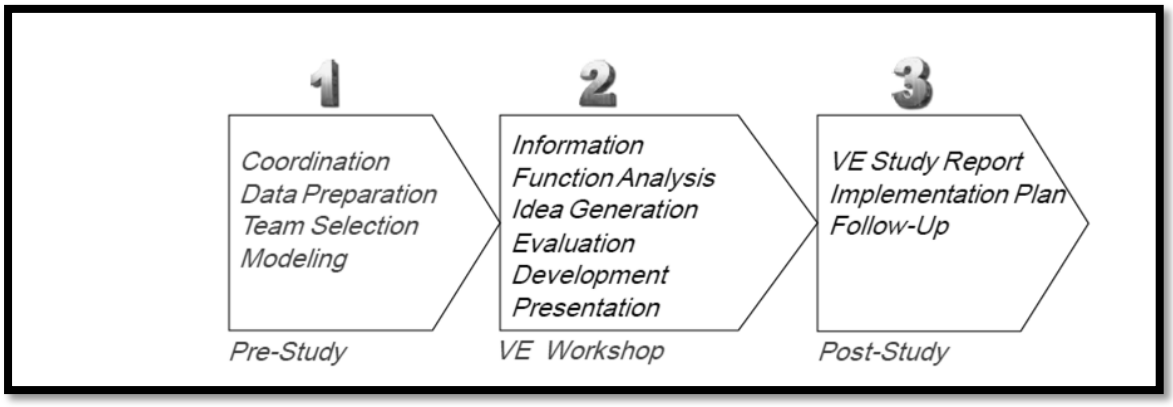

Figure 2-3 Value management 3 stages

2.9.1 Pre-Study Stage: (Information phase):

As Value Management is often looked to as a means of resolving emerging problems or providing direction, sometimes this phase is rushed to complete the Value Study.

This should be resisted because the ultimate success of the Value Study depends on thoroughly covering the activities contained in this phase. These activities fall into two categories - scope and logistics.

Scope Activities under this category are all associated with establishing the focus and bounds of the Value Management Study. The information that is gathered, assessed, and consolidated, forms the foundation for all subsequent analysis.

Key activities are:

It is a diagnostic phase focuses on forming an ongoing benchmark and frame objectives to evaluate outcomes in terms of their consistency with corporate or service strategies also identifies and prepares background material.

The assembled background material should represent a precise of the topic and perspectives of the stakeholders and participants. It immediately identifies key issues, areas of conflict, assumptions by various parties, etc. It also begins the process of identifying functional requirements of the program or project.

Essential activities include:

- Establish Value Management Study objectives.
- Canvass issues and concerns
- Formation of Value Study Team including technical specialists and stakeholders
- Establish study timetable
- Identify and gain commitment of stakeholders
- Nominate, invite and brief participants
- Arrange venue
- Create brief presenters for workshop component of the Information Phase
- Distribute consolidated background material.

Workshop

The information phase of the actual Value Study Workshop includes:

- Confirmation of Value Study objectives
- Scheme and project overview
- Project assumptions
- Project imperatives in terms of cost and funding
- Project imperatives in terms of time and other criteria
- Key issues and concerns.

The workshop starts with key participants presenting information. This provides an overview from the stakeholder's own perspective. It is an opportunity to quickly appreciate value judgments, and the rationale, underpinning the proposal(s) being considered. The background information gathered during the pre-workshop phase is tabled. This includes relevant data concerning the client's corporate, regional, area and project objectives.

The information phase provides the opportunity to explore the total project rationale, questioned from a functional viewpoint, with the intent of searching for alternative solutions to provide the client with best value for money.
This is the part of the information phase to identify assumptions that have been made in the project development from all stakeholders' points of view.

2.9.2 Value study stage:

Function analysis phase:

In this phase of a Value Study functions are identified and analyzed. A Value Study concentrates upon function, and the cost and worth of those functions.

Techniques developed to identify and analyze functions include Functional Hierarchies and the use of Function Analysis System Technique (FAST).
These techniques commence with the more global functions of the total system and then extend to specific functions of individual components. They can also be completed in the reverse order.

They provide the basis upon which alternatives may be generated and evaluated to eliminate or combine functions, and to ensure compatibility between functions within the whole system.

2.9.3 Ideas/options phase:

One outcome of a value study is a "shopping list" of alternative ideas to achieve value improvement.
Adjacent thinking is encouraged during this phase to produce as many ideas as possible, even those ideas that may seem unworkable or unreasonable. Generating ideas and options is encouraged by asking the following questions:

- How else may the required function be performed?
- What else will perform the required function?
- What will the alternatives cost?

There are several ways to structure the study to facilitate idea generation. The method depends upon the number of people in the study and the nature of the

project. In project terms various parts of the project will need to be specifically targeted for idea generation (eg. use of space within buildings, security systems, etc.). If it is a single product that is being considered, then the product will need to be analyzed component-by-component or aspect-by-aspect.
Where there are more than seven or eight people in the study, it is useful to generate ideas in small groups and then hold plenary sessions in which all ideas generated are identified and discussed.

2.9.4 Evaluation phase:

Each idea/option generated needs to be carefully considered by the group as a whole and decisions taken on which ideas should be evaluated in detail.
Ideas are evaluated in terms of the advantages and disadvantages they offer to the project with respect to value improvement. This includes those ideas that, in spite of additional capital cost, could lead to a better return on investment.

There is a tendency at this stage to discard ideas that might lead to additional re-design or to a disruption of the program. In a project where time is crucial, it may be too late in the development process to implement change but in other cases such changes can be incorporated within an acceptable time frame. Usually the majority of the ideas/options are retained for detailed evaluation.

There is a range of evaluation tools to assist this process, appropriate to the situation. For example, evaluation matrices may be used to determine the relative priorities of a list of objectives or project criteria.
The process works by considering one pair of criteria at a time and taking decisions as to the relative priority of each criterion.

These matrices are especially beneficial when considering issues and/or objectives at the earliest stages of project development. However, they may also be employed to rank detailed design criteria, for example the functional requirement of a floor finish option development; those ideas with most potential are developed to a stage to show if they are workable. This may include preparing detailed drawings and cost estimates. Part of this process may continue after the value study is over.
The extent to which option development occurs depends on the workshop duration, for example, a three-day workshop may allow the Value Study Group to make final decisions on option adoption.
Alternatively, a one-day workshop may rely upon the Action Plan resolution period for evaluation. Some options may require advice beyond either the expertise and/or authority of those present at the Value Study. For example a system wide option which might negate or defer the need for work. This would normally then require further corporate direction.

2.9.5 Action plan:

The final action in a Workshop is the preparation of the Action Plan, which encapsulates the outcomes and provides a framework for subsequent tasks/evaluation/ decision-making. It represents the consensus of views of the Value Study Workshop participants and highlights ideas that show greatest potential for value improvement.

Ideally, the workshop outcomes and the Action Plan should be made the subject of a presentation to the client (including senior representatives of Management), at which the entire Value Study Group attends.

The Plan identifies target dates for each item and nominates people to take responsibility for the pursuit of those items and any reporting. The ultimate success is dependent upon the effort with which the Action Plan is pursued.

Action Plan Coordinators should be nominated at the conclusion of the workshop to ensure the appropriate effort is applied and Action Plan Nominees have a common point of reference.

Elements to include are:

- List all activities to be undertaken
- Identify people responsible for each activity
- Indicate time frame (for each activity) for further evaluation and decision(s), and
- Specify finalization date.

It is especially important to involve the client in the co-ordination activities. Ideally, follow-up sessions are scheduled for Action Plan Nominees approximately one month after the Value Study Workshop. At that time the implementation schedule is examined to ensure that all value improvement opportunities are being pursued fully and to determine further actions.

This is an extremely useful approach as it gives the Action Plan Nominees a clear focus and promotes positive action.

2.9.6 Reporting:

Reporting requirements for Value Studies vary considerably according to the project stage at which the Value Study is undertaken. The earlier a Value Study is undertaken the more substantial the reporting requirements.

The reasons for this are best illustrated by examining the two most common phases at which project based Value Management Studies are undertaken.

The Value Study Team should provide an interim report approximately two weeks after the Value Study Workshop to provide Action Plan nominees with a rationale of key issues. This assists with the resolution of Action Plan issues. The report content should include:

- Value Study findings
- Project rationale and objectives
- Precise of the project scope
- Precise of the Value Study scope
- Summary outline of key functions, with “system” implications
- Description of value improvement options, together with a description of rationale and/or implications
- Outline of the Action Plan
- Appendices incorporating papers presented to the Value Study by participants and others.

2.9.7 Post study stage: Implementation phase:

After the interim report has been provided in the reporting phase, there will be a follow-up and revision meeting then the final report will be prepared. The final report should provide Project Management and the Client with a detailed record, observation and refined decisions.

It should present the outcomes of the follow-up meeting and executive summary of the Value Management Study as Concept Studies this provides a benchmark from which to monitor project development in terms of ensuring: agency corporate goals design development reflects concept philosophy.

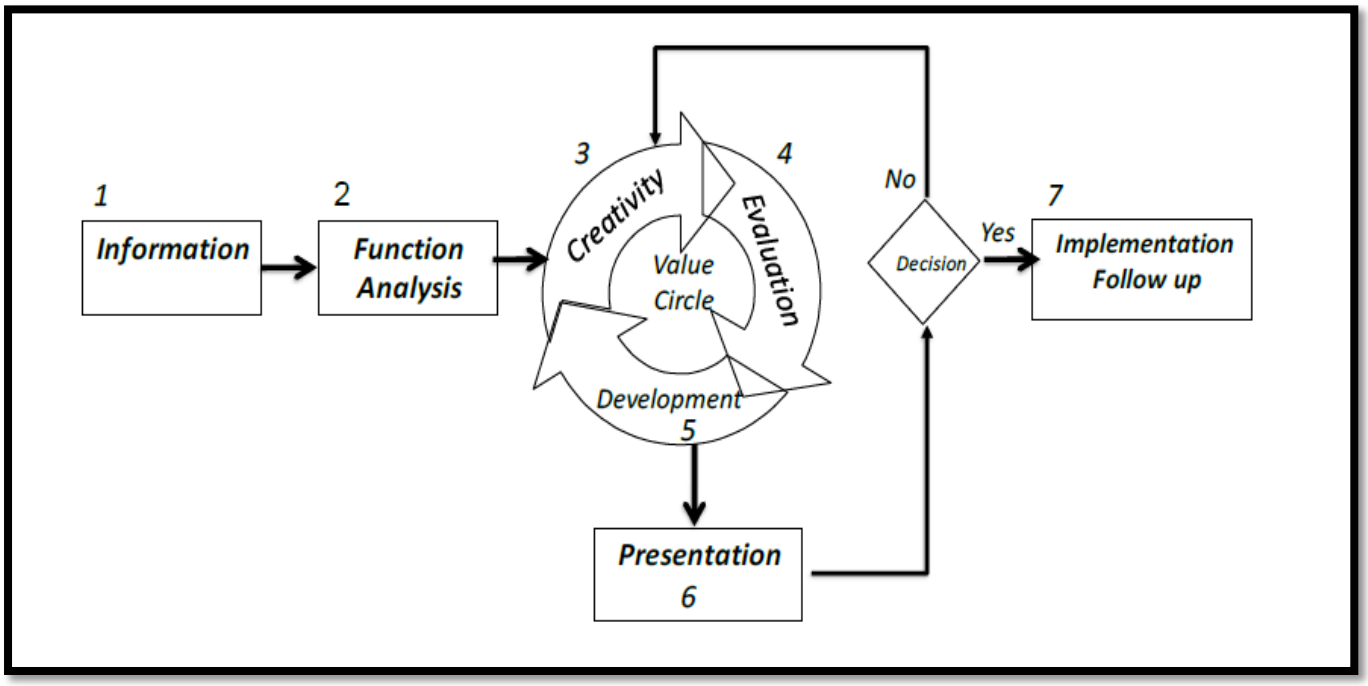

Figure 2-4 Value management 7 phases

2.10 The value management team:

2.11 2.10.1 Team structuring:

Depending on the scope and time restraints for the project, VM studies can vary from a one person to a team effort and may also have several people assigned to support the team if particular skills are needed. A five persons VM team supported on a part-time basis by other elements of the organization is usually a sufficient number. Select team members based on the following criteria:

1. Use employees who have had prior training in VM.
2. Select a project leader with appropriate VM workshop training and experience as a team member on one or more VM projects.
3. Select team members who have familiarity with the VM process such as a one-day VM orientation course. Include a suitable orientation if such experience is unavailable.

4. Identify work experience or background of the team members related to the particular project study.
5. Use a mix of talent to achieve different points of view. Typical team members might include a soils engineer, right-of-way specialist, materials specialist, environmental specialist, structural engineer, design engineer, landscape architect, traffic operations, maintenance, resident engineer, and an experienced cost estimator.
6. Include team members from popular concerns such as environment, liability, and public opinion.
7. Emphasize using the best talent available rather than obtaining only those who can be spared.

2.10.2 Team operation:

The team leader of value management should:

- In Creativity: take in mind that good ideas come from people who are properly motivated. Get all team members involved. Don't let anyone dominate the team.
- In Implementation: take in mind that receptivity to ideas has to be generated.
- Be a Good Listener. Listen attentively when explanations are made concerning problems that arise. The explanations almost always provide clues that otherwise would require hours of investigation and research. The experience of the team members might enable them to detect the true problem if the person making the explanation is given every opportunity to express their ideas. Also, the person who objects to a proposal may give an indication as to how it may be improved or modified to enable approval.
- Use Key Questions. The Value management approach is a QUESTIONING approach. In order to get answers, questions must be asked.
- Use Checklists. As an aid to the practicing VM - Team, the key questions of the VM Job Plan have been incorporated into checklists found in the chapters describing each phase. The checklists are not all-inclusive. The lists do, however, provide a good minimum of questions to ask.
- Record Everything. Don't trust your memory. During all phases of the study, record the information you have gained through interview; write down your ideas, the questions that need to be answered, and the details of your developed ideas. You will need this data in each succeeding step of the VM Job Plan and in preparing the workbook, the study summary, and your recommendations.

Each member must contribute to the study. The team leader determines each person’s talent and allocates tasks to make the best use of them.
In each phase of the Job Plan, the team carries out both individual and group actions. One member can obtain and organize costs, one can analyze the specifications and identify problem areas, one can get the equipment information, etc. Each can summarize and document the information so that the team can plan, create, and act to solve the problem.

2.10.3 Value Management Professional Qualifications:

Although there is strong excellence to being certified as a value management professional in the world, in Sudan there is neither professional practitioners nor Sudanese value society.

SAVE International bills itself as "The Value Society" This organization has membership, technical committees, and technical exchanges and sets the standard of practice through publications, conferences and an internationally recognized certification program. Certification is at three levels, each with their unique qualifying criteria and time period prior to certification requirement:

- Value Method Practitioner (VMP): is someone who has completed the basic workshop, has participated in a value analysis study, plus other experience, and has completed a value theory examination, but whose principle career is not value engineering.
- Associate Value Specialist (AVS): is the intermediate level in certification. Recognizes individuals who have completed 128 hours of value analysis study, but have not yet met all the experience and/or technical skills requirements for a CVS.
- Certified Value Specialist (CVS): Denotes full level of certification in the SAVE program. Requires 2 years of full time value work participated in SAVE activities, including completing an original paper, an all the experience and technical skill certification requirements established by SAVE

2.11 The best time to implement VM to a project:

It is important to note that VM can be applied at any stage in the construction development cycle and is not only limited to the early phases of a construction project. Larger, more complex and more expensive projects will benefit more from VM than small once-off projects.

The opportunity to improve value of a project is at its greatest at project inception, because as the project progresses construction costs and other costs and funds become committed. Objections to design or any other element should be made as soon as possible preferably during the briefing and design phase of a project. There are no to very low implementation costs for ideas given during the brief stage. As soon as construction starts and there has been detailed designs it become more expensive to change the building. Once the structure is erected, the options become very limited and costs of alterations are very expensive. Later intervention of VM tends to produce smaller proportional benefits, have a detrimental impact on the program and meet greater resistance. Kelly et al (1993:64) suggests that VM be done at a point where approximately 35% of the design (schematic/sketch) is completed due to the fact that costing data will be more readily available in the form of estimates and savings can be more easily identified.

Lecturer Peter Hughes who is responsible for value engineering. "Value engineering is vital to good innovation and design", he says. "The key lies in

maintaining a hard-nosed practical approach. Small to medium enterprises in particular should find that value engineering will give them a distinct market advantage."

A number of authors including Dean (1999) consider that to be productive VM must become an integral element of the design process thereby becoming an effective design management tool.

It is important to note that VM can be applied at any stage in the construction development cycle and is not only limited to the early phases of a construction project.

2.12.1: Value Management and design:

Good design begins with the needs of the user. No design, no matter how beautiful and ingenious, is any good if it doesn't fulfill a user need.

The necessity of effective Design Management is generally acknowledged by the industry and the findings indicate that VM is recognized as an effective Design Management tool. If this stage of a project's life is considered to be one which has the greatest impact on the outcome of a project, then the resources spent on this stage should reflect its importance.

The experts found that the benefits of VM are usually significant in obtaining value for money and improving performance and business procedures. The benefits often surprise those experienced in business by yielding a large return on a relatively modest investment. Authors agree that early VM in the design stage gives the benefit of minimizing abortive design work and early use provides greater flexibility to make changes with little cost.

The application of a VM study provides participants in the project development process with a more thorough knowledge of costs and the economic impact of various design decisions. Keith van Heerden (1989) felt so strongly about the results VM can achieve that he said, "no organization and no country can afford to ignore the increasingly important role VM is playing".

Al-Salmi (1989) found through a number of case studies that design teams were often apprehensive of conducting VM exercises, as they were concerned about delays to the schedule resulting from the procedure and any recommended changes. Design is a complex, creative and undefined process.

The findings recognize VM as an effective design management tool. The early application of VM within a project's life increases the rewards which can be reaped from focusing on design functions and construction objectives, highlighting how the budget cost can be achieved, while maintaining quality and performance standards.

- The decisions made in the early stages of a project affect all its aspects, yet the industry spends the least on this stage, the design process is of paramount importance in setting the parameters for any project.

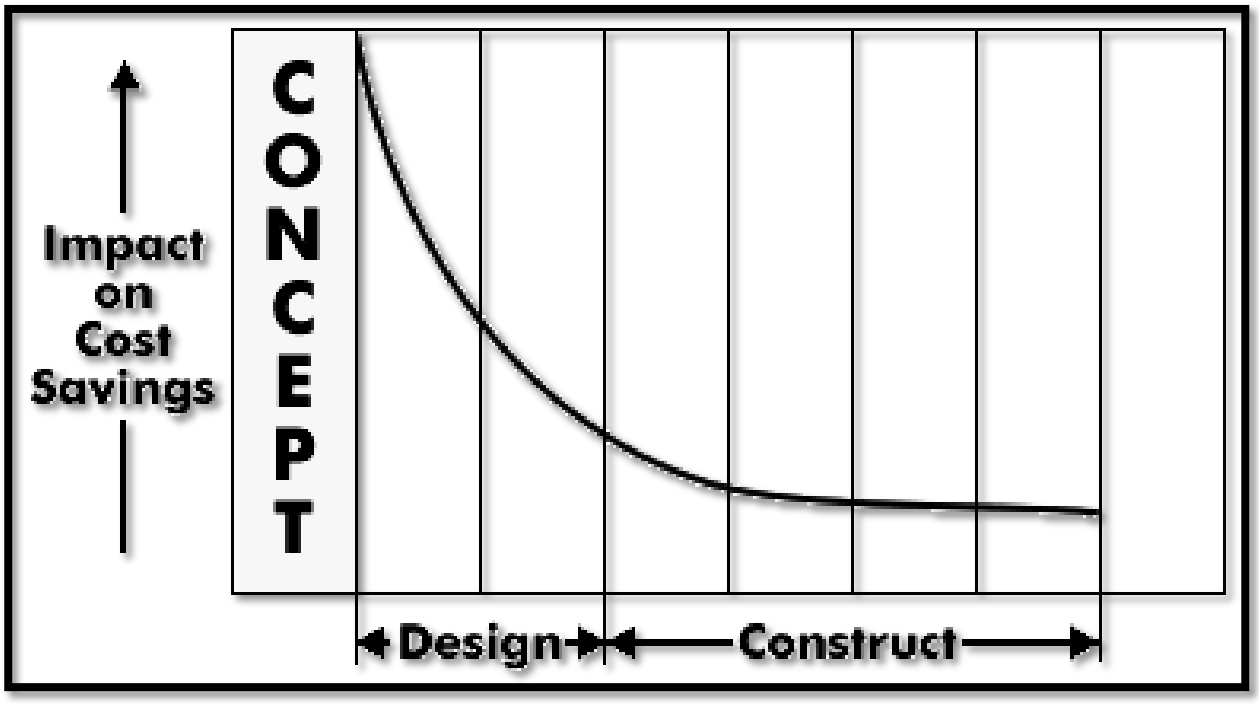

Figure 2-5 Impact of VM on cost saving

Evidence shows that it is the decision making or design process that has the greatest effect on the programming and cost of later events, The decisions made in the early stages of a project affect all its aspects, yet the industry spends the least on this stage, the design process is of top importance in setting the parameters for any project opportunity to engage stakeholders at key stages in design development to:

- Establish a common understanding of the project and functional objectives
- Agree criteria and constraints for judging a successful outcome
- Compare options and choose best value solution
- Test and refine chosen options
- Resolve design problems and jointly decide the way forward
- Review options from a constructability and maintainability point of view
- Compare procurement options and choose best value route

2.12.2 Importance of Value Management in Design:

Latham (1994) who noted that effective management of design is crucial to the success of a project. However he recognized that the design process is complex and has the potential for a lack of coordination.

Previous reports had suggested that it is best practice for a project to be fully planned before construction commences, as the risk of uncoordinated project documentation during the design stage is high.

It is clearly distinctive from the above statement the fundamental concept has shifted from cost-based to value-based, giving project stakeholders a greater and

central role in project development and delivery. It means that value for money can only be achieved when design alternatives generated must not only strike the balance of cost, performance and quality but also satisfy the objectives of the project.

What is cost effectiveness and how does it affect the designer? , The breakdown of total costs is illustrated and the eight factors to be taken into account by designers in selecting their materials are then considered. In a cost effectiveness analysis of the selection of major design materials, a number of factors are involved. A listing of some of the principal factors will serve to indicate the complexity of the problem and the amount of effort required to arrive at economical and meaningful decisions. Each of the factors requires investigation, evaluation, and input from various sources.

Material Selection Factors to be considered by designers:

- Availability of required design data on the material
- Initial and installation cost of a particular material
- Operational and maintenance requirements
- Source and availability of material
- Construction contractor's reaction and know-how -Conformance to a standard specification,
- Availability of sufficient data to develop performance specifications affects the design.

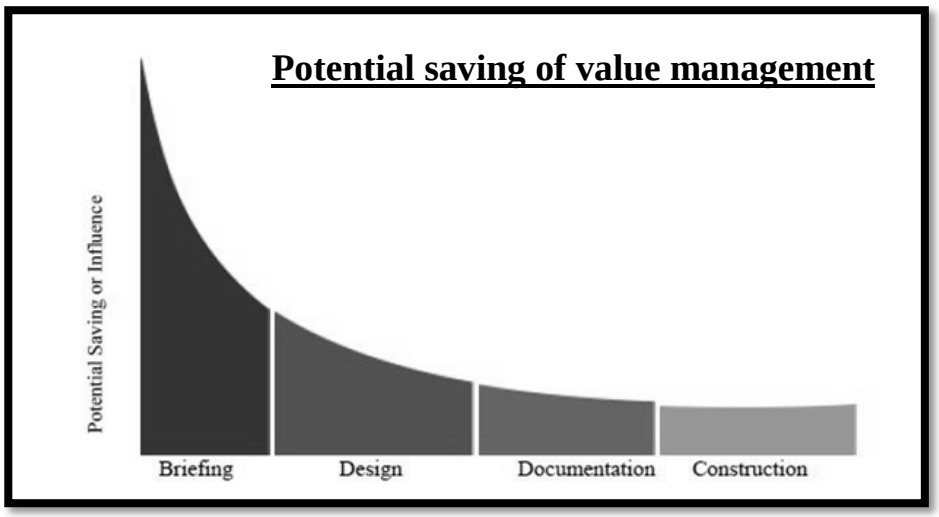

Figure 2-6

2.12.3 Value Management Is a Proven Tool For Design:

Heller (1971) strongly felt that VM should be applied early in the design stage as its benefits diminish as a program progresses towards completion. In their research Clark and Oliver (1998) found that the earlier value studies were undertaken, the greater the returns. Locke and Randell (1994) have found that the opportunity to improve the value of a project is at its greatest at the project inception. As the project progresses, the construction cost of elements becomes committed restricting the options available.

Kirk (1989) commented that it is becoming common practice to apply VM first to the client's brief, then to the concept design, and later to the engineering stage.

In his long-term research Dell'Isola (1997) found that clients are electing to use VM during the design process as a second look at major design decisions to aid project cost control, improve quality and value. He determined that savings averaging some 5-10% reduction in initial costs is achievable. He went on to suggest that the VM effort develops a cohesive team of self-motivated achievers who are committed to a common objective of optimizing owner expenditures using a planned effort. Many agree that a sense of shared interest in problem solving can keep conflicts at a lower level.

Factors to be Considered In a cost effectiveness analysis of the selection of major design materials, a number of factors are involved. A listing of some of the principal factors will serve to indicate the complexity of the problem and the amount of effort required to arrive at economical and meaningful decisions. Each of the factors requires investigation, evaluation, and input from various sources.

Conformance to a standard specification, or availability of sufficient data to develop performance specifications Impact on design. "The cost effectiveness-Value Engineering approach to the selection of design materials is a proven tool for cost reduction"

It is important to notice that VM does not pursue any design changes which are not in line with the projects required basic functions. This is where the functional analysis is technique is used.

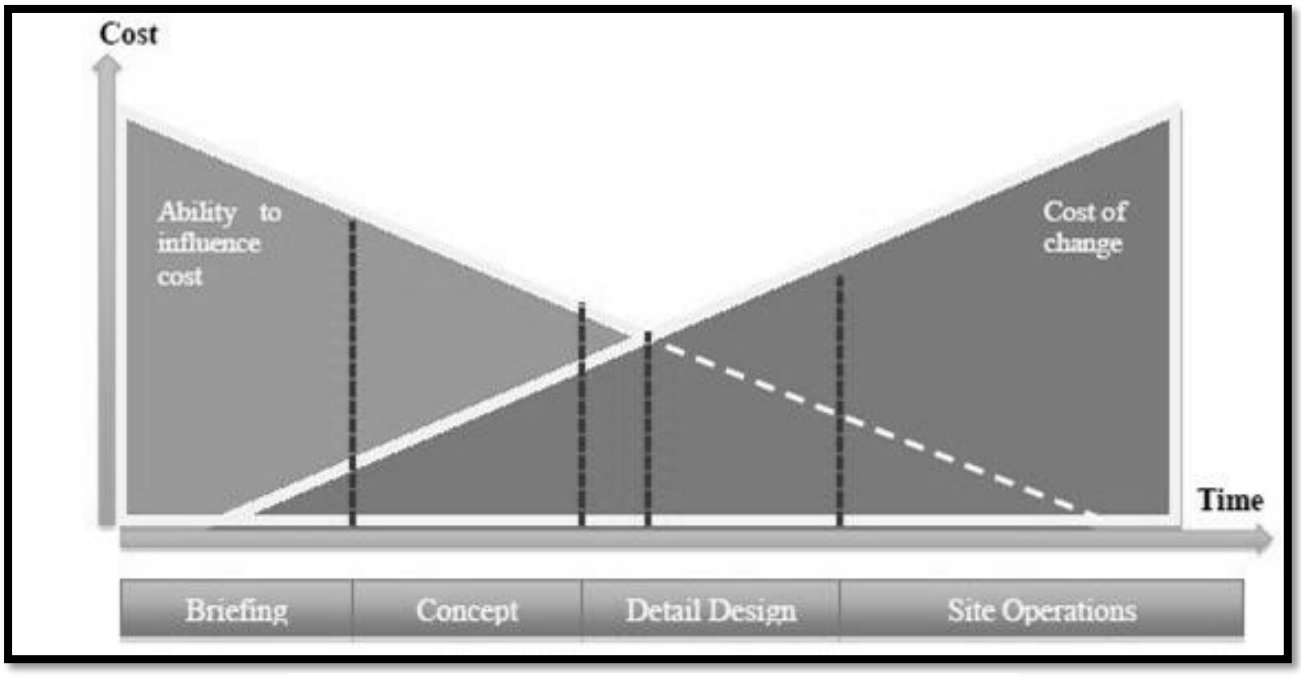

Figure 2-7 Potential to influence cost

source neasby barton & Knott 1999

However, not all value analysis will result with significant cost savings. Some value studies have determined that designs were under-funded with respect to the required performance, thus resulting in an increase to the design's cost.

2.13 Benefits of Value Management:

Benefits of a Value Management Study are:

- Concludes a better understanding of needs and the functions necessary to meet those needs.
- Defines a better definition of program or project objectives.
- Defines a better definition of quality and performance standards.
- Produces clearer briefs.
- Produces reduced wastage of resources.
- Provides capital funds savings.
- Develops improved operational efficiencies.
- Helps team building and strategies which Creates a climate of shared understanding.
- Reduces conflict and risks.
- Fosters joint ownership of problems and solutions.
- Create new ideas for improved outcomes.
- Enhance the skills of the participants.

- Saves on project development time and ultimate service delivery to the community.

To obtain maximum benefit from a value management approach, it is important to make somebody within the organization (usually the project manager or a representative from the project team) explicitly responsible. The value manager will need to establish a general understanding of the techniques and processes involved to allow management of the overall process. This will include scheduling workshops and reviews at appropriate points in the project process. The value manager will also be responsible for implementing any actions arising from the process.

2.14 Value Management investment return:

The results of project based Design Value Studies undertaken on budget sector projects in NSW have exceeded expectations based on international experience. Value Studies completed at the Concept Stage have exceeded those results by an even wider margin. When considering the return on investment, the earlier that Value Management is introduced in the procurement process, the greater the possible improvement in value.

This is illustrated in the return on investment diagram below for the procurement phases of concept, design and documentation.

The graph of "Cost impact of making changes over time" below illustrates the inverse relationship between the cost of making changes and the potential for making savings. It illustrates the importance of scheduling the Value Management Study at the earliest stage of the project lifecycle to optimize potential value improvements.

Norton et. al (1995:18) identified the following types of projects that will benefit the most from VM:

- Costly projects: VM can result in savings of up to 5-15% of the total costs involved on the project and therefore it is very cost effective to apply VM to higher cost projects
- Complex projects: With a VM study one has the opportunity to get expert second opinions, especially if there are members on the team that are independent from the original design tea m. On complex projects it is vital to get expert opinions. By using VM, attention can be given to complex issues
- Repetitive projects: When the same type of building/asset needs to be built in many different locations, the utilization of VM becomes very cost effective because cost reduction and ideas that add value to the project can be incorporated into all the buildings to be built later on
- Unique projects with new technology elements and few precedents the reason for using VM in the above type of projects is similar to complex projects. It relates to the obtaining of expert opinions

- Projects with very restricted budgets: For these projects it is imperative to get maximum value for the least amount of money. VM seeks to eliminate unnecessary costs
- Projects with compressed design programs: M should be properly coordinated with the construction program to minimize time spent on it. VM can come up with innovative ideas to relieve pressure on design programs and accelerate programs
- High visibility projects: These are projects sponsored by the government or environmentally sensitive projects. It is important that as little as possible goes wrong on these projects to avoid the media embarrassing the parties involved on the project.

VM is not restricted to the types of projects mentioned above, but can be applied to any project/building or asset. VM can be applied to parts of buildings or subdivisions of projects.

2.16 Integration of VM and Sustainable Construction (SC)

The linkage between VM and Sustainable Construction (SC) could be realized during the information phase, the creativity phase and the evaluation phase of the SAVE International Standard VM Job Plan

Information Implementation Follow
The VM-SC linkage will be explained, here, in the following sequence.
- A brief description of each phase of the VM Job Plan.
- Outlining the VM activities in each phase
- Summarizing the Sustainable Construction issues to be discussed.
- Define the VM-SC synergy by stating the proposed outcome of each phase.

The VM Methodology employs various tools and techniques that help us to plan for better Sustainable Construction (SC); such as Life Cycle Costing (LCC), function modeling, strategic problem solving, Pareto analysis, paired comparison, Quality Base Selection (QBS), evaluation criteria, quality function deployment, design for Six Sigma, target costing, “Lean” concepts, idea management and action planning.
This proposed integration between VM and SC may encourage others to explore this relatively untapped subject due to a lack of research and development of both concepts.

2.17.1 Previous studies:

Several researches, books and papers has been published about VM around the world , the raising number of studies ,books and conferences proves the importance and the big need for VM .

Many Sudanese researchers studied VM and VE and its practice in construction industry but no conferences, papers or magazines has been done to en courage architects and engineers to apply it in construction industry. The ascending number of the studies about VM is giving hope that VM will soon be practiced in construction industry in Sudan and hopefully in all industries and fields.
Here is a summary of some VM researches internationally and locally.

2.17.2 International Previous studies:

Value Management in Design Planning: a systems-based framework for multi-disciplinary team involvement: **by:** Mohamad Saifulnizam Suhaimi BSc. (Hons) Quantity Surveying, Msc. Project Management, Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Construction Project Management
Civil Engineering and Built Environment Science and Engineering Faculty Queensland University of Technology September 2014
The researcher had investigated the VM process and focused on how design issues can improve construction process on site and saves cost .this research had made several findings proved that VM should be used as a design planning for further development and used expandantly within sustainable construction .

2.17.3 Local previous studies:

2.17.3.1 POTENTIALITY FOR THE APPLICATION OF VALUE ENGINEERING IN CONSTRUCTION INDUSTRY IN SUDAN:

A thesis submitted for the admission to the degree of Ph.D. in Civil Engineering **,** By: ABDALLA MOHAMMED AWADALLA AHMED, (B.Sc. Civil Eng., M.Sc., Structural Eng., U.of K.), Supervised by:Dr. AHMED ELAMIN HAROUN , Dr. BAKRI ABDELRAHIM GAAFAR
The researcher studied the impact of design on construction projects and presented The Historical Development of Value Engineering , Application of Value Engineering Techniques. Value Engineering in U.S.A., The European Standard of Value Management, Value Engineering in U.K., Value Engineering in Australia and Value Engineering in Saudi Arabia The Value

2.17.3.2 Concept and Techniques of Value Engineering in Construction Industry in Sudan: , by:Ibrahim Habiballa Ibrahim Hamaza, Supervised by: DR. Awad Saad Hassan

The researcher represented value engineering and showed the concepts of value engineering and its application in the Sudanese construction field, the researcher used a questionnaire to collect information and analyzed it and found out that there is a good knowledge of value engineering but no practice , the researcher found that more than 88% of the participants thought that the most important time to make value study is feasibility and design stage .

The researcher found out that some engineers apply the concepts of VE depending on their individual experience and skills, also the researcher found that there is absence of VE studies in construction companies in Sudan although the respondents considered that is very necessary.

2.18 Integration of VM and the other construction management approaches:

2.18.1 Integration of VM and Cost management:

There is misconception that people commonly confuse Value management with cost management.

Kelly (1993:72) defines cost management as "a service that synthesizes traditional quantity surveying skills with structured cost reduction or substitution techniques using a multi-disciplinary team."

The confusion between VM and cost management techniques arises due to the incorrect application VM techniques turning them into cost cutting exercises, and the use of bad practices by some Value Managers (Alasheash 1994).

Cost management is an objective characterization of client requirements, which are expressed in monetary terms only and traditionally require the skills of a Quantity Surveyor. It is a procedure partly concerned with reducing cost by deleting parts of the project, by modifying the product or replacing specified items with cheaper alternatives. Though cost management and value management are two distinct activities, both are useful and can complement each other. While VM provides authoritative reviews at milestone points, cost management provides ongoing control of costs throughout the project.

2.18.2 Integration of VM and Risk Management:

Risk Management (RM) and Value Management (VM) are widely used in project management as best practice to facilitate successful project delivery.

Risk management is the process of identifying, analyzing and taking actions on risks throughout the life of the project to help ensure it achieves its objectives. Risk is concern uncertainty on the objectives of the project; a risk can either mark as a threat or an opportunity. Risk management should be proactive rather than reactive; risks should be managed at the earliest opportunity in the project life cycle.

Risk and value management are interrelated tasks that should be practiced in parallel and continued throughout the life of the project. Effective utilization of RM and VM methodologies aid project managers to reduce uncertainty and risk exposure while maximizing value and return on investment (Dallas2006), Australian Standard for Value encourages clients to have a RM component within VM studies.

2.18.3 Integration between value management and life cycle costing:

Life cycle costing is a technique for economic evaluation which considers the costs applicable to the total life of the asset. The costs that are taken into account are the following:

- Initial investment cost consisting of site costs, professional fees and capital cost
- Energy costs
- Operation and maintenance costs
- Replacement of components costs
- Occupancy costs
- Alterations costs
- Taxation costs
- Salvage revenue and disposal costs

Life cycle costing goes hand on hand with a VM study and it is important to look at what it is and how it is incorporated into VM. “Forecasting and assessing the total cost of an asset over its whole life should be an integral part of any decision if the integrated team is to deliver the best value solution” (Thomas et.al 2005:179) In VM the life cycle costing is used as an evaluative tool. It can assess competing design alternatives, consider costs of ownership over the economic life of each alternative etc. all expressed in present value.

It is very important to apply LCC techniques during the design as the design has a direct influence on operation and maintenance of a building. These costs are usually incurred over a long period of time and can collectively far outweigh the initial capital costs of the facility. Therefore, during a VM study the VM team must have detailed information about the economic life of the building/asset, operating costs, cost of the owners’ capital required, and return on investment figures etc to make informed and clever decisions, compare different cost alternatives and thus add value to a project.

2.18.4 Integration of VM and Quality Management:

A Quality Management System (QMS) is a management system that focuses on the quality policy and requirements of an organization.

Integrating VM into a quality management system, called "Value-Managed Quality System (VMQS)", that complies with the recent ISO 9001:2000 quality standard, it is possible for construction companies to achieve better effectiveness and efficiency, as well as fulfilling the continual improvements requirement of the said international standard. Such value achievements and improvements should allow for sustainable competitive advantages to be realized.

Recently, the Masters Builders Association Malaysia (MBAM) has even adopted a group quality scheme using VMQS to facilitate contractors and sub-contractors in Malaysia to achieve their ISO 9001:2000 certification, accordingly. This is in line with the association's aspiration to promote and encourage contractors, subcontractors and others to deliver quality works on their building and construction projects, both locally and overseas.

The International Organization for Standardization (ISO) introduced its 9000 standard for adoption by 3 organizations. The standard comprised of;

i. ISO 9000: 2000 Fundamentals and Vocabulary
ii. ISO 9001: 2000 Requirements of Standards
iii. ISO 9004: 2000 Guidance for Performance Improvement

The requirements of the standard, ISO 9001: 2000 promotes a process approach in the developing, implementing and improving a quality management system effectively in order to enhance customer satisfaction by meeting their requirements. It emphasizes on the importance of;

- Understanding and meeting requirements,
- Need to consider processes in terms of added value,
- Obtaining results of process performance and effectiveness, and
- Continual improvement of processes based on objective measurement.

It is essential for a QMS to be market-orientated so as to cater for the customers' current and future requirements or needs. To do so, the resources and activities need to be managed as a process, efficiently and effectively.

A Value-Managed Quality System (VMQS) is a way forward to towards achieving a more efficient and effective QMS that can also provide for continual improvements. It is defined as "A quality management system that complies with the current ISO standard by integrating value management into the quality system for continual improvements" (Ong & Loh, 2002). Essentially, VMQS guides you on WHAT and HOW to do it. Whilst most QMS is concern with "doing the things RIGHT" by through policies and procedures to meet the customer requirements efficiently, VM focuses on "doing the RIGHT things" by aiming to achieve value by ensuring effective policies and procedures and continual improvements meet or enhance customer satisfaction. With the combination of the two powerful and

effective methodologies, VMQS allows the notion of "Doing the RIGHT things RIGHT" to be realized.
In VMQS, VM can be introduced into QMS in three ways;
1. When embarking on a QMS
2. Reviewing an existing QMS
3. Continual improvement of any QMS
Several benefits can be identified with VMQS, namely:
a) Better quality system and performance;
b) Better focus on company's and client's objectives;
c) Foster and improve team working;
d) Achieve value for money;
e) Improved functionality and efficiency;
f) Reduction in time and costs;
g) Higher value and quality of services, design, etc.;
h) Increase public image (willingness to improve);
i) Encourage creativity and innovation;
j) Improves efficiency/effectiveness in utilizing resources;
k) Improves risks management;
l) Increasing/sustaining competitive advantage;
m) Ensures continual improvements.

In essence, the VMQS fosters "Doing the Right Things Right" concept and ensures that the quality management system developed for any construction companies can deliver more effective and efficient organizational and work processes continuously to achieve better quality work and products, consistently. It changes the traditional mindset and construction approach into dynamic companies capable of delivering quality construction and performance excellence at international quality standard.

It is the latest innovative quality management approach aimed at changing the traditional organizational mindset and construction approach into dynamic companies capable of delivering quality construction and performance excellence at international quality standard. Such value achievements and improvements should allow sustainable competitive advantages to be realized.

VM can be applied in quality management system to make it more efficient and effective.

2.19 Summary:

Throughout the literature reviewed in this chapter it is observed that value management is not only a flexible structured comprehensive management system; but it is also a very good design tool improves the design by making innovative choices and creative decisions to achieve the project objectives with the lowest cost and the highest quality in the scheduled time.

It is anticipated that the successful implementation of a VM program will result in additional benefits beyond design and cost savings; for example, constant

updating of standards and policies, accelerated incorporation of new materials and construction techniques; employee enthusiasm from participation in agency decisions; increased skills obtained from team participation.

VM methodology and tools could be considered as an integral part of sustainability analyses. Furthermore, VM integrates with the other managerial schools as mentioned in this chapter such as Quality Management (QM), Risk Management (RM) , Cost Management (CM) etc. in the same time VM is a tool for the designer too.

CHAPTER THREE

DATA COMPILATION

3.1 Introduction:

Questionnaire is a very accurate data collecting tool because it surveys large numbers of contributors and represents their opinion about the certain topic. this questionnaire is aim to collecting data in regard to scientific research which related to the subject matter of study , so to direct the research on the appropriate way according to the given result.

3.2 Design of Questionnaire sectors:

The questionnaire for this study was divided into 2 sectors:

Sector 1 : asks questions about the awareness about Value Management.

Sector 2 : asks questions about the practice of Value Management.

3.3 The research population:

In this study the population of the study consists of architects and engineers in several job positions with various ranges of experience to gain point of views on the topic of the research.

3.4 Questionnaire Distribution:

The questionnaire has been distributed randomly among architects and engineers in Khartoum state. 100 copies of the questionnaire have been distributed and the return percentage was 68% so the 68 copies were collected and analyzed.

3.5 Data Analysis:

The researcher analyzed the questionnaire results using SPSS

All the tables and diagrams of the data analysis is prepared by the researcher by using SPSS.

3.3.1.1 Nature of job (manager, contractor, subcontractor, consultant, designer):

- 22 % of the sample were managers, 3% were contractors , 37% were consultants ,

35% were designers and 3% were subcontractors.

Nature of your job					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manager	15	22.1	22.1	22.1
	Contractor	2	2.9	2.9	25.0
	Consultant	25	36.8	36.8	61.8
	Designer	24	35.3	35.3	97.1
	Subcontractor	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

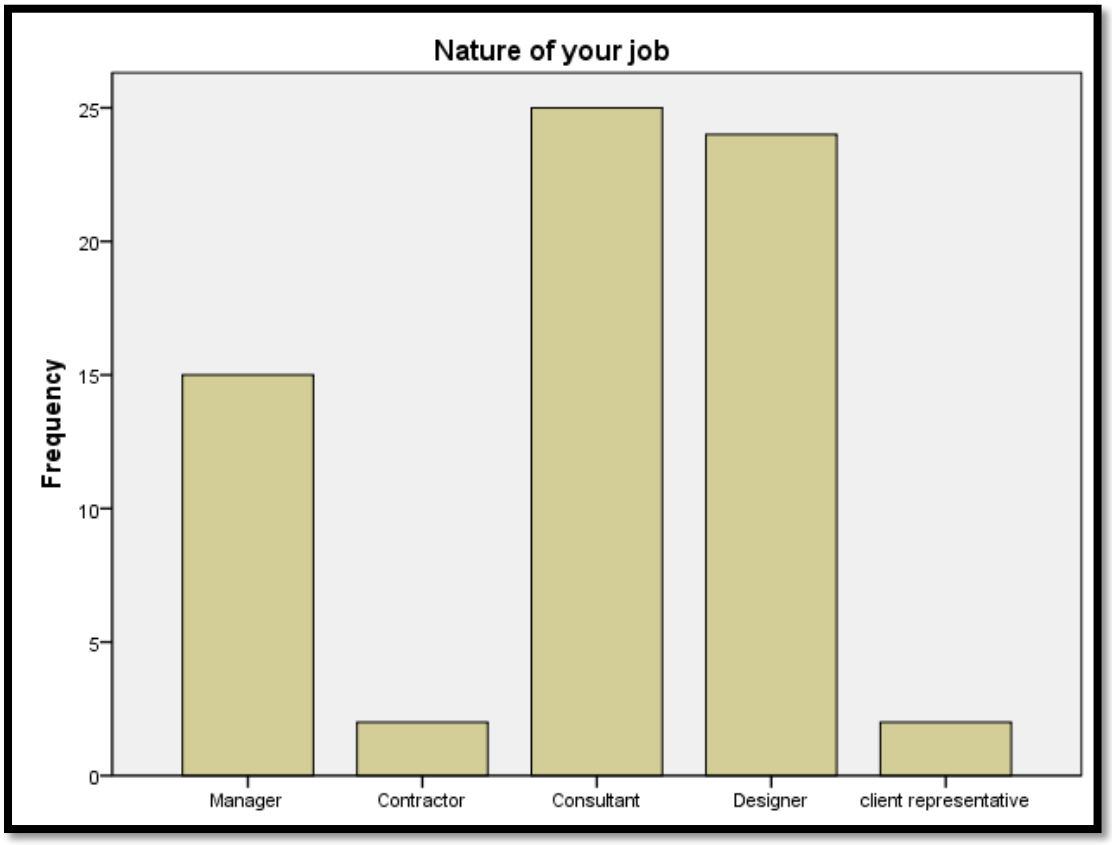

Figure (3.1)
Source: Prepared by the researcher according to the questionnaire

3.3.1.2 location of work (ministry, governmental organization, consultant company, construction company, academic field)…

13.4 % of the sample worked in the ministry of planning,7.5% worked in governmental organizations , 64.2% worked in consultant companies , 10.4 % worked in contractors companies and 4.5% worked in the academic field.

Where do you work					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ministry	9	13.2	13.4	13.4
	Governmental Organization	5	7.4	7.5	20.9
	Consultant company	43	63.2	64.2	85.1
	Construction company	7	10.3	10.4	95.5
	Academic field	4	5.9	4.5	100.0
	Total	68	100.0	100.0	
Missing	System	0	0		
Total		68	100.0		

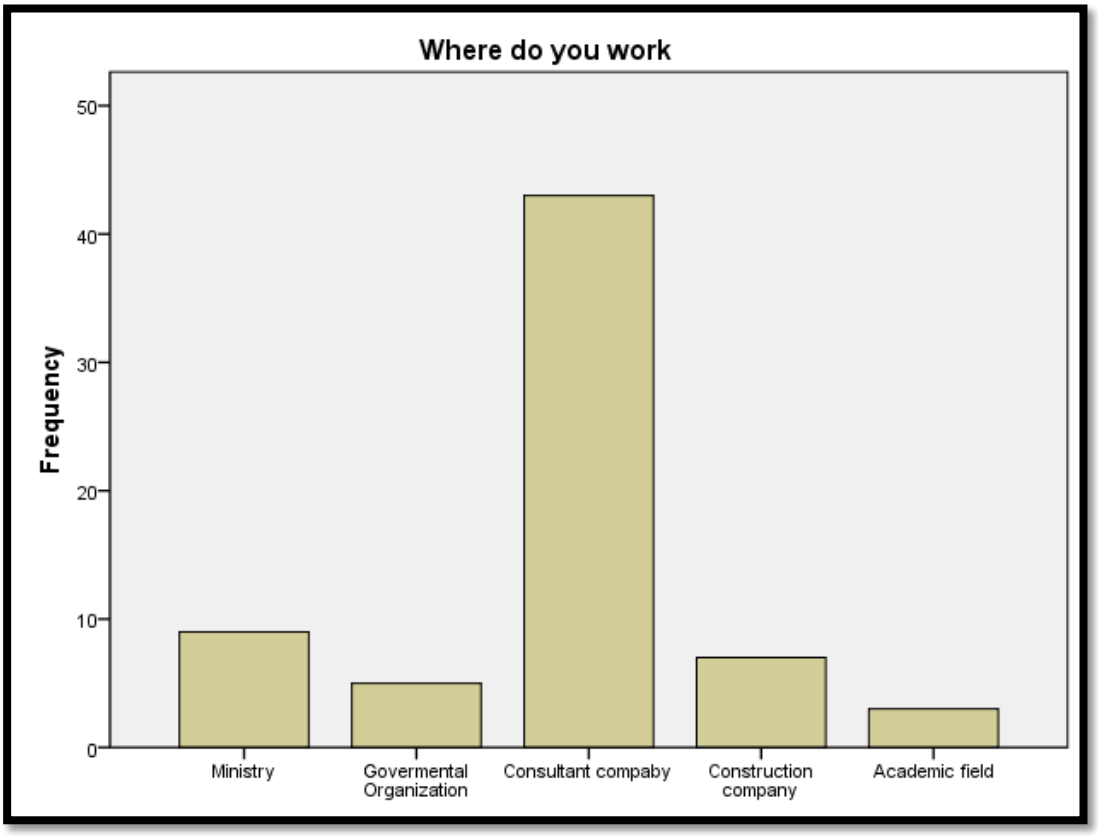

Figure (3.2)
Source :Prepared by the researcher according to the questionnaire

3.3.1. 3 How many VM training courses did you participate in:

- 75.8 % of the sample were involved in VM workshop,9.1% participated in 1 workshop 10.6% participated in 2 workshops , 3 % participated in 3 workshops and 1.5% participated in 4 workshops.

How many VM workshops did you practice in					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	50	73.5	75.8	75.8
	1	6	8.8	9.1	84.8
	2	7	10.3	10.6	95.5
	3	2	2.9	3.0	98.5
	4	1	1.5	1.5	100.0
	Total	66	97.1	100.0	
Missing	System	2	2.9		
Total		68	100.0		

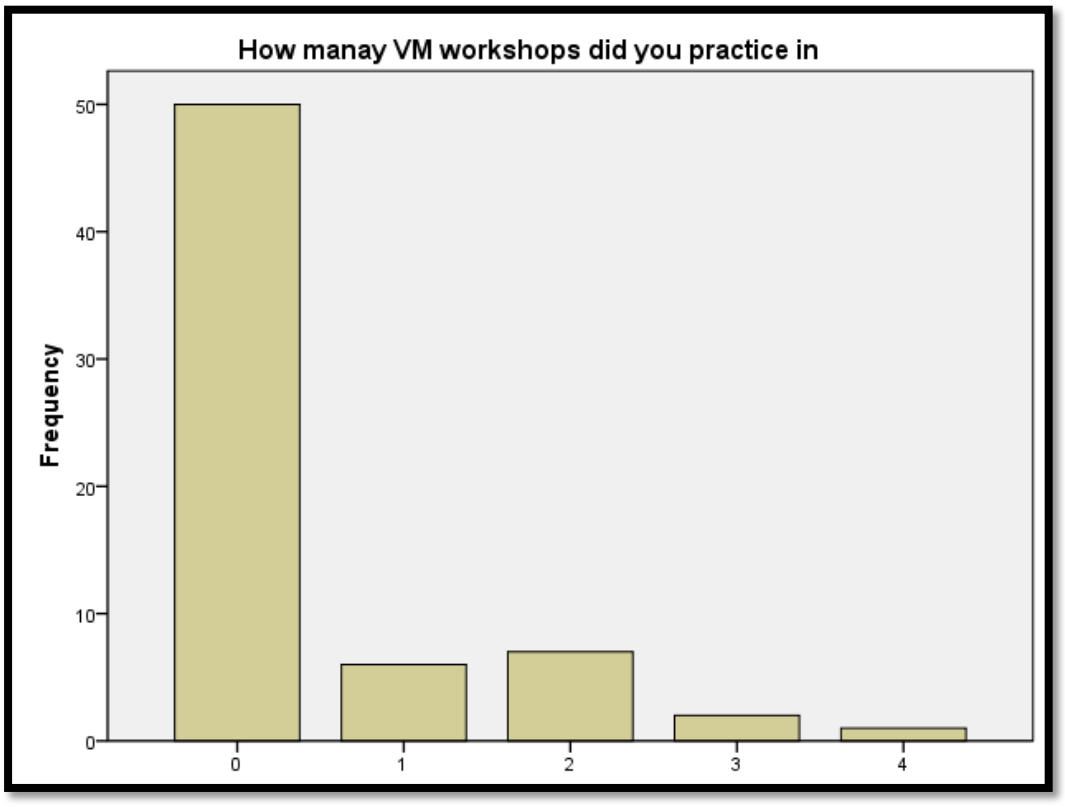

Figure (3.3)
Source: Prepared by the researcher according to the questionnaire

3.3.1.4 VM means Total Quality Systems Management

7o.6 % of the sample agreed ,13.2% disagreed and 16.2 were neutral. The researcher noticed that there is misconception among the responers between VM and TQS .

VM mean tool quality systems management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	14	20.6	20.6	20.6
	Agree	34	50.0	50.0	70.6
	Neutral	11	16.2	16.2	86.8
	Disagree	9	13.2	13.2	100.0
	Total	68	100.0	100.0	

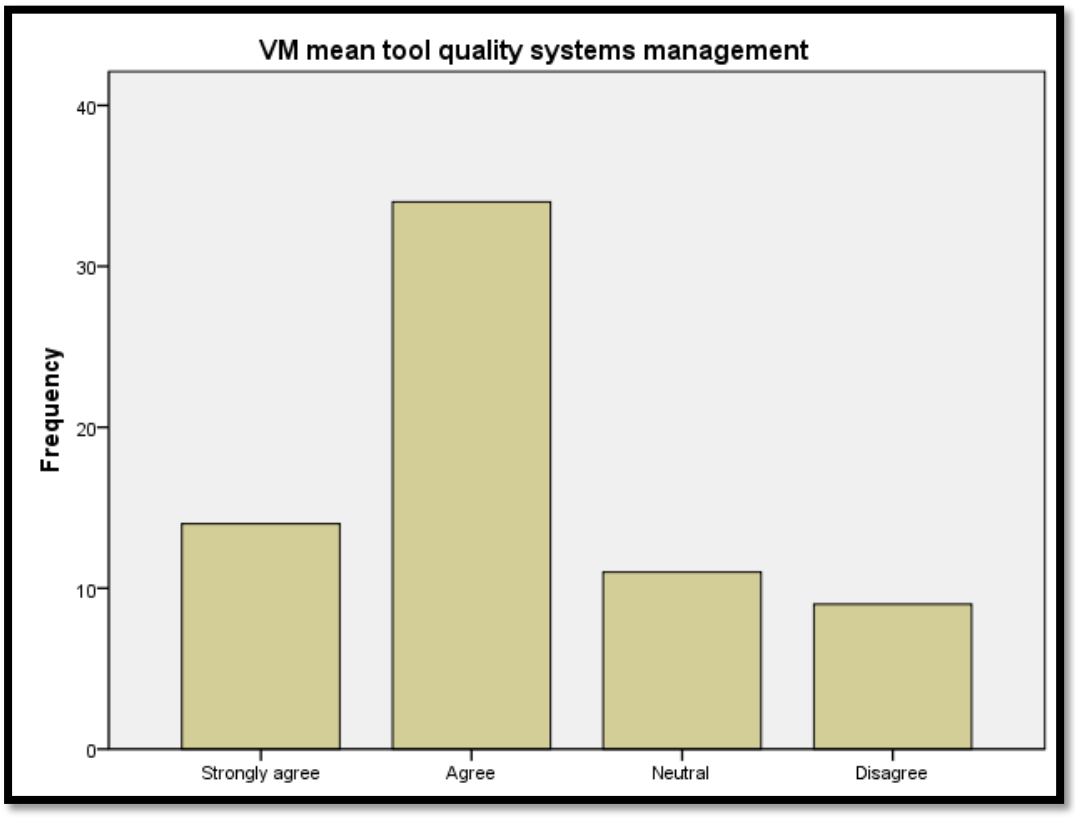

Figure (3.4)
Source: Prepared by the researcher according to the questionnaire

3.3.1.5 VM means Cost Management:

56.7 % of the sample agreed, 20.9% disagreed and 22.4 were neutral.

The researcher noticed that there is misconception among the responders between VM and CM; although there is integration between VM and CM but they are two different managerial schools. .

VM means cost management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	13	19.1	19.4	19.4
	Agree	25	36.8	37.3	56.7
	Neutral	15	22.1	22.4	79.1
	Disagree	14	20.6	20.9	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

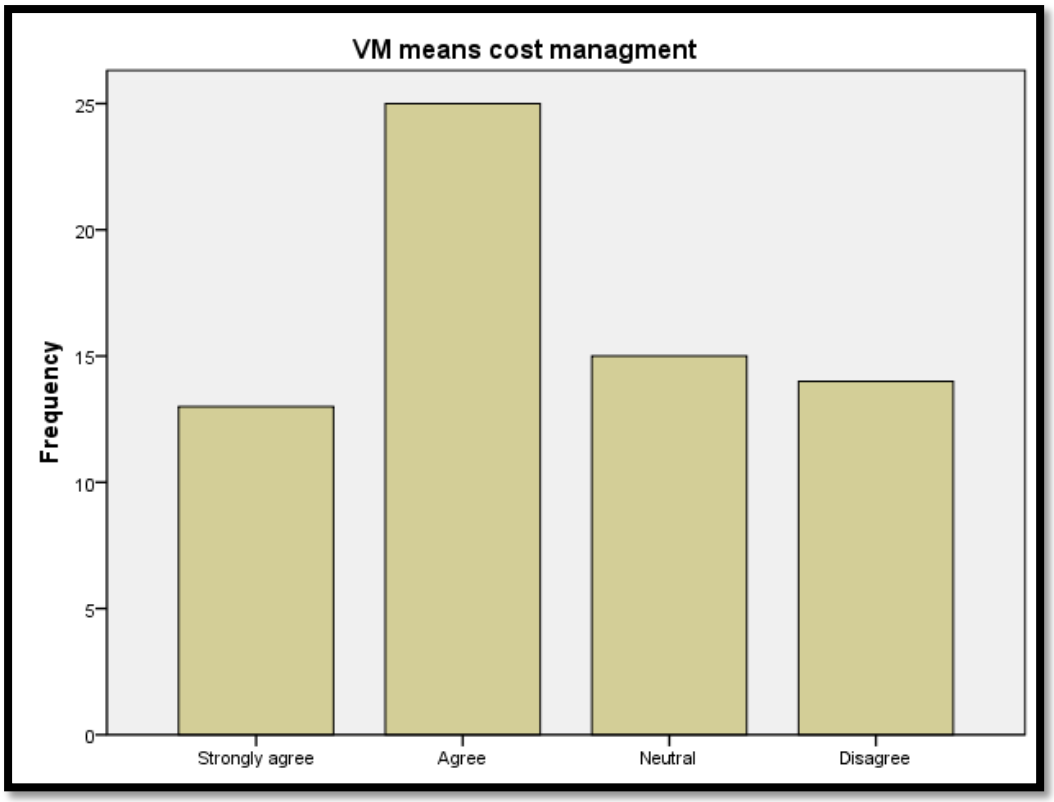

Figure (3.5)

Source: Prepared by the researcher according to the questionnaire

3.3.1.6There is misconception between VM and Cost Management

- 73.1 % of the sample agreed ,13.4% disagreed and 13.4 were neutral.

There is misconception between VM and Cost Management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	15	22.1	22.4	22.4
	Agree	34	50.0	50.7	73.1
	Neutral	9	13.2	13.4	86.6
	Disagree	8	11.8	11.9	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

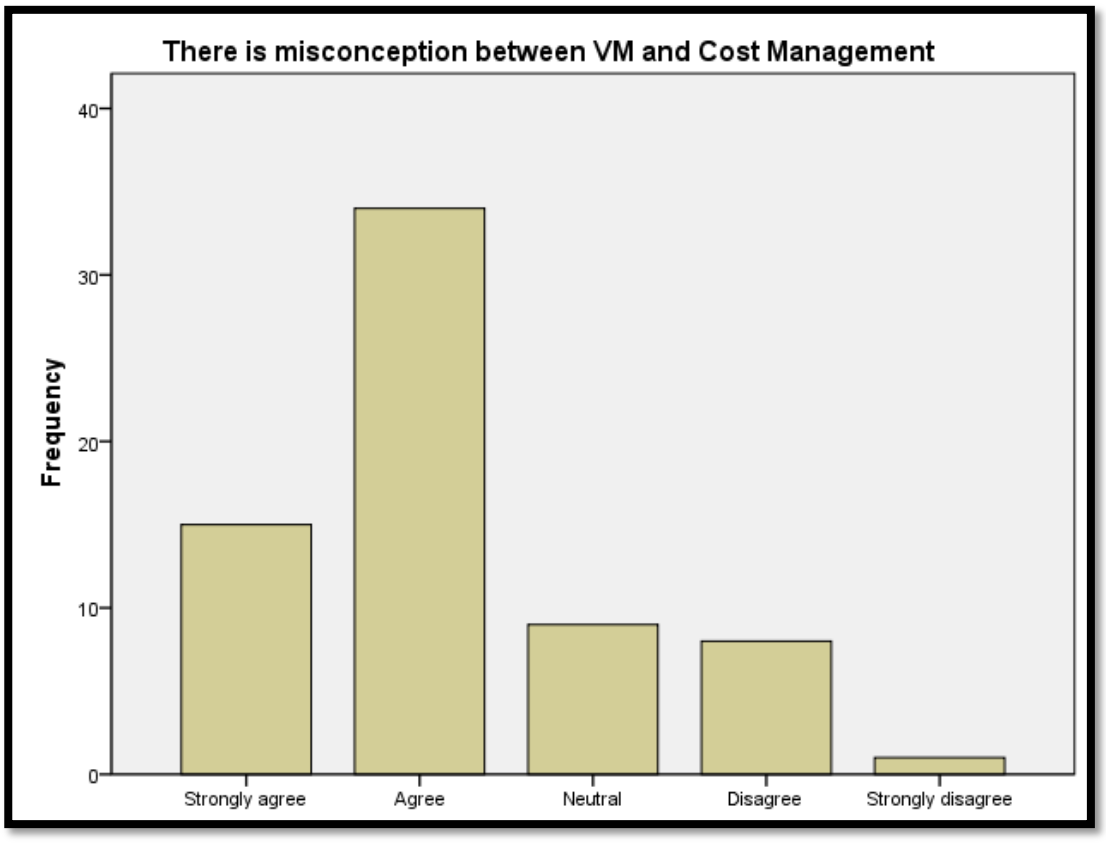

Figure (3.6)
Source: Prepared by the researcher according to the questionnaire

3.3.1.7 VM is a logical ,systematical decision making tool :

- 84.8 % of the sample agreed, 3% disagreed and 12.1 were neutral.

VM is a logical systematical decision making tool					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	16	23.5	24.2	24.2
	Agree	40	58.8	60.6	84.8
	Neutral	8	11.8	12.1	97.0
	Disagree	2	2.9	3.0	100.0
	Total	66	97.1	100.0	
Missing	System	2	2.9		
Total		68	100.0		

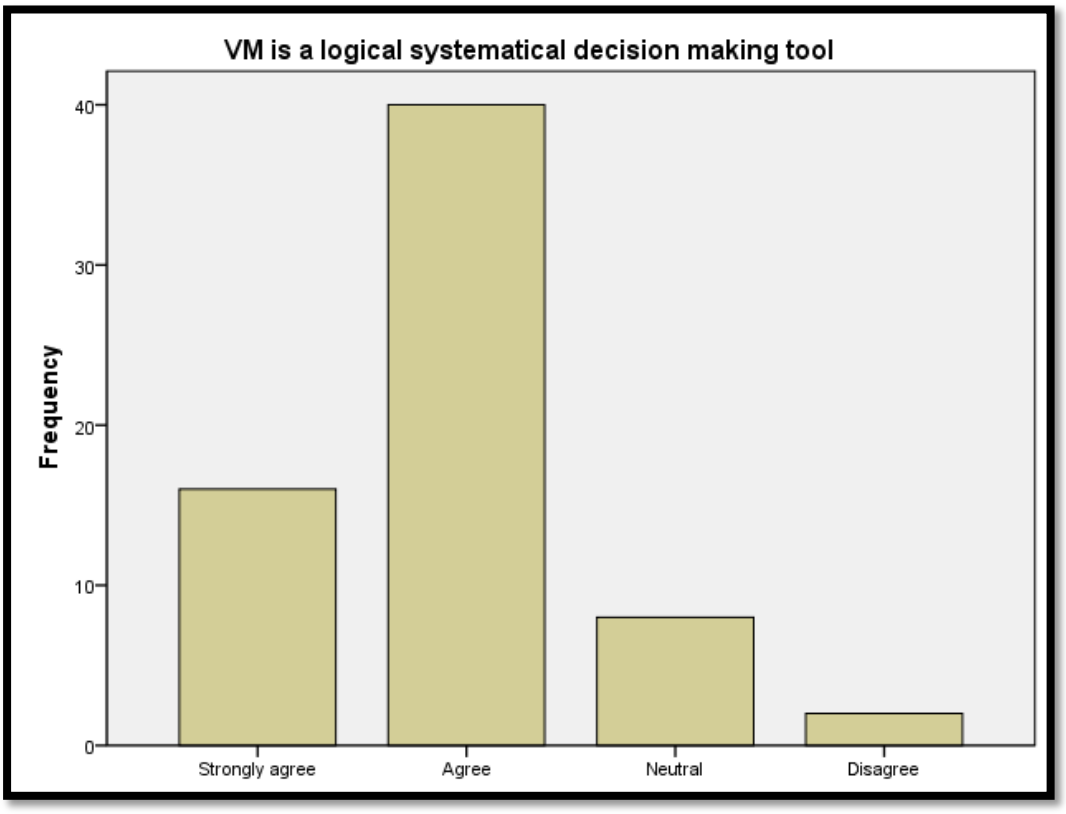

Figure (3.7)
Source: Prepared by the researcher according to the questionnaire

3.3.1.8 VM is primarily concerned with substituting materials selection that maximizes the functional development and minimizes cost :

- 75.3 % of the sample agreed, 4.4% disagreed and 22.1 were neutral.

VM is primarily concerned with substituting materials selection that maximizes the functional development and minimizes cost					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	19	27.9	27.9	27.9
	Agree	31	45.6	45.6	73.5
	Neutral	15	22.1	22.1	95.6
	Disagree	3	4.4	4.4	100.0
	Total	68	100.0	100.0	

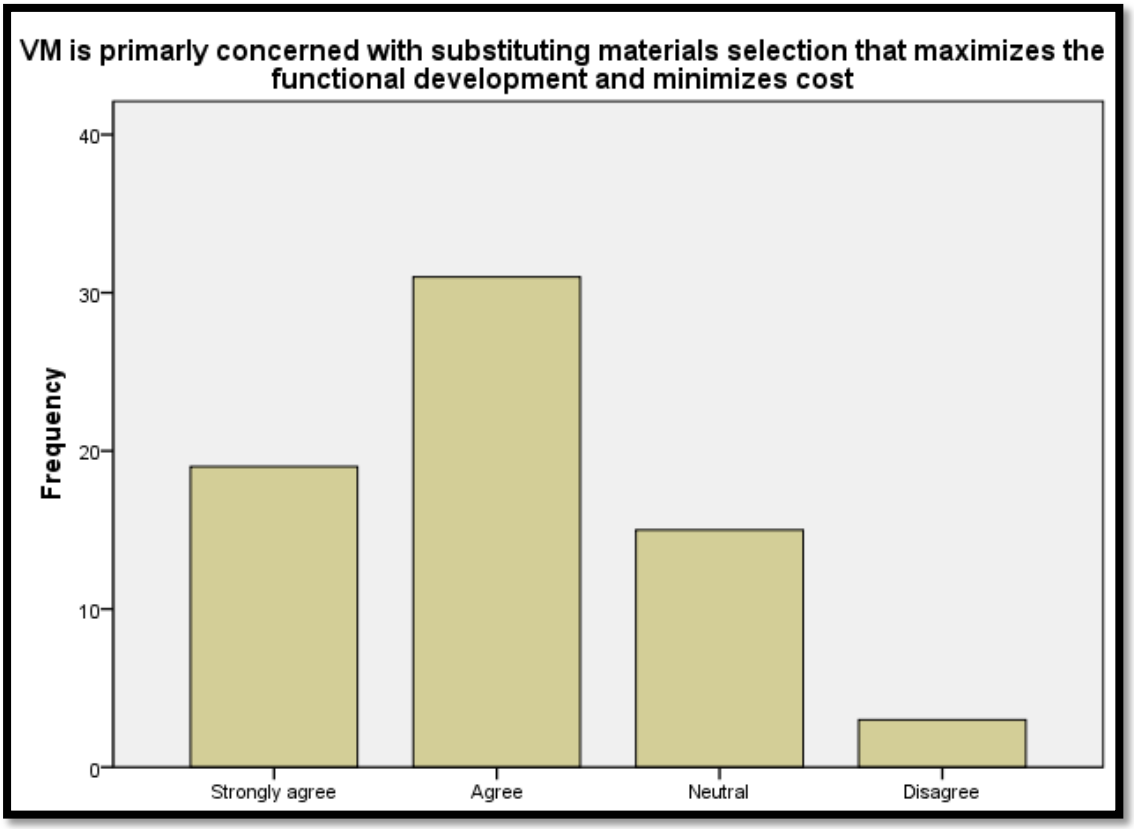

Figure (3.8)
Source: Prepared by the researcher according to the questionnaire

3.3.1,9 Implementing of VM will increase life cycle and enhance quality of the project:

- 89.7 % of the sample agreed ,0% disagreed and 13.3 were neutral.

Implementing of VM will increase life cycle and enhance quality					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	31	45.6	45.6	45.6
	Agree	30	44.1	44.1	89.7
	Neutral	7	10.3	10.3	100.0
	Total	68	100.0	100.0	

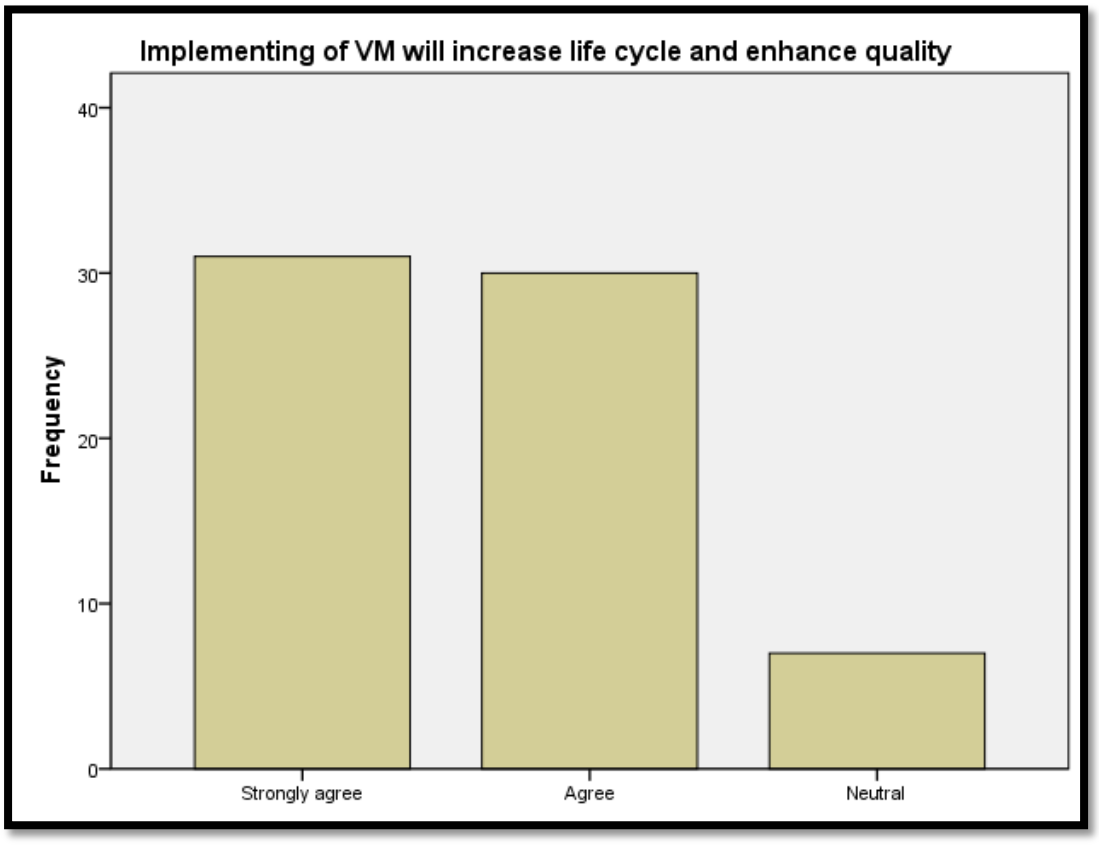

Figure (3.9)
Source: Prepared by the researcher according to the questionnaire

3.3.1.10 Implementing VM will reduce cost and ensure function:

- 71.6 % of the sample agreed ,6% disagreed and 20.9 were neutral.

Implementing VM will reduce cut and ensure function					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	15	22.1	22.4	22.4
	Agree	33	48.5	49.3	71.6
	Neutral	14	20.6	20.9	92.5
	Disagree	4	5.9	6.0	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

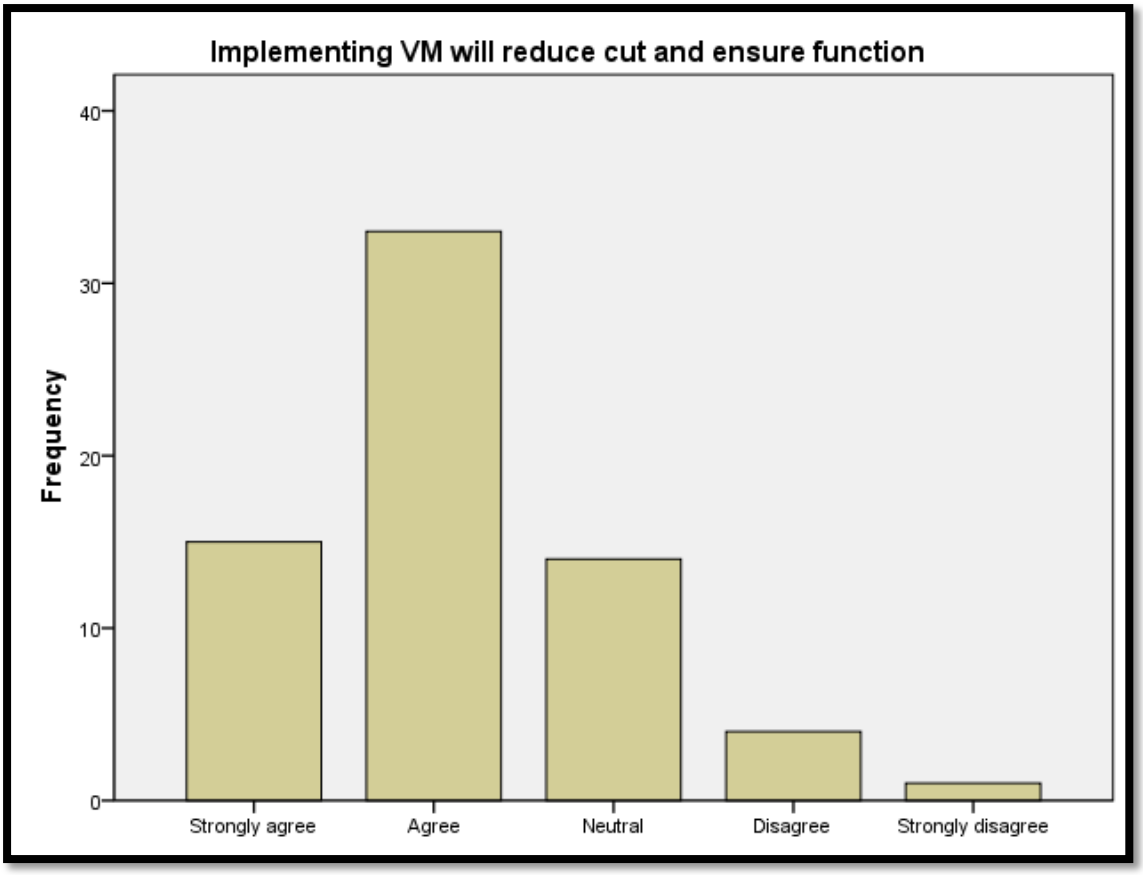

Figure (3.10)
Source: Prepared by the researcher according to the questionnaire

3.3.1,11 Implementing VM improves performance of the construction projects :

- 83.8 % of the sample agreed ,2.9% disagreed and 13.2 were neutral.

Implementing VM improves performance of the construction projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	31	45.6	45.6	45.6
	Agree	26	38.2	38.2	83.8
	Neutral	9	13.2	13.2	97.1
	Disagree	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

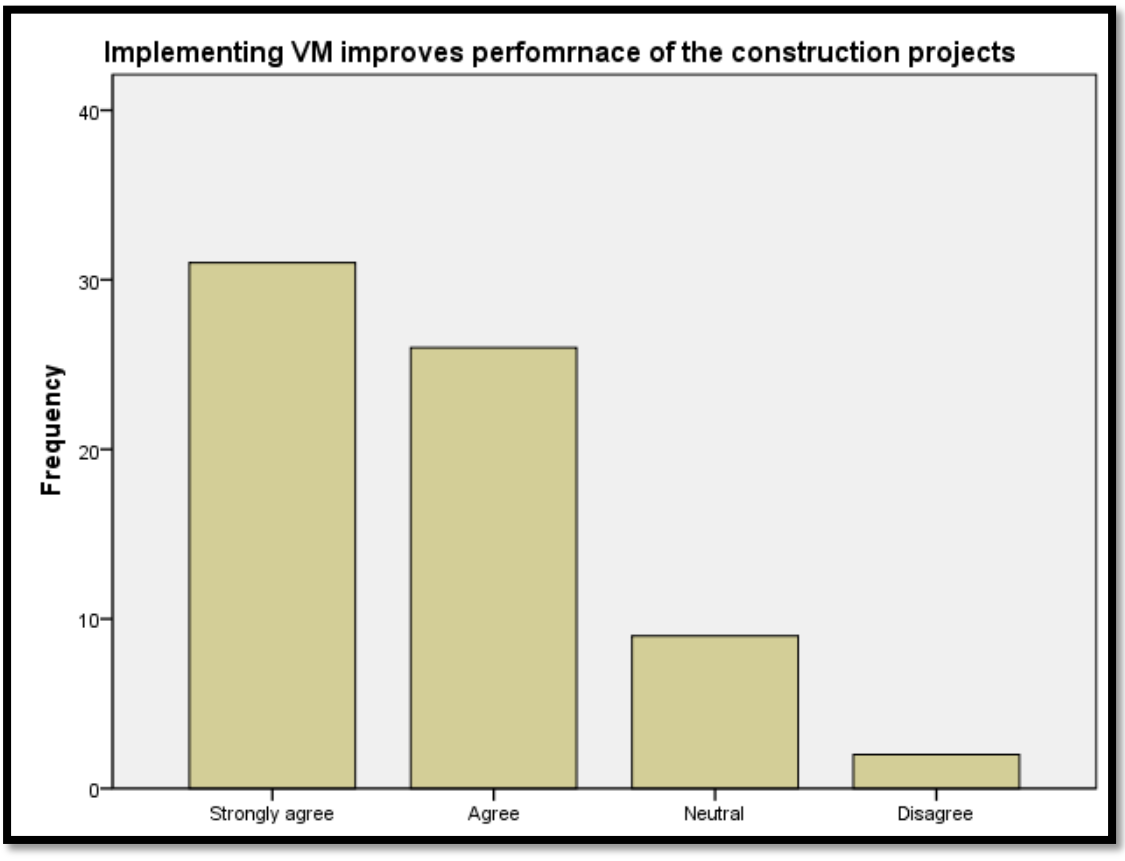

Figure (3.11)
Source: Prepared by the researcher according to the questionnaire

3.3.1.12 VM will improve projects planning and designing :

- 8o.6 % of the sample agreed 4.5% disagreed and 13.4were neutral.

VM will improve projects planning and designing					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	24	35.3	35.8	35.8
	Agree	30	44.1	44.8	80.6
	Neutral	9	13.2	13.4	94.0
	Disagree	3	4.4	4.5	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

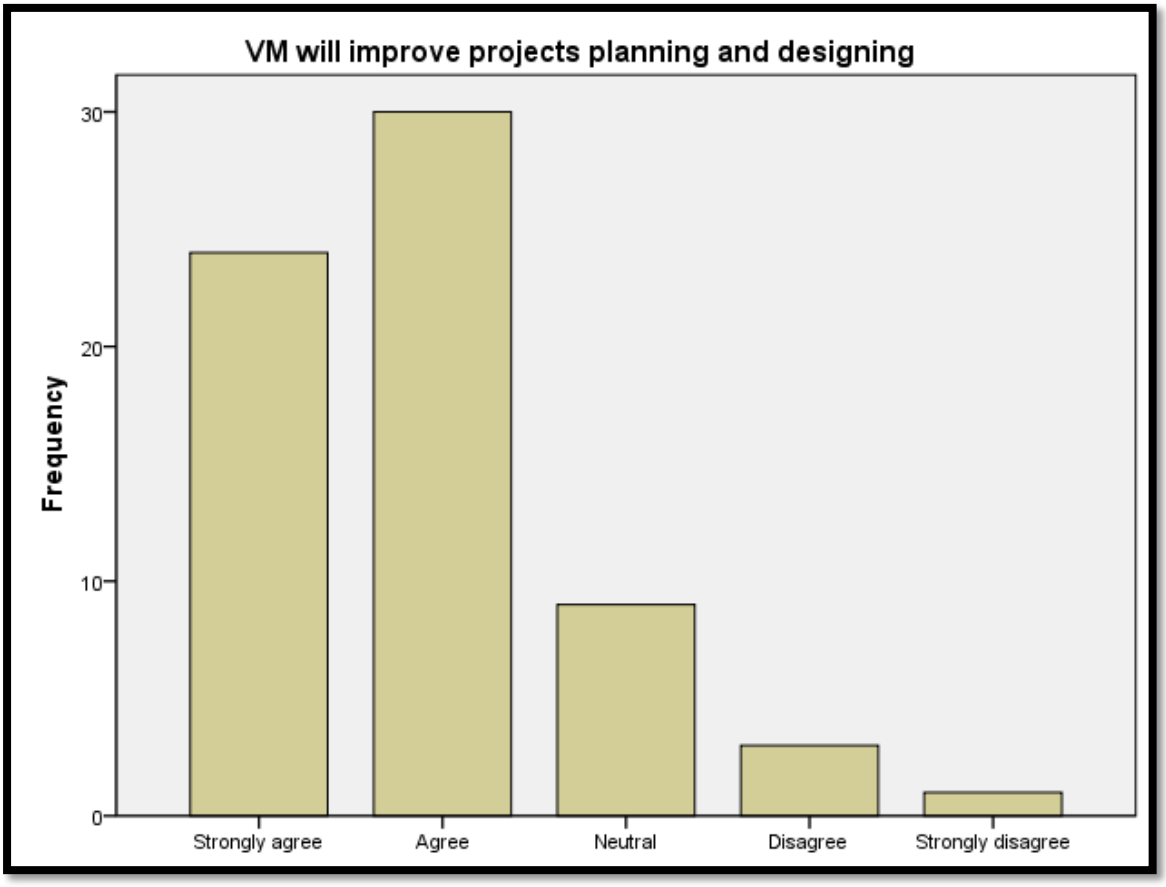

Figure (3.12)
Source: Prepared by the researcher according to the questionnaire

3.3.1,13 VM sets a clear road map for the project :

74.2 % of the sample agreed, 4.5% disagreed and 21.2 were neutral.

VM sets a clear road map for the project					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	22	32.4	33.3	33.3
	Agree	27	39.7	40.9	74.2
	Neutral	14	20.6	21.2	95.5
	Disagree	3	4.4	4.5	100.0
	Total	66	97.1	100.0	
Missing	System	2	2.9		
Total		68	100.0		

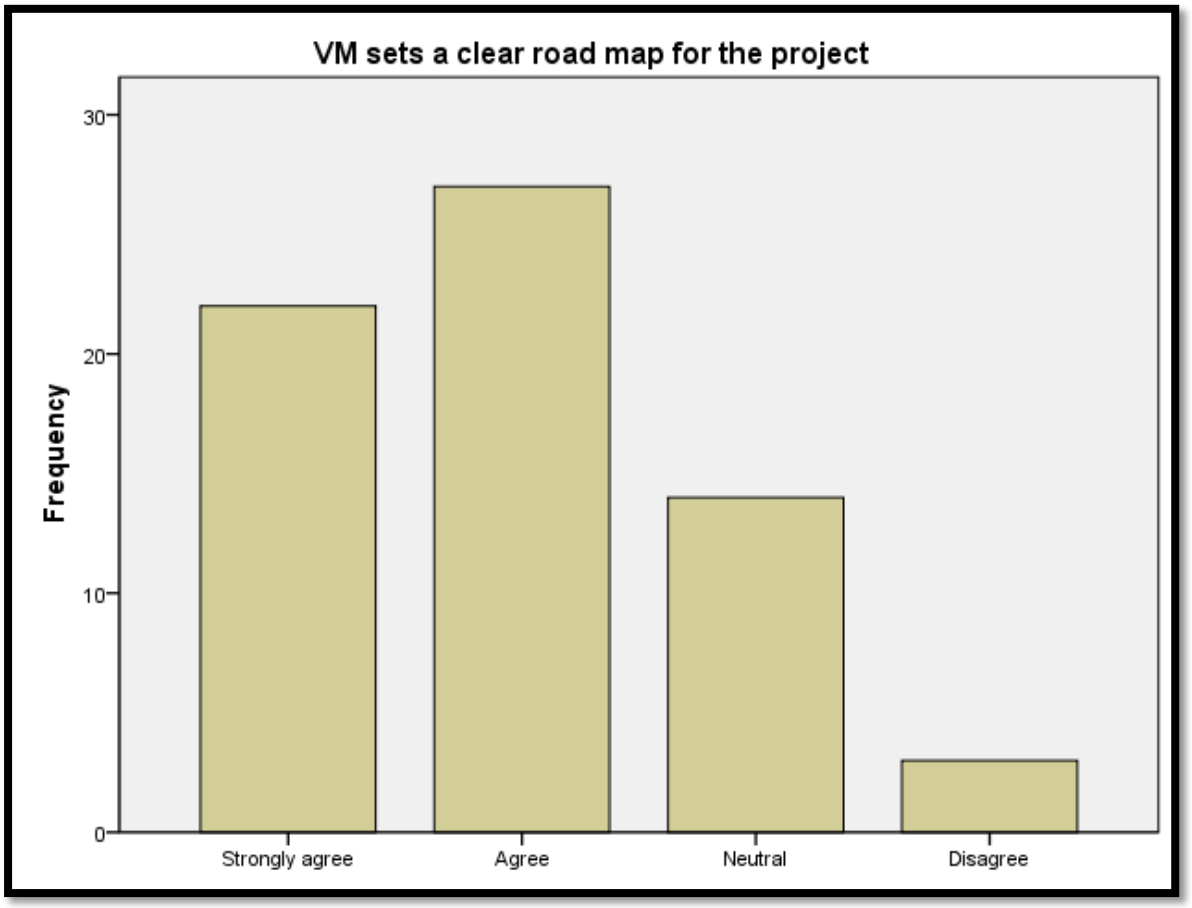

Figure (3.13)
Source: Prepared by the researcher according to the questionnaire

3.3.2.1 There is increasing need for VM :

94.1 % of the sample agreed, 1.5% disagreed and 2.9 were neutral.

There is increasing need for VM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	39	57.4	57.4	57.4
	Agree	25	36.8	36.8	94.1
	Neutral	2	2.9	2.9	97.1
	Disagree	1	1.5	1.5	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	68	100.0	100.0	

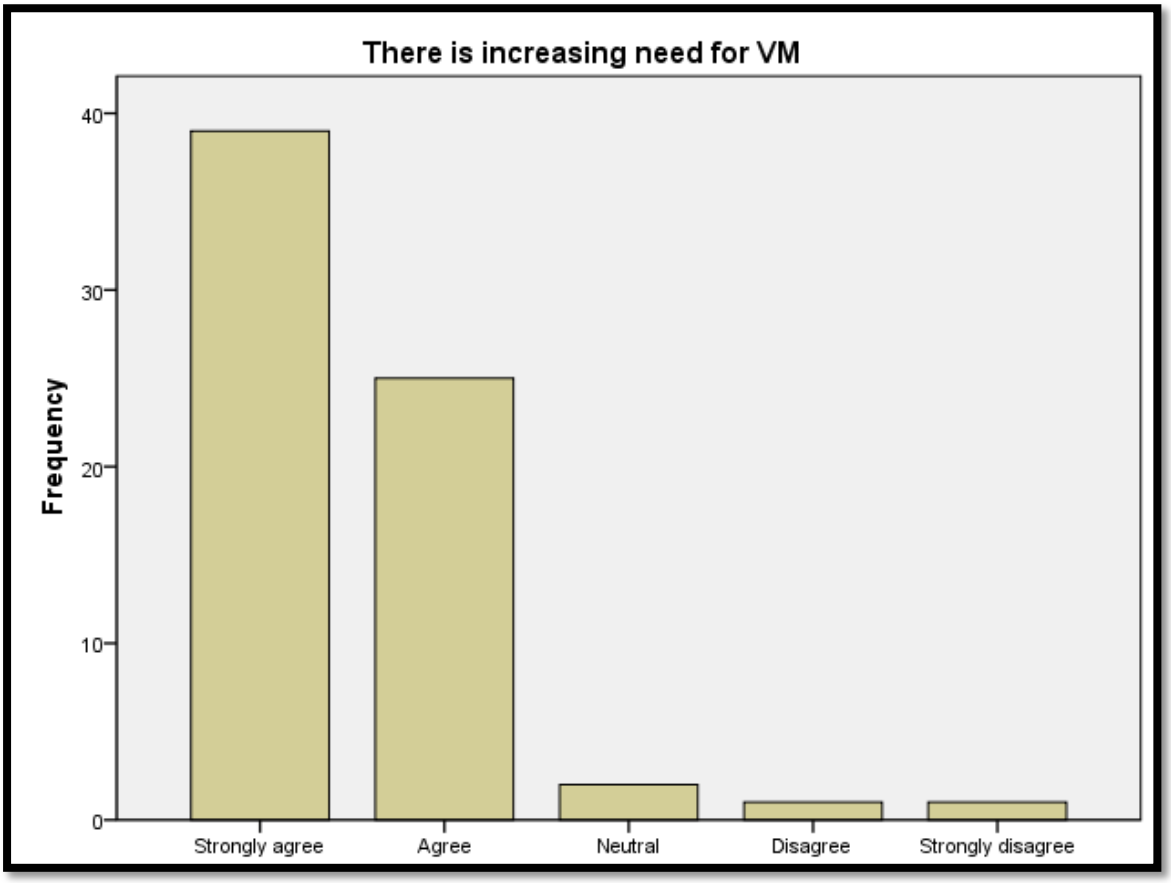

Figure (3.14)
Source: Prepared by the researcher according to the questionnaire

3.3.2.2 Customer`s satisfaction is assured when applying VM :

- 77.9 % of the sample agreed ,2.9% disagreed and 19.1 were neutral.

Customer satisfaction is assured when applying VM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	23	33.8	33.8	33.8
	Agree	30	44.1	44.1	77.9
	Neutral	13	19.1	19.1	97.1
	Disagree	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

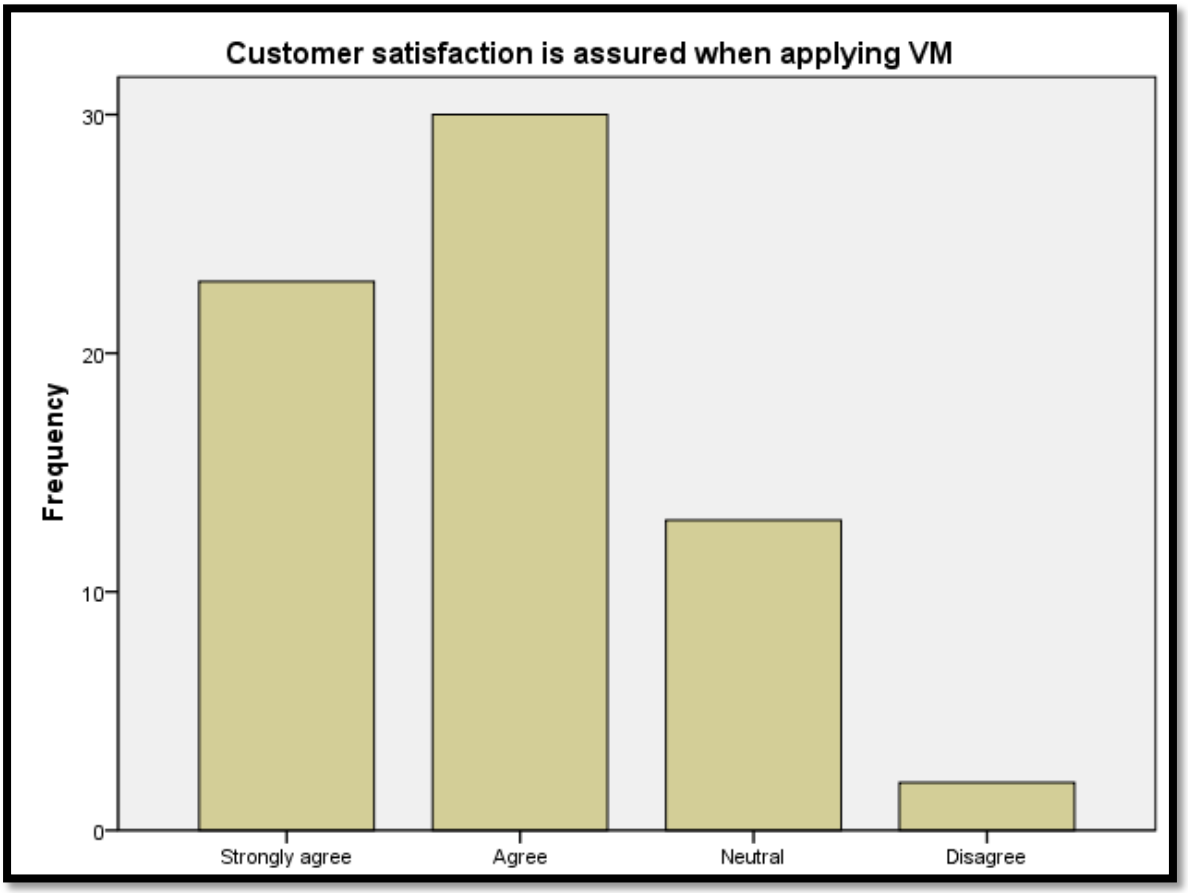

Figure (3.15)
Source: Prepared by the researcher according to the questionnaire

3.3.2.3 Implementation of VM will attract more customers:

- 68.2 % of the sample agreed ,4.5% disagreed and 27.9%were neutral.

Implementing of VM will attract more customers					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	20	29.4	30.3	30.3
	Agree	25	36.8	37.9	68.2
	Neutral	18	26.5	27.3	95.5
	Disagree	3	4.4	4.5	100.0
	Total	66	97.1	100.0	
Missing	System	2	2.9		
Total		68	100.0		

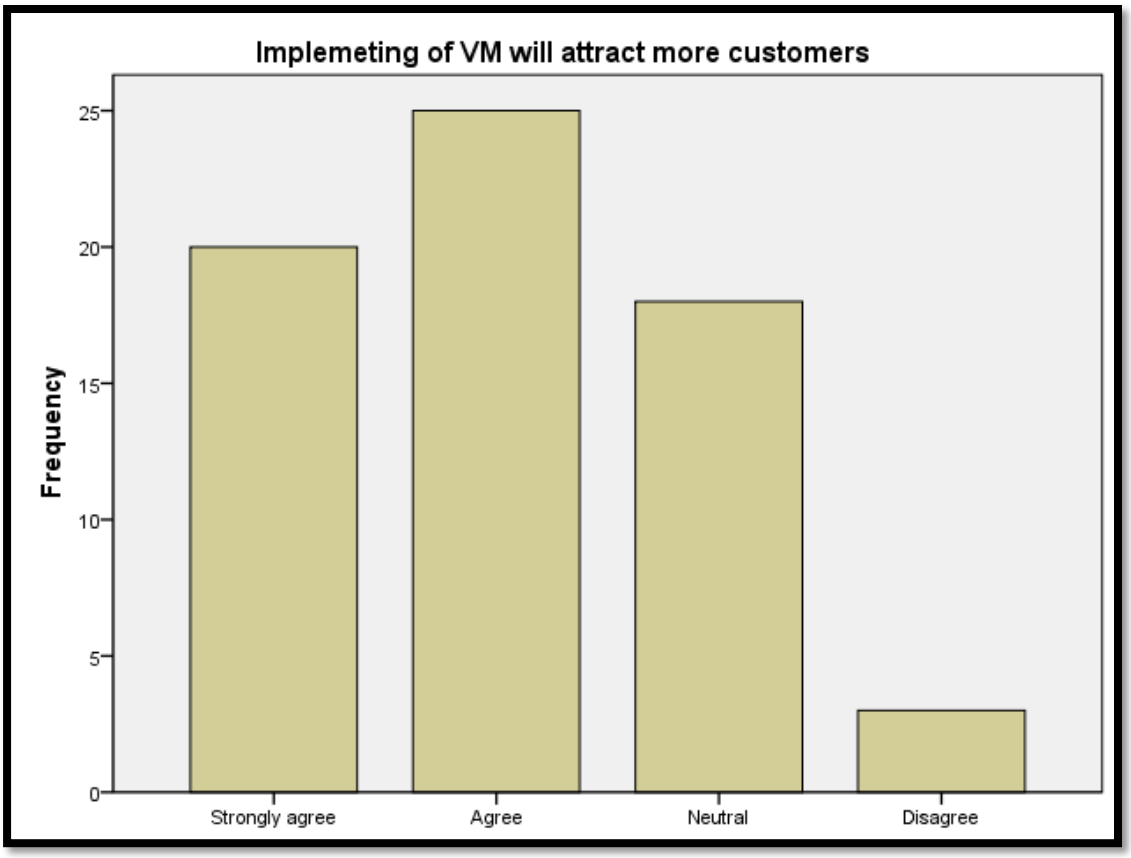

Figure (3.16)
Source: Prepared by the researcher according to the questionnaire

3.3.2.4 Customers contribution to VM workshops helps to make the right choices that meet their requirements :

- 85.1 % of the sample agreed ,9.0% disagreed and 6% were neutral.

Customers contribution to VM workshops helps to make right choices that meet their requirements					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	25	36.8	37.3	37.3
	Agree	32	47.1	47.8	85.1
	Neutral	6	8.8	9.0	94.0
	Disagree	4	5.9	6.0	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

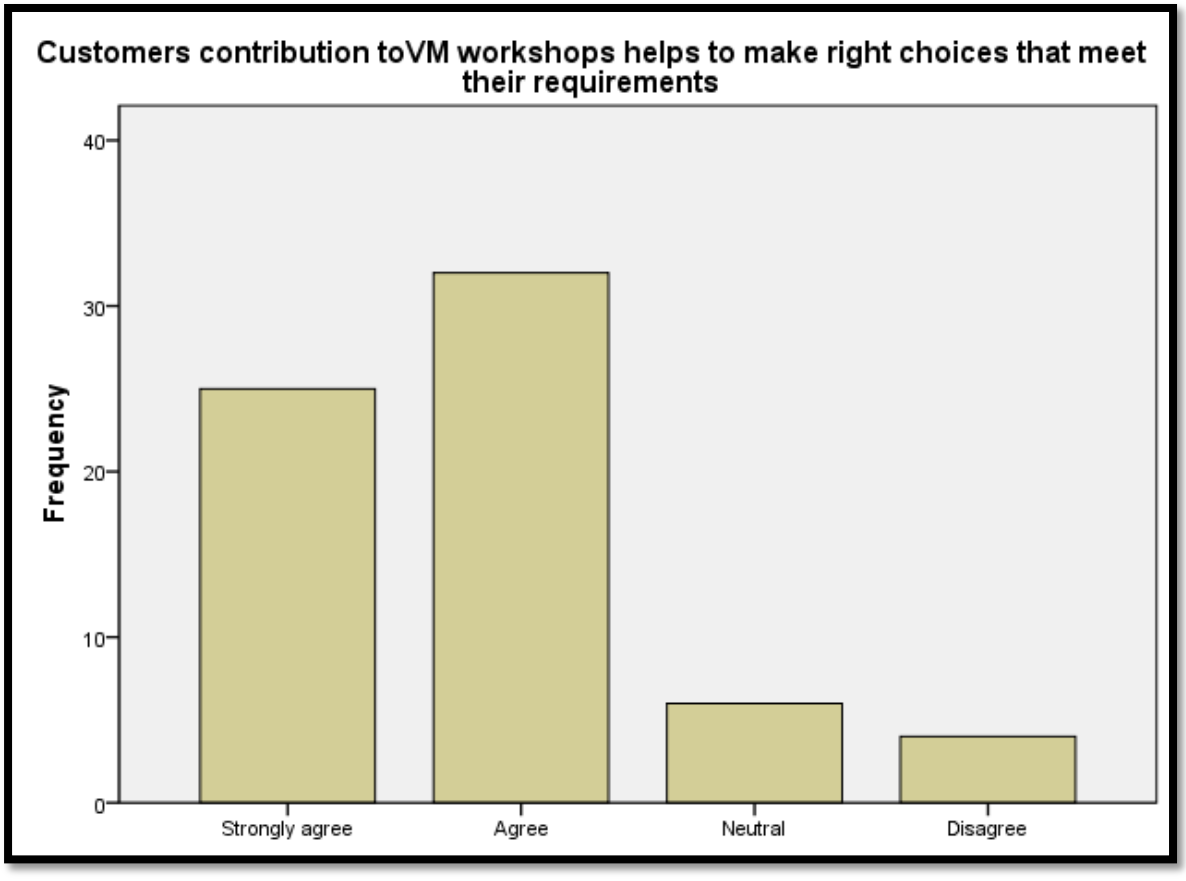

Figure (3.17)
Source: Prepared by the researcher according to the questionnaire

3.3.2.5 VM workshops enhance communications between project team members

- 73.1 % of the sample agreed ,7.5% disagreed and 19.1 % were neutral.

VM workshops enhance communications between project team members					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	24	35.3	35.8	35.8
	Agree	25	36.8	37.3	73.1
	Neutral	13	19.1	19.4	92.5
	Disagree	5	7.4	7.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

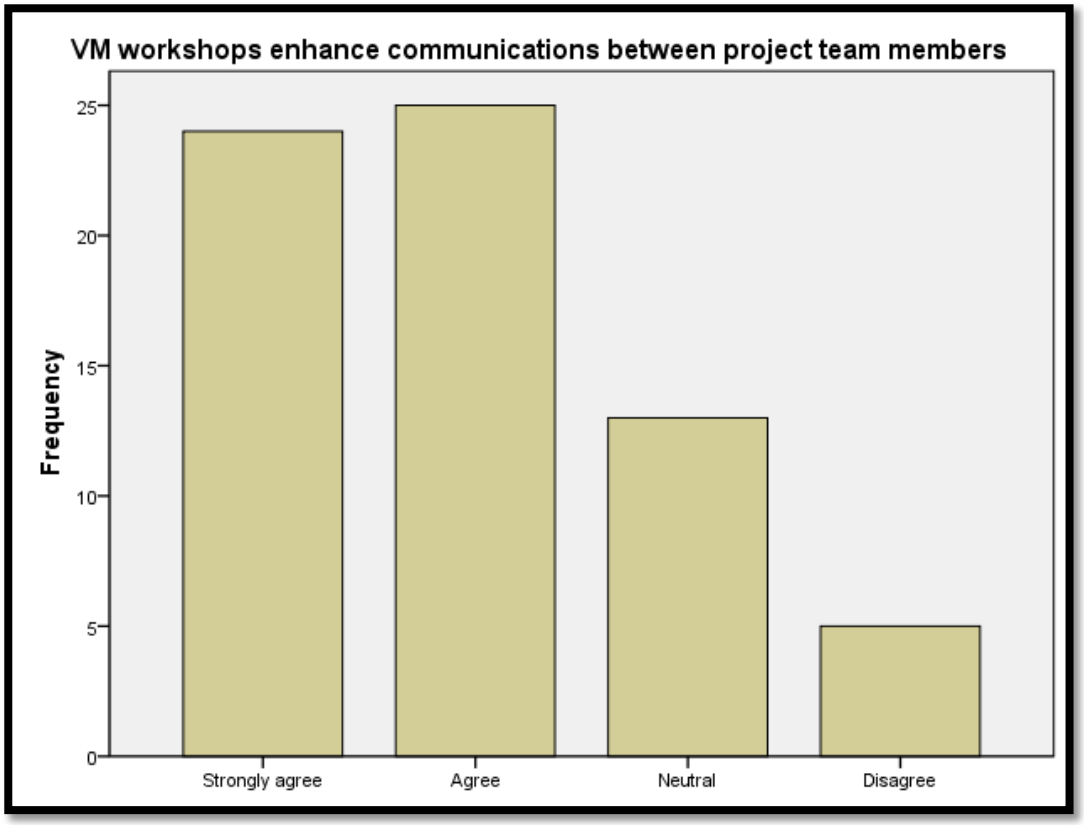

Figure (3.18)
Source: Prepared by the researcher according to the questionnaire

3.3.2.6 There is partial implementation of VM in governmental projects:

- 25.8 % of the sample agreed ,33.4% disagreed and 40.9% were neutral.

There is partial implementation of VM in governmental projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	3	4.4	4.5	4.5
	Agree	14	20.6	21.2	25.8
	Neutral	27	39.7	40.9	66.7
	Disagree	17	25.0	25.8	92.4
	Strongly disagree	5	7.4	7.6	100.0
	Total	66	97.1	100.0	
Missing	System	2	2.9		
Total		68	100.0		

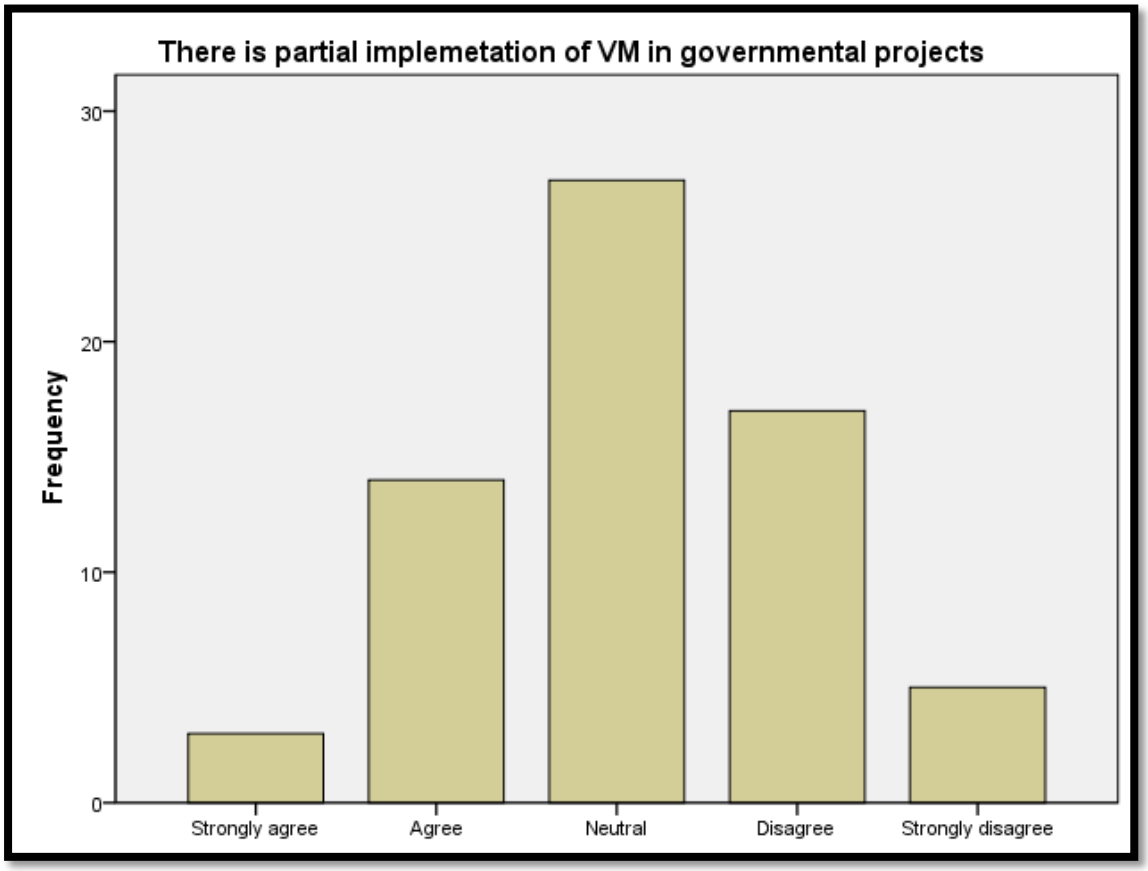

Figure (3.19)
Source: Prepared by the researcher according to the questionnaire

3.3.2.7 There is no implementation of VM in the private projects ;

- 4o.3 % of the sample agreed, 29.9% disagreed and 26.9% were neutral.

There is no implementation of VM in private projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	6	8.8	9.0	9.0
	Agree	21	30.9	31.3	40.3
	Neutral	18	26.5	26.9	67.2
	Disagree	20	29.4	29.9	97.0
	Strongly disagree	2	2.9	3.0	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

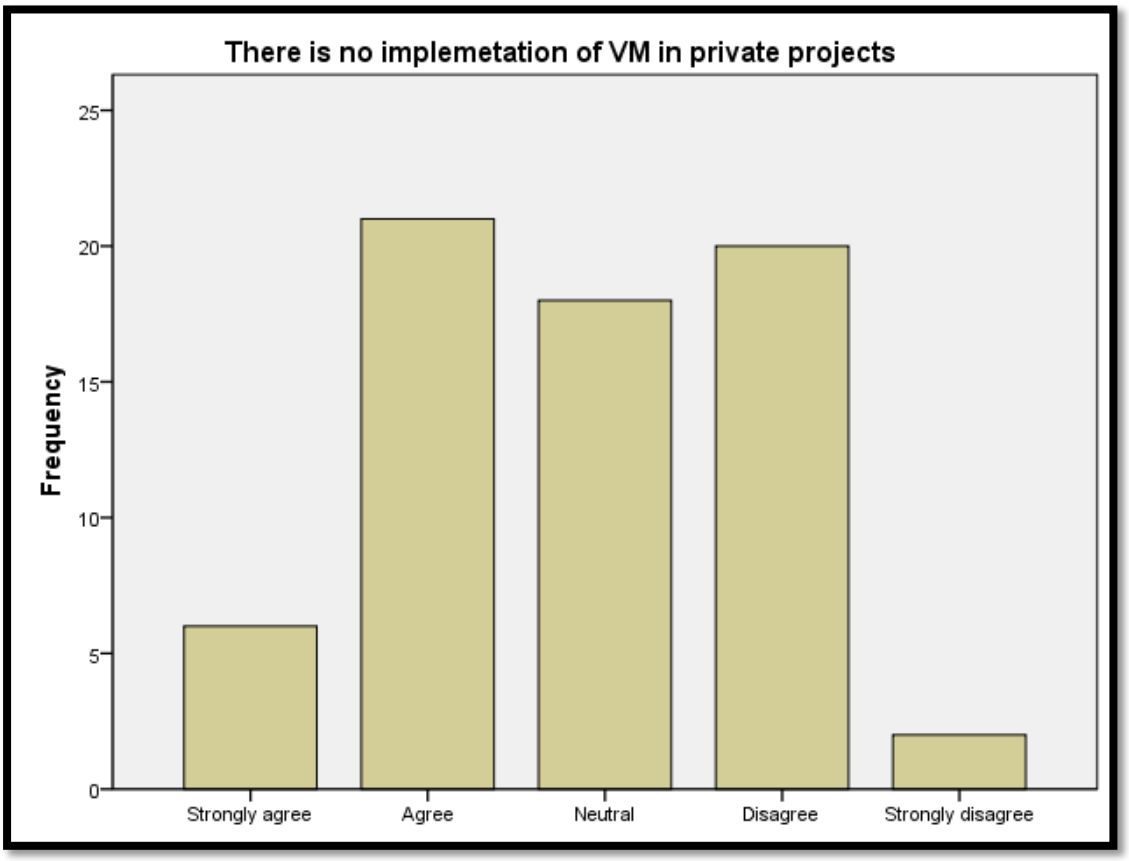

Figure (3.20)
Source: Prepared by the researcher according to the questionnaire

3.3.2.8 VM is not functional, that is the reason of the limited use of VM in construction projects ;

- 23.1 % of the sample agreed, 50.8% disagreed and 26.2 were neutral.

VM is not functional, that is the reason of the limited use if VM in construction projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	3	4.4	4.6	4.6
	Agree	12	17.6	18.5	23.1
	Neutral	17	25.0	26.2	49.2
	Disagree	25	36.8	38.5	87.7
	Strongly disagree	8	11.8	12.3	100.0
	Total	65	95.6	100.0	
Missing	System	3	4.4		
Total		68	100.0		

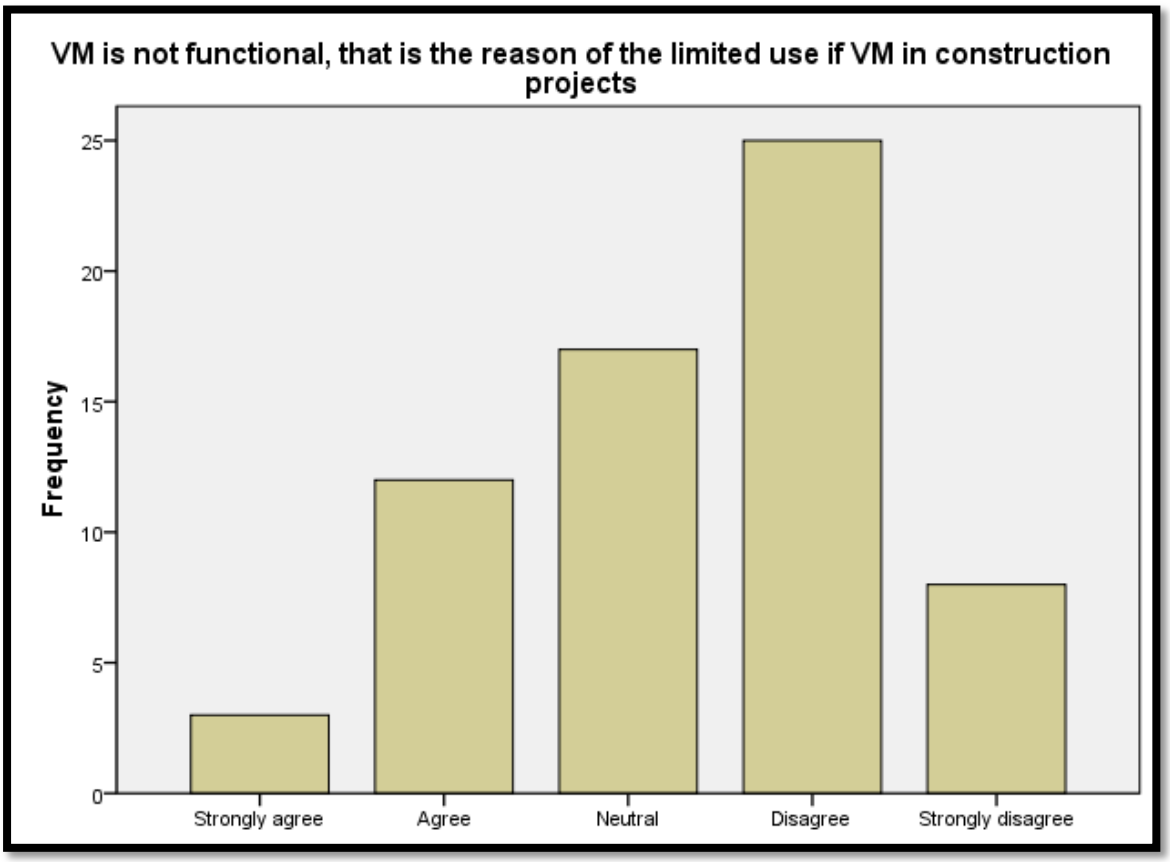

Figure (3.21)
Source: Prepared by the researcher according to the questionnaire

3.3.2.9 Lack of knowledge is the reason of the limited use of VM in construction projects ;

- 9o.9 % of the sample agreed, 3.0% disagreed and 6.1 %were neutral.

lack of knowledge is the reason of the limited use of VM in construction projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	26	38.2	39.4	39.4
	Agree	34	50.0	51.5	90.9
	Neutral	4	5.9	6.1	97.0
	Disagree	2	2.9	3.0	100.0
	Total	66	97.1	100.0	
Missing	System	2	2.9		
Total		68	100.0		

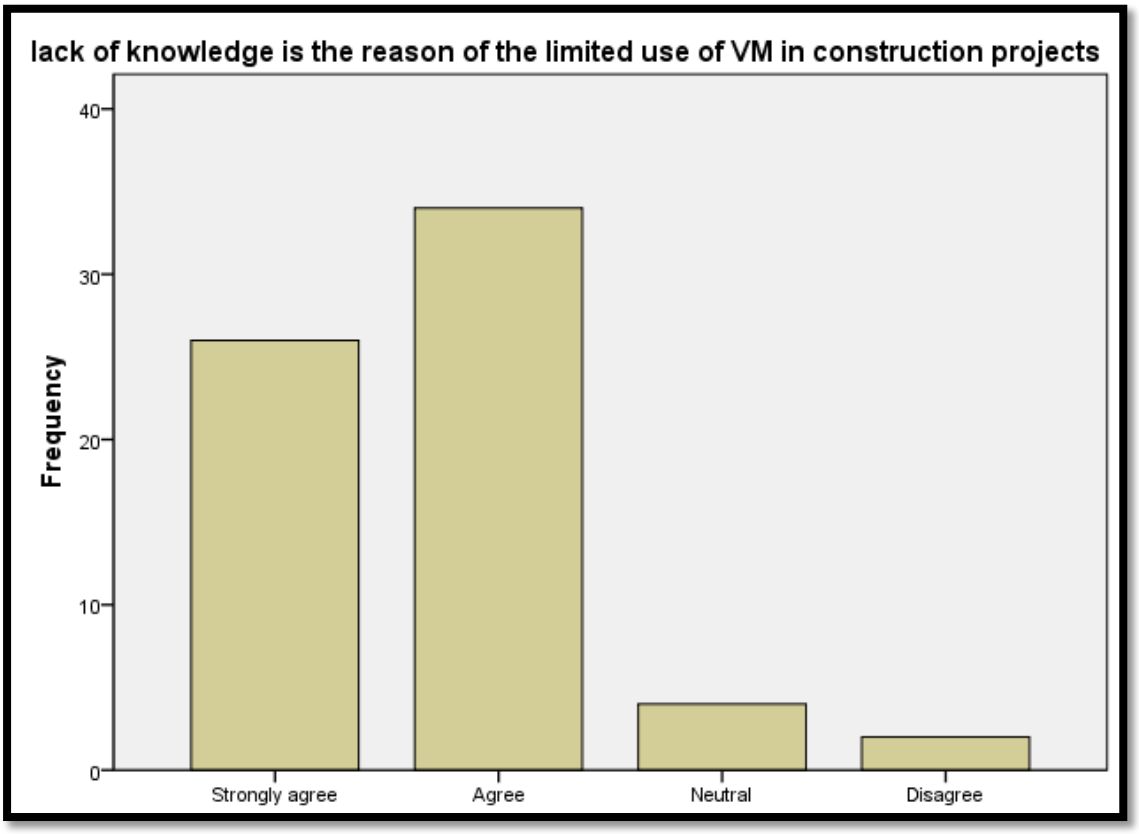

Figure (3.22)
Source: Prepared by the researcher according to the questionnaire

3.3.2.10 There are no training courses available for VM in Sudan ;

- 7o.6 % of the sample agreed, 10.3% disagreed and 17.6 % were neutral.

There is no training courses available for VM in Sudan					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	24	35.3	35.3	35.3
	Agree	24	35.3	35.3	70.6
	Neutral	12	17.6	17.6	88.2
	Disagree	7	10.3	10.3	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	68	100.0	100.0	

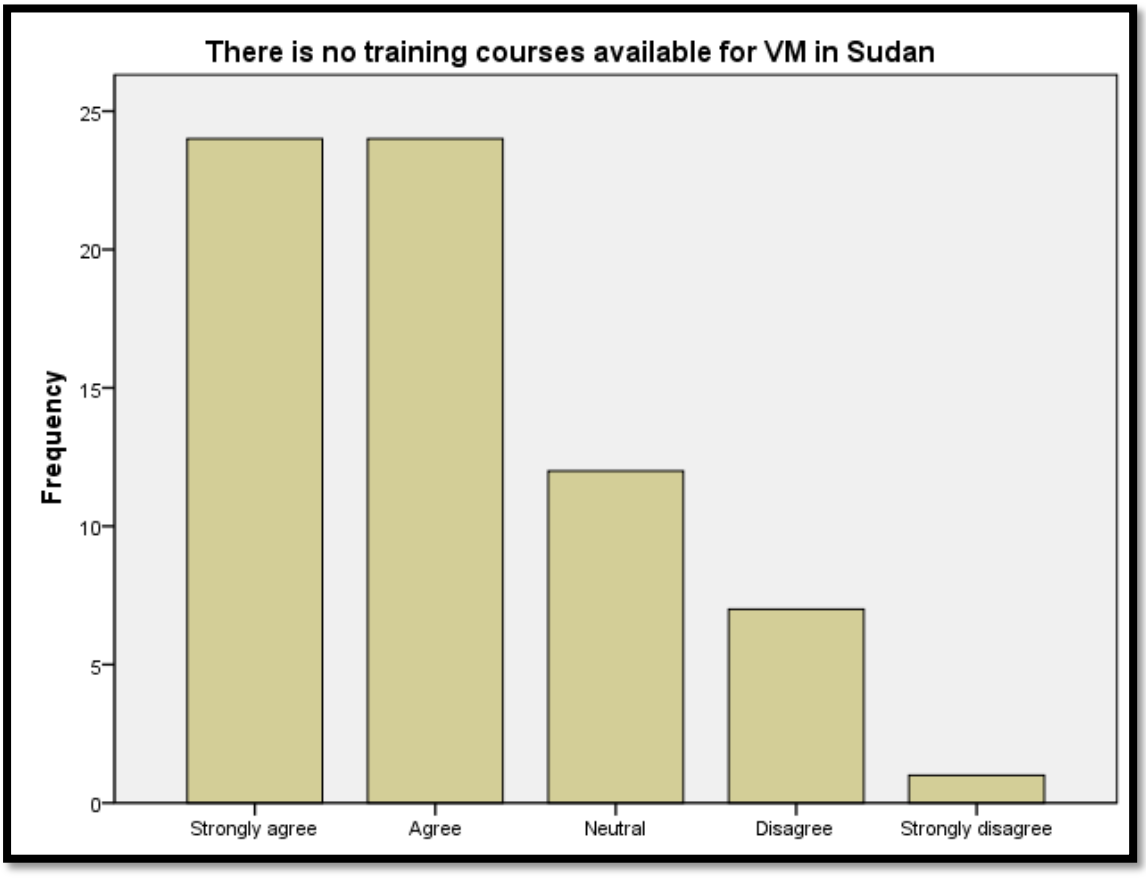

Figure (3.23)
Source: Prepared by the researcher according to the questionnaire

3.3.2.11 The benefits of VM are not clear to construction Industry professionals ;

- 69.1 % of the sample agreed, 16.1% disagreed and 14.7% were neutral.

The benefits of VM are not clear to construction Industry professionals					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	10	14.7	14.7	14.7
	Agree	37	54.4	54.4	69.1
	Neutral	10	14.7	14.7	83.8
	Disagree	9	13.2	13.2	97.1
	Strongly disagree	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

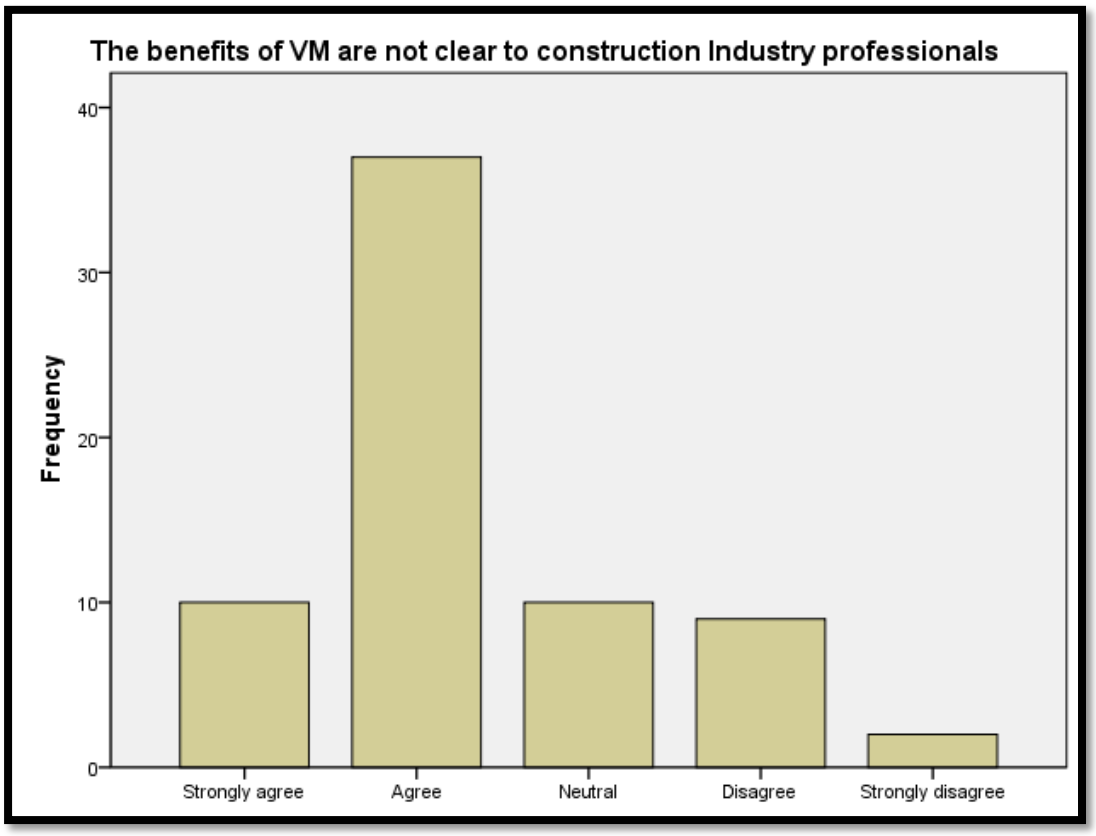

Figure (3.24)
Source: Prepared by the researcher according to the questionnaire

3.3.2.12 VM is a useful practice ;

- 91.2 % of the sample agreed, 4.4% disagreed and 4.4% were neutral.

VM id a useful practice					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	31	45.6	45.6	45.6
	Agree	31	45.6	45.6	91.2
	Neutral	3	4.4	4.4	95.6
	Disagree	1	1.5	1.5	97.1
	Strongly disagree	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

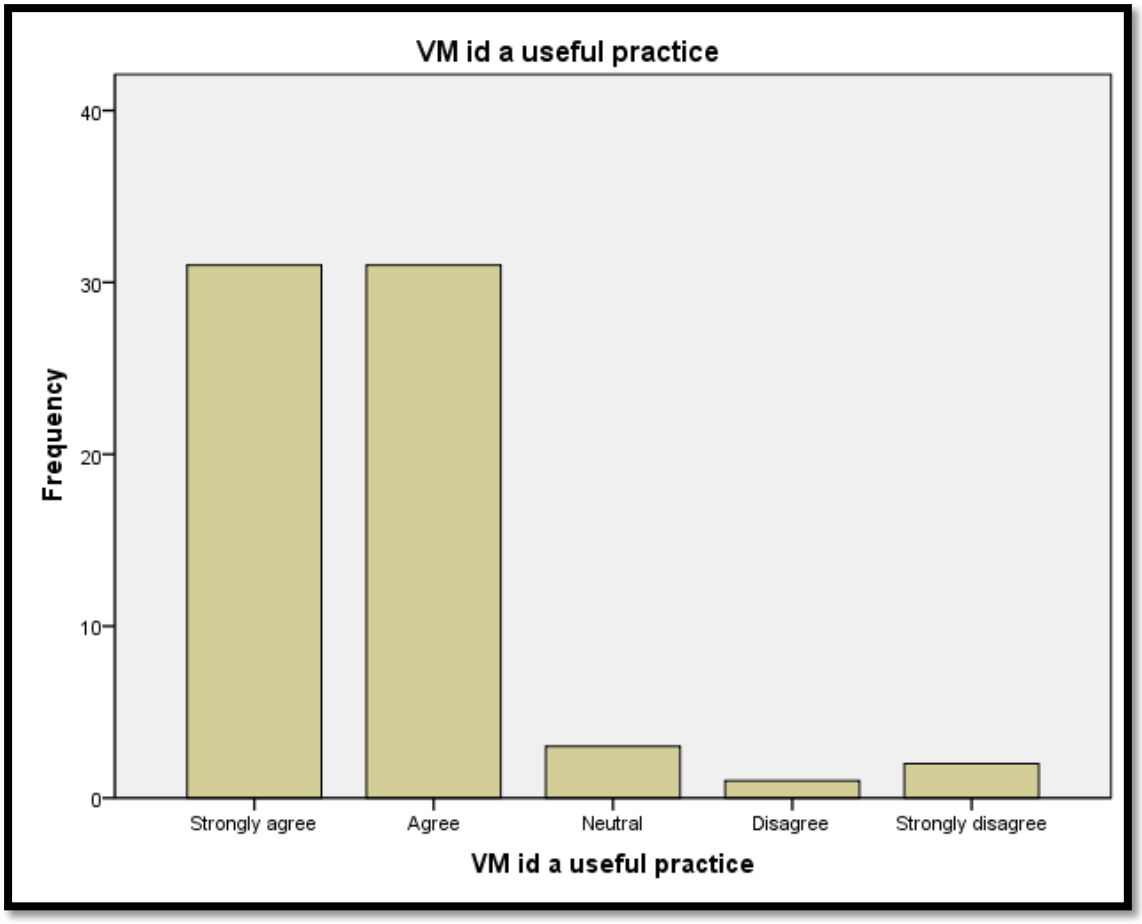

Figure (3.25)
Source: Prepared by the researcher according to the questionnaire

3.3.2.13 VM is suitable for all the projects ;

- 67.6 % of the sample agreed, 23.5% disagreed and 8.8% were neutral.

VM is suitable for all projects					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	22	32.4	32.4	32.4
	Agree	24	35.3	35.3	67.6
	Neutral	16	23.5	23.5	91.2
	Disagree	6	8.8	8.8	100.0
	Total	68	100.0	100.0	

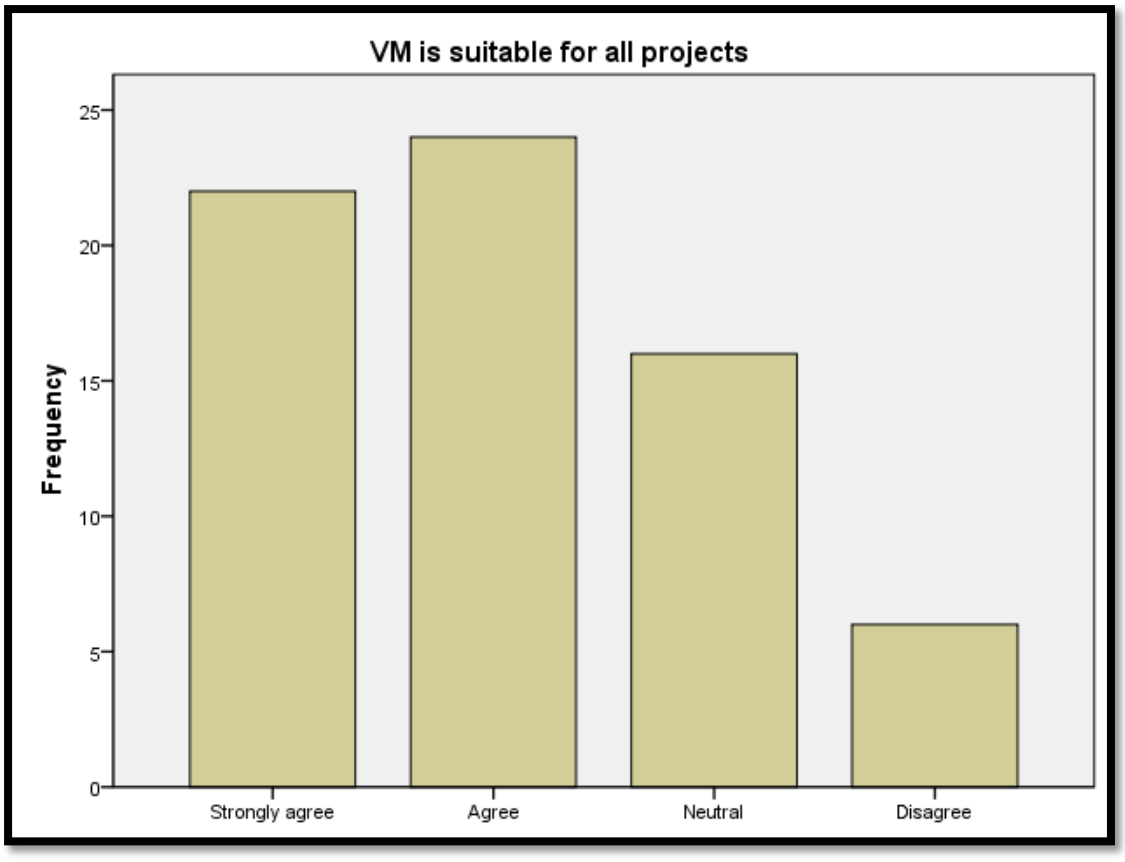

Figure (3.26)
Source: Prepared by the researcher according to the questionnaire

3.3.2.14 The bigger and the more complex projects the more we need VM ;

- 95.6 % of the sample agreed, 1.5% disagreed and 2.9 % were neutral.

The bigger and the more complex projects the more we need VM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	34	50.0	50.0	50.0
	Agree	31	45.6	45.6	95.6
	Neutral	2	2.9	2.9	98.5
	Disagree	1	1.5	1.5	100.0
	Total	68	100.0	100.0	

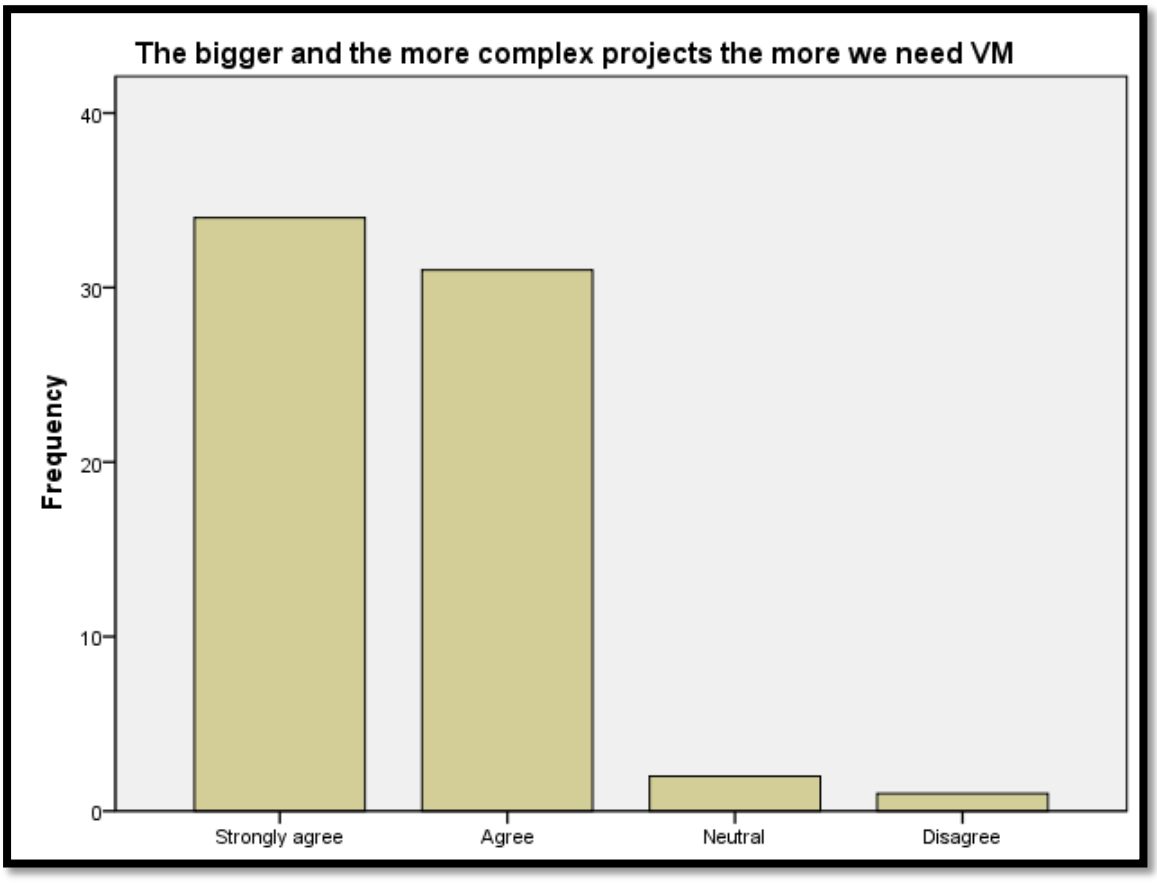

Figure (3.27)
Source: Prepared by the researcher according to the questionnaire

3.3.2.15 The earlier VM is applied the more we gain;

- 89.7 % of the sample agreed, 2.9% disagreed and 7.4% were neutral.

The earlier is applied the more we gain					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	35	51.5	51.5	51.5
	Agree	26	38.2	38.2	89.7
	Neutral	5	7.4	7.4	97.1
	Disagree	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

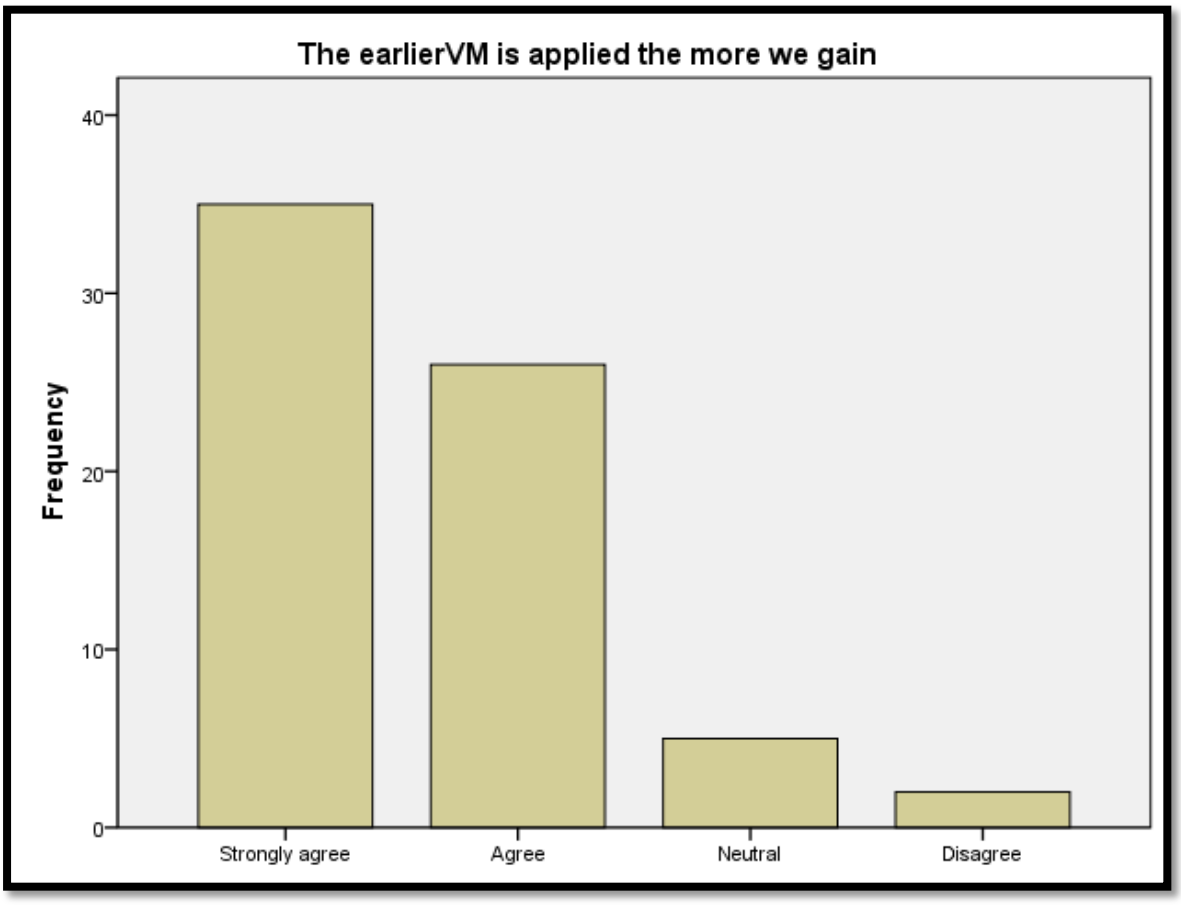

Figure (3.28)
Source: Prepared by the researcher according to the questionnaire

3.3.2.16 VM workshop from briefing and sketch designs results in a clearer brief ;

- 83.6 % of the sample agreed, 1.5% disagreed and 13.4% were neutral.

VM workshop from briefing and sketch designers results in a clearer brief					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	19	27.9	28.4	28.4
	Agree	37	54.4	55.2	83.6
	Neutral	9	13.2	13.4	97.0
	Disagree	1	1.5	1.5	98.5
	33	1	1.5	1.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

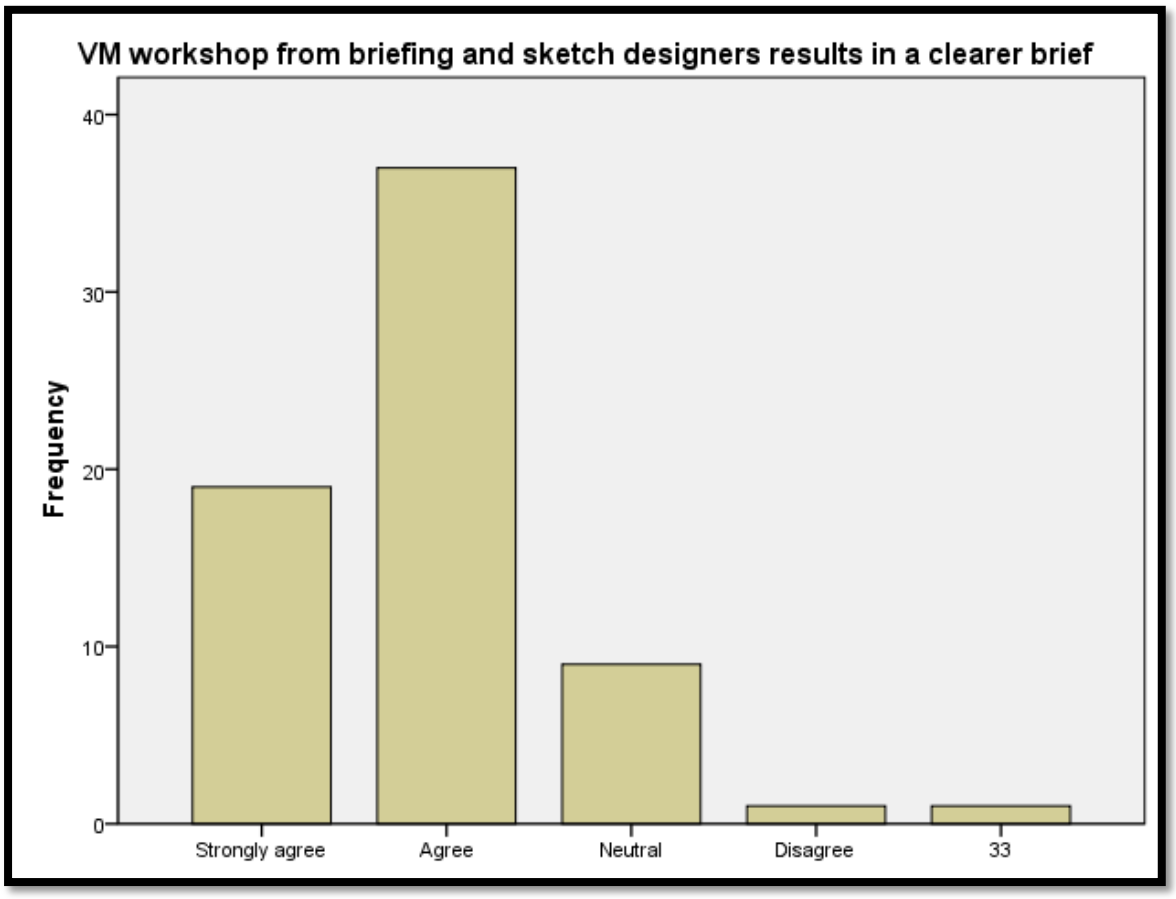

Figure (3.29)
Source: Prepared by the researcher according to the questionnaire

3.3.2.17- VM isn`t practiced in Sudan from design stage , it is used when facing problems ;

- 76.5 % of the sample agreed, 5.9% disagreed and 17.6 were neutral.

VM isn't practices in Sudan from design stage, it is used when facing problems					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	17	25.0	25.0	25.0
	Agree	35	51.5	51.5	76.5
	Neutral	12	17.6	17.6	94.1
	Disagree	3	4.4	4.4	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	68	100.0	100.0	

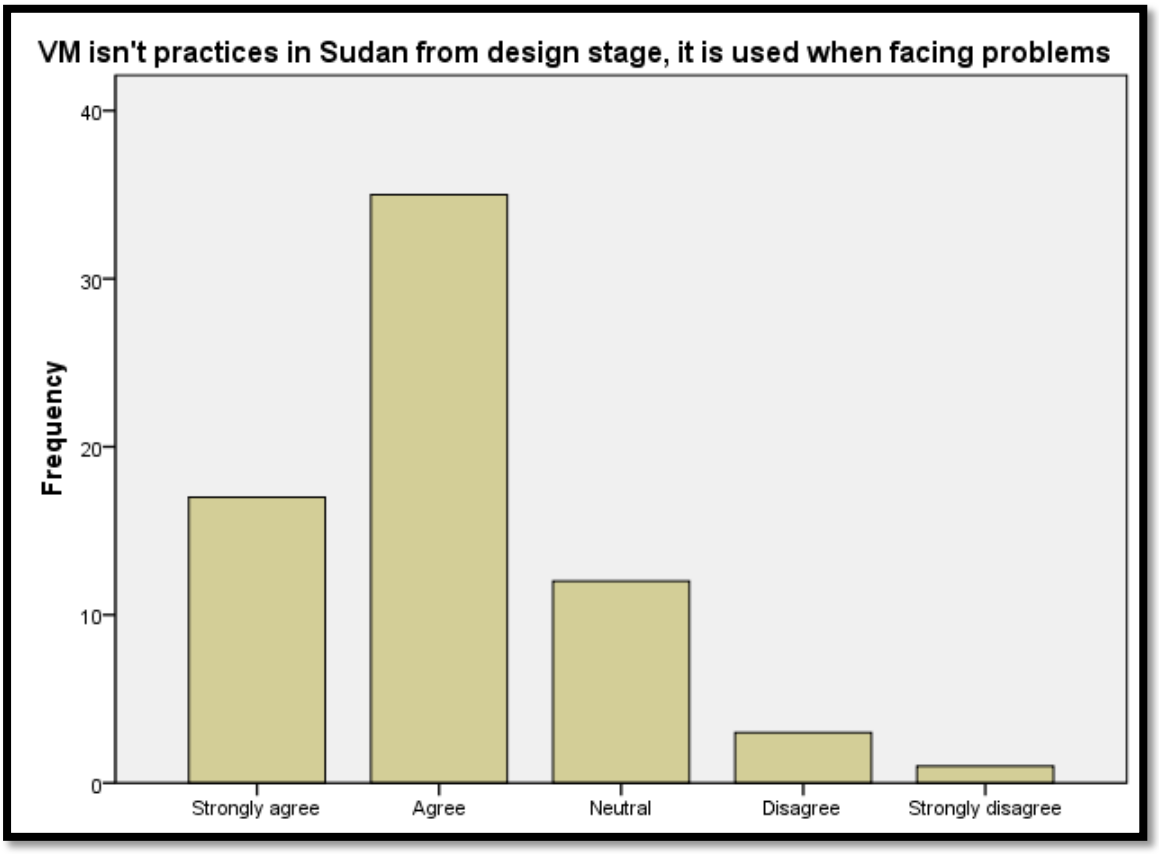

Figure (3.30)
Source: Prepared by the researcher according to the questionnaire

3.3.2.18 VM helps to reach more innovative designs;

- 83.8 % of the sample agreed, 2.9% disagreed and 13.2% were neutral.

VM helps to reach more innovative designs					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	22	32.4	32.4	32.4
	Agree	35	51.5	51.5	83.8
	Neutral	9	13.2	13.2	97.1
	Disagree	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

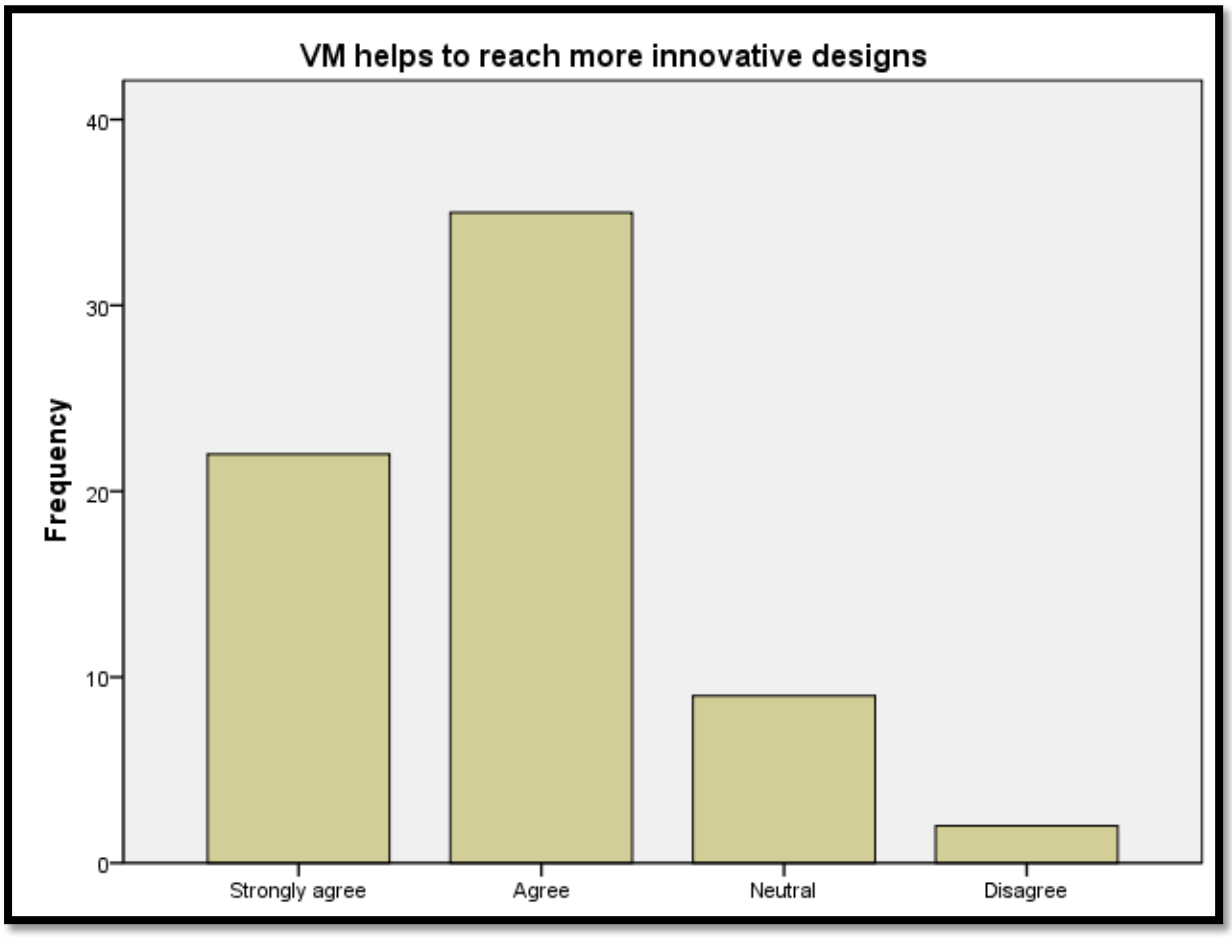

Figure (3.31)
Source: Prepared by the researcher according to the questionnaire

3.3.2.19 Implementing VM earlier minimizes changes in design later in construction and helps to avoid delays and cost inflations ;

- 83.6 % of the sample agreed, 4.5% disagreed and 11.9% were neutral.

Implementing VM earlier minimizes changes in design later in construction and helps to avoid delays and cost inflations					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	26	38.2	38.8	38.8
	Agree	30	44.1	44.8	83.6
	Neutral	8	11.8	11.9	95.5
	Disagree	3	4.4	4.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

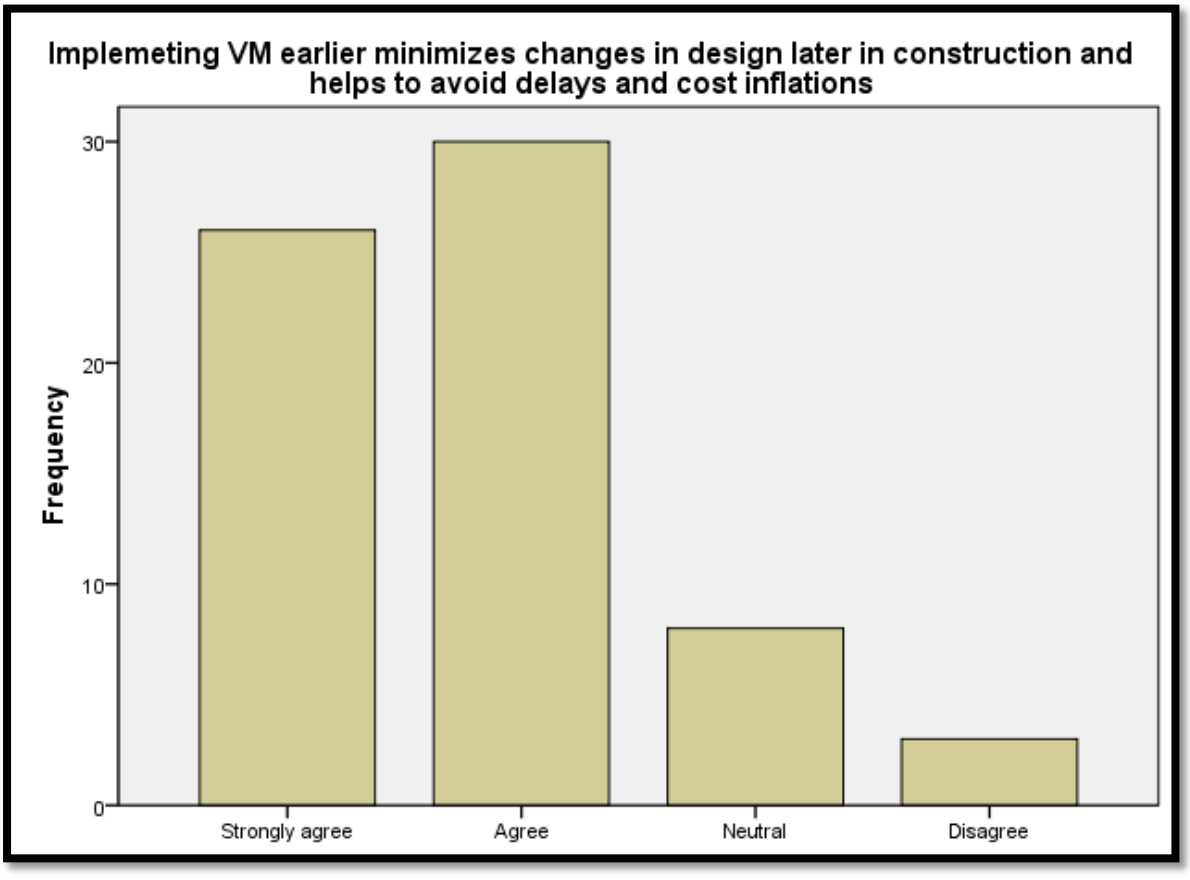

Figure (3.32)
Source: Prepared by the researcher according to the questionnaire

3.3.2.20 Designers benefit from VM and vice versa ;

- 67.2 % of the sample agreed, 4.4% disagreed and 28.4% were neutral.

Designers benefit from VM and vice versa					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	16	23.5	23.9	23.9
	Agree	29	42.6	43.3	67.2
	Neutral	19	27.9	28.4	95.5
	Disagree	3	4.4	4.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

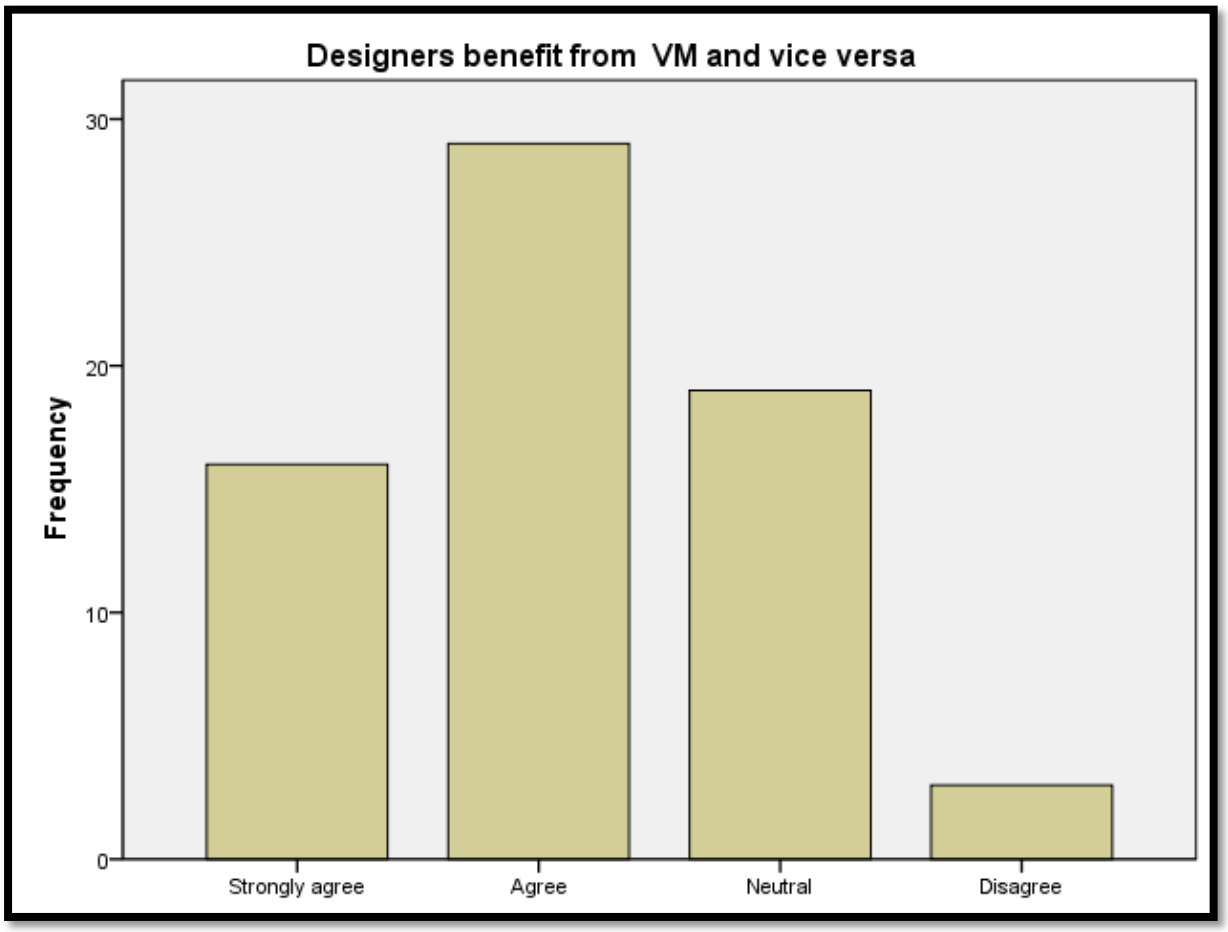

Figure (3.33)
Source: Prepared by the researcher according to the questionnaire

3.3.2.21 The integration between design team and VM team benefits the project and improves performance ;

- 97.1 % of the sample agreed, 0% disagreed and 2.9% were neutral.

The integration between design team and VM team improves performance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	29	42.6	42.6	42.6
	Agree	37	54.4	54.4	97.1
	Neutral	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

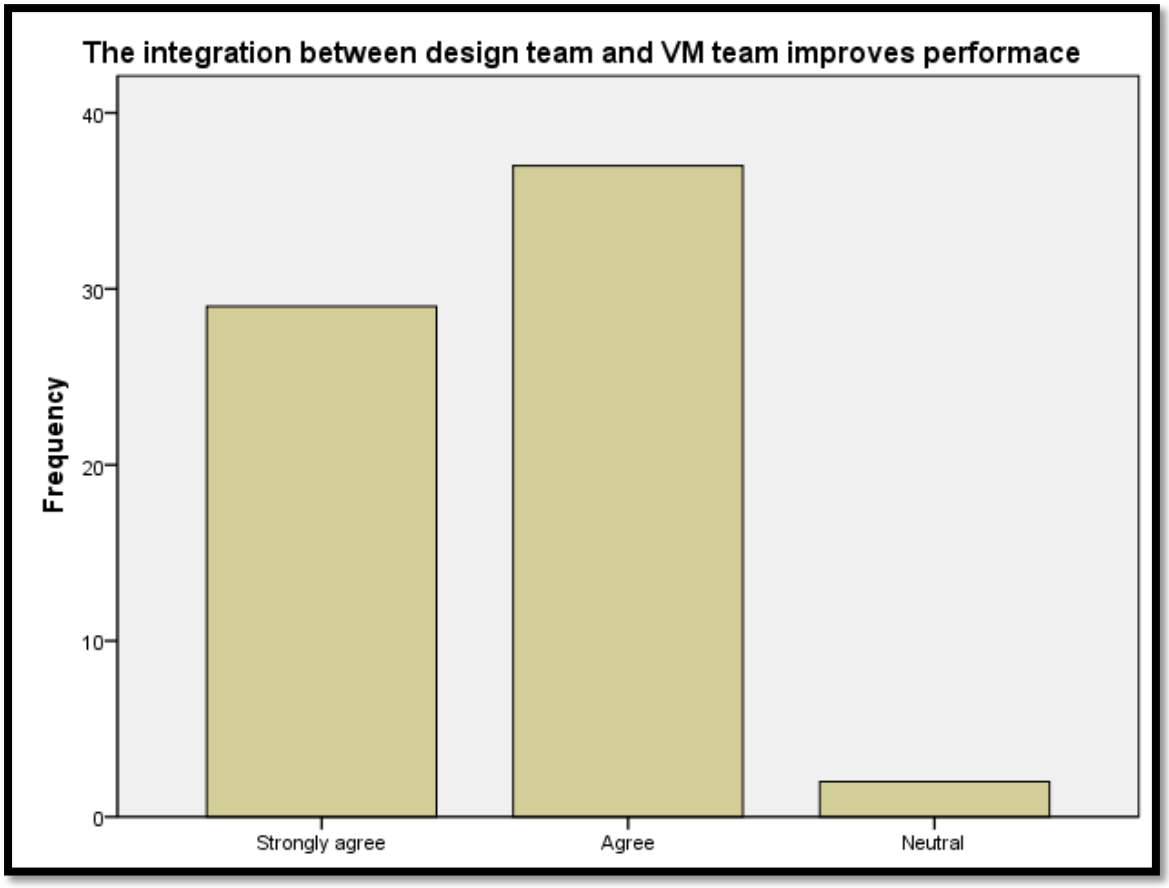

Figure (3.34)
Source: Prepared by the researcher according to the questionnaire

3.3.2.22 VM may be considered as a design tool ;

- 77.6 % of the sample agreed, 9.0% disagreed and 13.4 were neutral.

VM may be considered as a design tool					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	15	22.1	22.4	22.4
	Agree	37	54.4	55.2	77.6
	Neutral	9	13.2	13.4	91.0
	Disagree	6	8.8	9.0	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

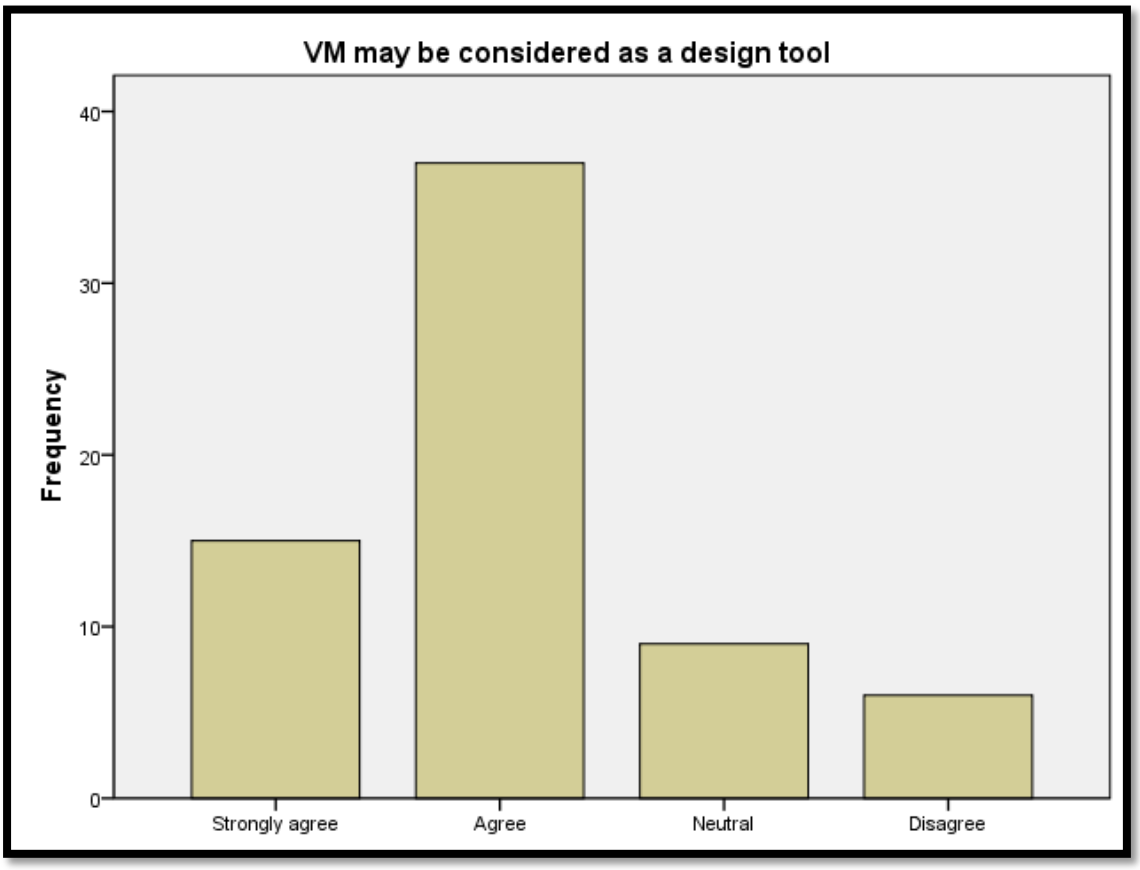

Figure (3.35)
Source: Prepared by the researcher according to the questionnaire

3.3.2.23 Workshops and seminars will encourage the companies to implement VM

- 95.6% of the sample agreed, 0% disagreed and 4.4% were neutral.

Workshops and seminars will encourage the companies to implement VM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	38	55.9	55.9	55.9
	Agree	27	39.7	39.7	95.6
	Neutral	3	4.4	4.4	100.0
	Total	68	100.0	100.0	

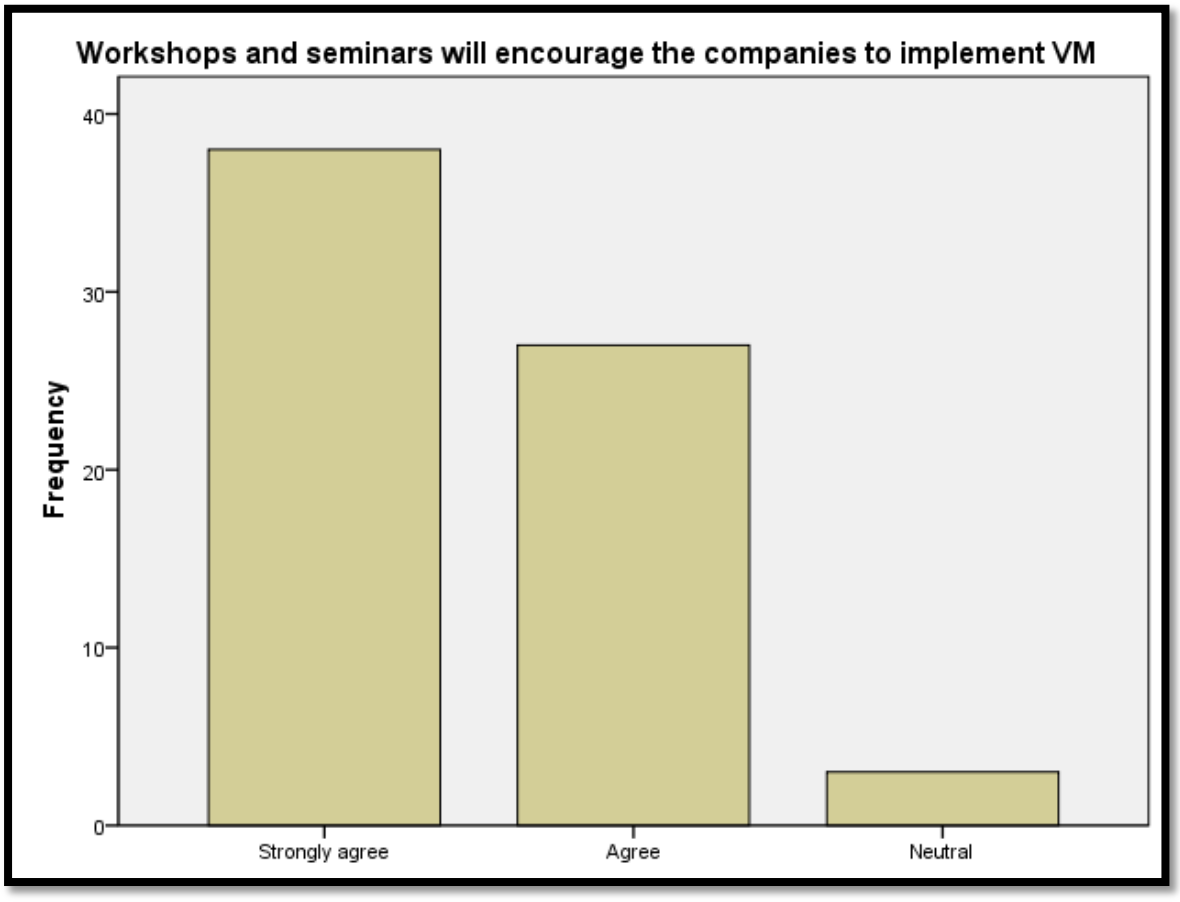

Figure (3.36)
Source: Prepared by the researcher according to the questionnaire

3.3.2.24 Training courses will help to provide construction professionals with the needed knowledge for practicing VM ;

- 95.6 % of the sample agreed, 0% disagreed and 4.4% were neutral.

Training courses will help to provide construction professionals with the needed knowledge for practicing VM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	34	50.0	50.0	50.0
	Agree	31	45.6	45.6	95.6
	Neutral	3	4.4	4.4	100.0
	Total	68	100.0	100.0	

Figure (3.37)
Source: Prepared by the researcher according to the questionnaire

3.3.2.25 Courses about VM should be included in syllabuses in colleges and universities ;

- 95.5 % of the sample agreed, 1.5% disagreed and 3.0% were neutral.

Courses about VM should be included in syllabuses in colleges and universities					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	36	52.9	53.7	53.7
	Agree	28	41.2	41.8	95.5
	Neutral	2	2.9	3.0	98.5
	Disagree	1	1.5	1.5	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

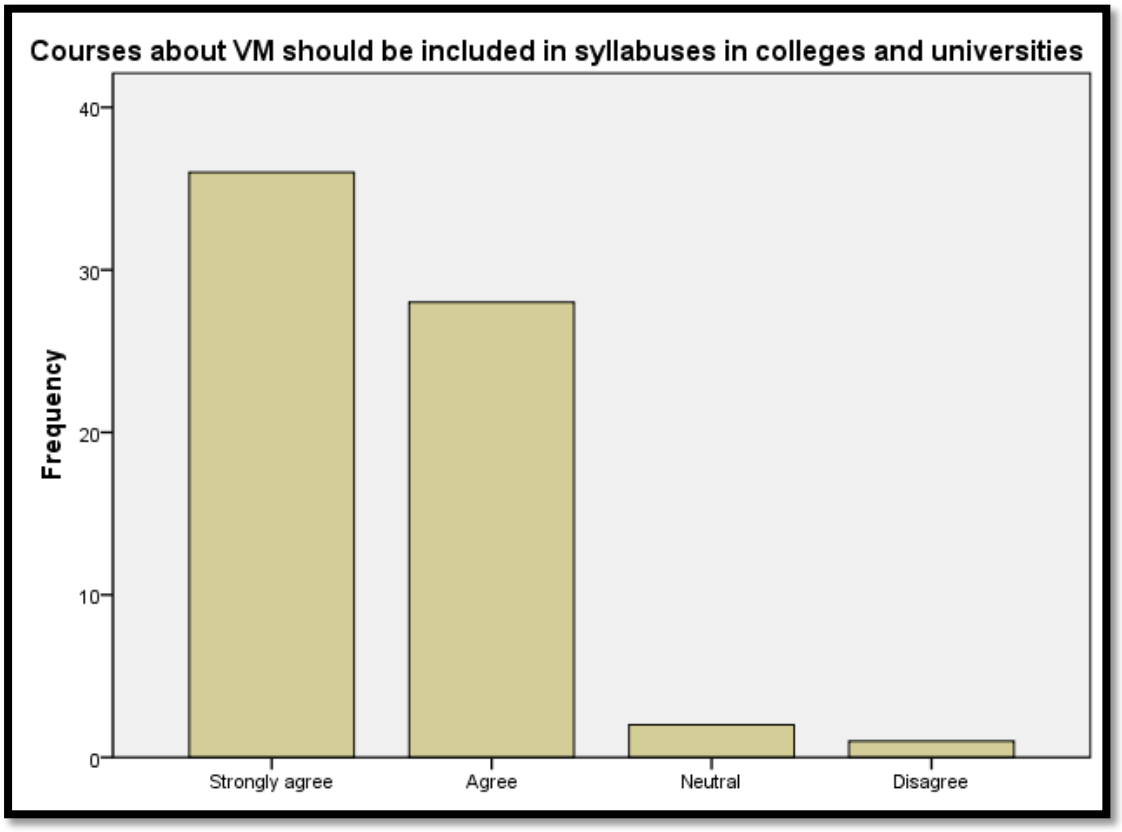

Figure (3.39)
Source: Prepared by the researcher according to the questionnaire

3.3.2.26 Establishing value management departments in ministries and governmental organizations will increase the implementation of VM ;

- 85.1 % of the sample agreed, 6.0% disagreed and 9.0% were neutral.

Establishing value management departments in ministries and governmental organizations will increase the implementation of VM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	32	47.1	47.8	47.8
	Agree	25	36.8	37.3	85.1
	Neutral	6	8.8	9.0	94.0
	Disagree	4	5.9	6.0	100.0
	Total	67	98.5	100.0	
Missing	System	1	1.5		
Total		68	100.0		

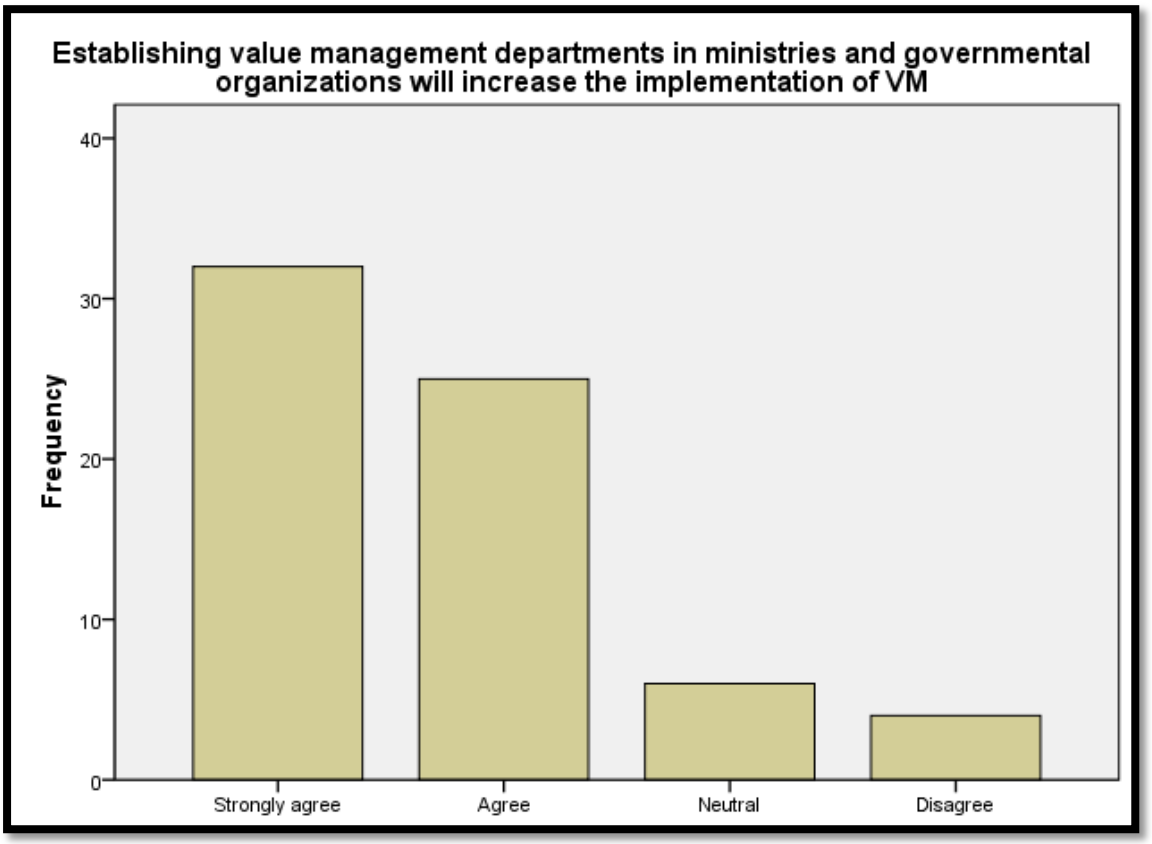

Figure (3.40)
Source: Prepared by the researcher according to the questionnaire

3.3.2.27 Establishing VM professional society will organize the practice of VM in Construction Industry Sector ;

89.7 % of the sample agreed, 0% disagreed and 10.3% were neutral.

Establishing VM professional society will organize the practice of VM in construction industry sector					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	28	41.2	41.2	41.2
	Agree	33	48.5	48.5	89.7
	Neutral	7	10.3	10.3	100.0
	Total	68	100.0	100.0	

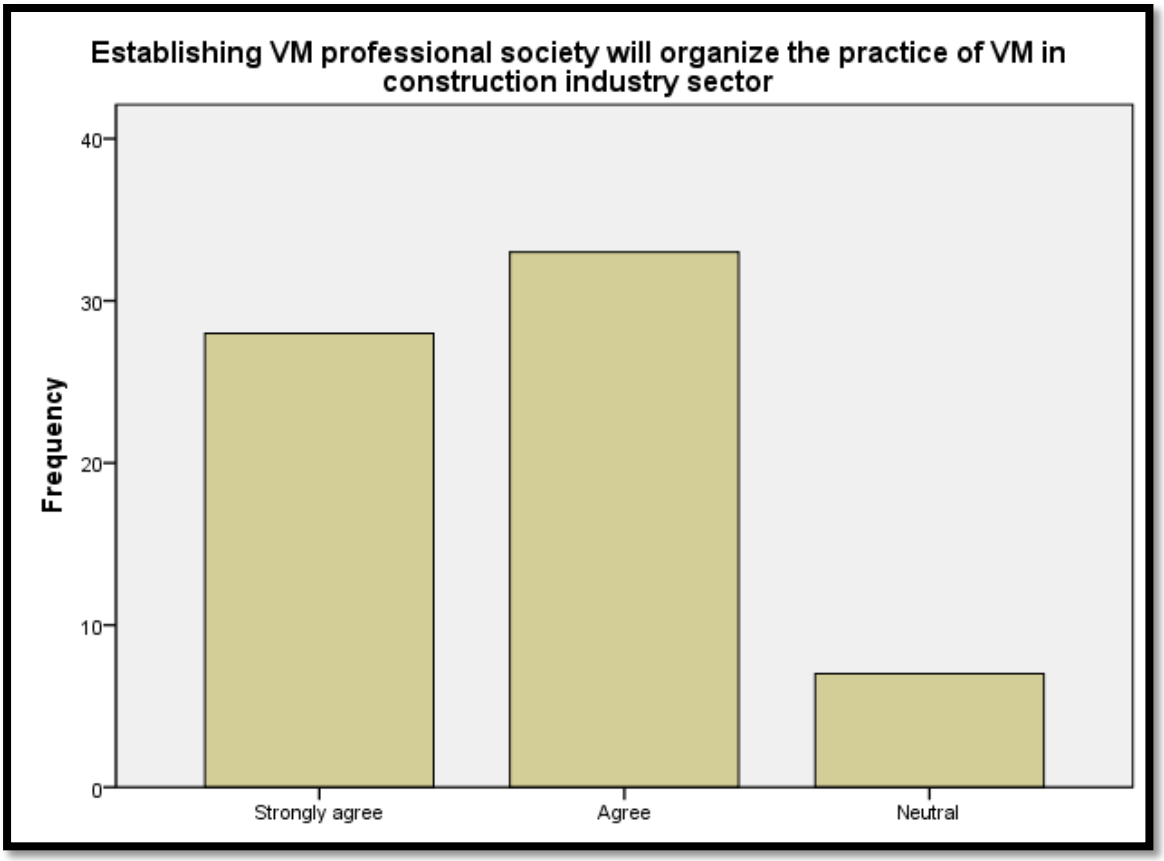

Figure (3.41)
Source: Prepared by the researcher according to the questionnaire

Summary:

The researcher noticed that the feedback of the participants were positive to the topic of the research and willing to know more about value management. The researcher has noticed the following:

- 75.8% of the sample did not practice VM.
- 73.1% of the sample agreed that there is misconception between VM and CM
- 84.8% of the sample agreed that VM is a logical systematic decision making tool.
- 71.6% of the sample agreed that VM will reduce cost and enhance quality.
- 83.8% of the sample agreed that implementing VM improves the project performance.
- 25.8% of the sample agreed that there is partial practice for VM in construction industry in Sudan.
- 77.6% of the sample agreed that VM is a design tool and should be applied from the planning and designing stages.
- 80.6% of the sample agreed that implementing VM improves architectural design and planning.
- 94.1% of the sample agreed that there is increased need for implementing VM.
- 90.9% of the sample agreed that the lack of awareness about VM is the reason of the limited practice f it.
- 83.6% of the sample agreed that implementing VM minimizes design changes later in construction.

CHAPTER FOUR

CONCLUSION AND RECOMMENDATIONS

This chapter represents the results and conclusions the researcher's reached through the literature review and the questionnaire results ,It summarized those results and suggested recommendations to help increasing the knowledge about VM and encourages implementing its concepts to achieve a truly innovative designs and successful projects.

4.1Conclusion:

The researcher has concluded the following:

- Value management application in construction projects has proven to assist construction team in making structured approach to decision making in the design of a project.
- There is an increasing need for more understanding and awareness about value management and its benefits to architectural designs and the project as whole.
- Most of the participants did not distinguish VM and VE and thought that they are same; therefore more publications and presentations are needed to raise the awareness.
- Although the idea of early implementation of VM is well accepted among construction industry practitioners they don't apply it.
- There is no documentation for the limited implementation of value management in architectural designs in Sudan.
- The limited implementation of VE was in construction projects in Sudan is in changing orders only and was not planned from the early stages.
- VM is a proven tool design tool and architects will benefit from it to create creative valuable designs with the minimum changes in construction stage.

4.2 Recommendations:

The researcher recommends the following:

- Presentations and seminars should be presented to the governmental ministries and private construction companies to raise the awareness of the importance of implantation of VM.
- Professional institutions should present courses and training workshops graduates professional practitioners of VM.
- To encourage both public and private construction company to implement VM to construction projects from the earliest stage.
- To establish VM specialized departments in the ministry of planning.
- To put the VM study as a stage of the project and include that I the rules of contractual systems and procurements.

4.3 Recommendations for Further Studies:

There are several recommendations for further research the researcher concluded based on findings from this research.

- Setting rules and measures to conduct VM.
- To develop visualization computerized software to monitor the implementation of VM through the stages of the project.
- To include VM in syllabuses in architectural and all engineering collages and graduate colleges.
- To Study the integration between sustainable architecture and VM.
- To Study the integration between VM and RM and TAM.
- To study the integration of implementing REVIT and BIM and implementing VM.
- To promote for VM by practical application to set the mode for the good of the future of construction industry in Sudan.

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APPENDIX

Sudan University of Science and Technology
College of Graduate Studies/Architecture and Planning

Questionnaire: about Implementation of Value Management as a Design Tool In Construction Projects in Sudan

Note : (These the questions are all and only limited to construction practice in Sudan , please notice that: VM. refers to Value Management.)

1- Nature of your job (manager, contractor, subcontractor, consultant, designer):……..

2- Years of Experience:……..

3- Where do you work (ministry, governmental organization, consultant company, construction company, academic field)……

4- How many VM workshops did you participate in:……..

A- Knowledge about VM:

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1- VM means Total Quality Systems Management					
2- VM means Cost Management					
3- There is misconception between VM and Cost Management					
4- VM is a logical ,systematical decision making tool					
5- VM is primarily concerned with substituting materials selection that maximizes the functional development and minimizes cost					
6- Implementing of VM will increase life cycle and enhance quality					
7- Implementing VM will reduce cut and ensure function					
8- Implementing VM improves performance of the construction projects					

9- VM will improve projects planning and designing					
10- VM sets a clear road map for the project					

B- Practice of Value Management in Sudan:

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1- There is increasing need for VM					
2- Customer`s satisfaction is assured when applying VM					
3- Implementation of VM will attract more customers					
4- Customers contribution to VM workshops helps to make the right choices that meet their requirements					
5- VM workshops enhance communications between project team members					
6- There is partial implementation of VM in governmental projects					
7- There is no implementation of VM in the private projects					
8- VM is not functional , that is the reason of the limited use of VM in construction projects					
9- Lack of knowledge is the reason of the limited use of VM in construction projects					
10- There is no training courses available for VM in Sudan					
11- The benefits of VM are not clear to construction Industry professionals					
12- VM is a useful practice					

13- VM is suitable for all the projects					
14- The bigger and the more complex projects the more we need VM					
15- The earlier VM is applied the more we gain					
16- VM workshop from briefing and sketch designs results in a clearer brief					
17- VM isn`t practiced in Sudan from design stage , it is used when facing problems					
18- VM helps to reach more innovative designs					
19- Implementing VM earlier minimizes changes in design later in construction and helps to avoid delays and cost inflations					
20- Designers benefit from VM and vice versa					
21- The integration between design team and VM team benefits the project and improves performance					
22- VM may be considered as a design tool					

C- Future of VM practice in Sudan:

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1- Workshops and seminars will encourage the companies to implement VM					
2- Training courses will help to provide construction					

professionals with the needed knowledge for practicing VM					
3- Courses about VM should be included in syllabuses in colleges and universities					
4- Establishing value management departments in ministries and governmental organizations will increase the implementation of VM					
5- Establishing VM professional society will organize the practice of VM in Construction Industry Sector					