

# **STRUCTURAL MODEL OF VALUE MANAGEMENT IN GREEN CONSTRUCTION**

by

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## LIST OF ABBREVIATIONS

ACEM	Association of Consulting Engineers Malaysia
ANZ	Australian Newzer Land
AVE	Average Variance Extarcted
BREEAM	Building Research Establishment Environmental Assessment Methodology
CIDB	Construction Industry Development Board
CR	Composite Reliability
DDC	Demonstration and Documentation Centre
EPU	Economic Planning Unite
GBI	Green Building Index
GOF	Goodness Of Fit
GUI	Graphical User Interface
IVMM	Institute Value Management Malaysia
LEED	Leadership in Energy and Environmental Design
LV	Latent Variable
LSE	Largest Structural Equation
MAHB	Malaysia Airports Holdings Berhad
MV	Manifest Variable
PAM	Pertubuhan Arkitek Malaysia
PLS-SEM	Partial Least Square- Structural Equation Modeling
PSDC	Professional Services Development Corporation

SC	Sustainable Construction
SPSS	Statistical Package for Social Science
TNB	Tenaga National Bhd
VAF	Variance Accounted For
VE	Value Engineer
VIF	Variance Inflation Factor
VM	Value Management
VMA	Value Management Academy

# **MODEL BERSTRUKTUR BAGI PENGURUSAN NILAI DALAM PEMBINAAN**

## **HIJAU**

### **ABSTRAK**

Pembangunan pembinaan lestari atau mapan boleh menyumbang terhadap penambahbaikan prestasi nilai melalui pengurangan kos operasi dalam jangka panjang, menambah baik kualiti output, mengurangkan penggunaan bahan di samping mitigasi dalam pembaziran sumber. Namun demikian, disebabkan kos permulaan yang tinggi dan tempoh bayaran balik yang panjang menyebabkan klien tidak begitu berminat melaksanakan kelestarian dalam pembangunan pembinaan. Seajar dengan ini, integrasi daripada pengurusan nilai (value management, VM) dan pembinaan lestari (sustainable construction, SC) diperkenalkan untuk memberi tumpuan yang lebih terhadap atitud atau sikap klien. Secara teori, kebarangkalian mengintegrasikan kelestarian dengan kajian pengurusan nilai telah dicadangkan dalam literatur, namun belum dipraktikkan secara meluas di seantero dunia. Sebagai keputusan, objektif utama kajian ini bertujuan menilai model integrasi daripada VM dan SC di samping menilai perkaitan di antara pengurusan nilai berintegrasi dan pembinaan lestari dengan prestasi nilai projek dengan kesan penyederhanaan atitud klien. Soal selidik diedarkan kepada 284 orang responden melalui pos dan e-mel kepada pemudah cara atau fasilitator GBI. Daripada 284 soal selidik yang diedarkan, 74 dipulangkan dan boleh digunakan. Data dianalisis melalui model persamaan struktur Kuasa Dua Terkecil Separa menggunakan Smart PLS dan perisian SPSS. Dapatan menunjukkan bahawa terdapat perkaitan yang positif di antara integrasi VM dan SC dengan atitud klien dan prestasi nilai. Tesis ini memaparkan suatu rangka kerja berkonsep, yang mungkin pertama kali diuji secara empirik dalam pembinaan hijau, yang juga merupakan suatu sumbangan teori.



# **STRUCTURAL MODEL OF VALUE MANAGEMENT IN GREEN CONSTRUCTION**

## **ABSTRACT**

Sustainable construction development would contribute to improve value performance by decreasing operation cost in long run, improving quality of outputs, reducing material consumption as well as mitigating in wastage of resources. However, due to high initial cost and long payback period clients are not interested in implementation of sustainability in construction development. In line with this, the integration of value management (VM) and sustainable construction (SC) has been introduced to focus more on client attitude. While the possibility of integrating sustainability with value management study has been theoretically proposed in the literature, it has not yet been widely put into practice around the world. As a result, the main objectives of this study shaped to assess the modeling of integration of value management and sustainable construction as well as to evaluate the relationship between integrated value management and sustainable construction with project value performance with mediating effect of client attitude. Questionnaires were sent out to 284 respondents via postal mailing and e-mailing to GBI facilitators. From 284 questionnaires distributed, 74 of the questionnaire were returned and deemed usable. The data was analyzed through Partial Least Squares structural equation modeling using Smart PLS and SPSS software. The findings showed a positive relationship between integration of VM and SC with client attitude and value performance. The results also found that client attitude partially mediated the relationship between integrated VM and

SC with value performance. This thesis presented a conceptual framework that could be the first time being empirically tested in the green construction, which is a theoretical contribution by itself.

# CHAPTER 1: INTRODUCTION

## 1.1 Background

Rapid economic and technological development over the previous centuries combined with substantial exploitation of non-renewable resources and population growth and climate changing have encouraged the relatively current re-emergence of the sustainable development technique (Horvath and Matthews, 2004; Chong et al., 2009). A present aim today is to search for sustainable construction from the social, economic, ecological and psychological point of view and to gather the worldwide knowledge and utilize it in an innovative way to be able to increase standards of social and economic issues (Maliene & Malys, 2009).

Sustainable construction (SC) strives to achieve the sustainable development targets through utilize of knowledge and technology to improve the sustainable construction of operations and practices, production processes, and design of infrastructures. However, the construction activities appear to be leaved behind substantial environmental factors. The key aim of SC is to gain the sustainable development's purpose to meet the needs of both the present and the future generations without reducing their living requirements (Chong et al., 2009).

According to prior studies such as those conducted by Bueren and Priemus (2002) and Ding (2008), the sustainable construction barriers include a lack of guidance, lack of client commitment, lack of knowledge, negative attitude about cost, and limited evidence of success. Some of the key barriers in sustainable development may include of representing the link between economic performance and sustainability and

demonstrating how sustainability elements can be modified into quantifiable symptoms that financial analysis and managers can utilize (Szekely & Knirsch, 2005).

On the other hand, value management (VM) has been introduced into the construction industry as a useful tool to cope with many barriers: environmental impact, safety issues, budget constraints, and after all, value for money (Shen et al., 2006). If the value management can be executed effectively, the barriers-solving techniques can decrease costs while increasing performance and quality outcomes in a project (Shen et al., 2006).

Value management is a strong structure to deliver the balance triumvirate of environment, economics and society, mostly because of the integrated decision-making method inherent in the value management study, the potential of VM in distilling objectives towards the preferred outcomes and the robust facilitation (Abidin & Pasquire, 2007).

However, Abidin and Pasquire (2007) argued for a more collaborative approach in addressing the value management and sustainable construction that has focused on client responsibility during the green construction project. Value management provides a means for the client to contribute to a better-built environment and the opportunity to stimulate enhancements in the construction process.

Also, one of the weaknesses of implementation in construction project is its incapability to precisely identify client needs and effectively transform these needs into the completed facility. It is essential that pay attention to action as an incitement for further sustainable decision-making, knowledge must be gathered and offered to meet client requirements. In addition, the construction project should connect with clients to establish what they need. However, the usefulness of implementing sustainable construction development depends mostly on client's desire.

The perception that sustainability adds costs (Bartlett and Howard, 2000) and value management aims to reduce cost (Connaughton and Green, 1996) may lead to a seemingly conflicting interest. It is established that the sustainability perspective corresponds with the direction of value management. Thus, conditioning the position of value management as tactical system can embed sustainability into construction (Abidin & Pasquire, 2005).

As the potentials of value management are to deliver sustainable projects as well as the significance of sustainability in order to improve the value in construction projects, therefore, value management should be considered as a strategy that theoretically able of delivering sustainable development (Al-Saleh and Taleb, 2010). On the other hand, some researchers have shown that green development in the construction industry can attract more investment funds (Igloo, 2005) and provide more values to the projects. For instance, sustainability aspects would contribute to improve project value such as improved quality of output, increase productivity, profitability, reduction to life cost and business enhancement (Hayles, 2004). Therefore, further research on efficient ways to incorporate sustainability concerns without appearing liabilities to VM facilitators or leading to conflict with the other needs of clients appears a essential research within the construction projects.

## **1.2 Research Problem**

The world is faced with environmental problem such as climate changing, air pollution, inefficient energy consumption, the loss of a sense of community and non-optimal allocation of economic resources (Hodges, 2005; Manoliadis et al., 2007; Seyfang,

2010). The developed environment in overall and the construction project in particular are main customers of energy and natural resources (Ding, 2008). The International Energy Agency (IEA) in 2014, estimated that approximately 40 percent of total energy consumption is designated to the construction industry. Recently, construction activity has increased substantially in developing countries such as Malaysia (The Economic Report 2014-2015). The producing improve in volume of construction has burdened local construction management technique and, in some situation, led to ecological damage, both globally and locally (Merino et al., 2010). In this matter, construction activities play an important role to increase the asserted problems. These and related problems have introduced the necessity for sustainable construction development in order to reduce the effects of construction activities on the environment. However, there are barriers in addressing sustainable construction development such as lack of training and knowledge in sustainable construction, unfamiliarity with green technologies in the design, lack of expressed interest, limited evidence of success, long payback period and at last but not least, lack of client commitment (Williams and Dair, 2007). To keep up with industry demand, construction companies must adopt tools and technique to deal with the client commitment from current practice to sustainability approaches and new systems of thinking.

Value management is a structural process which focuses on collating the knowledge requirements of the project and managing them throughout the construction process and then using what has been learnt to inform future project to the clients. In addition, with the VM capability for eliminating unnecessary cost, it is possible that sustainability could be upheld without unnecessary costs increased. Therefore, it can be demonstrated that sustainability can be economically viable (Abidin & Pasquire, 2005). However, the

intrinsic capabilities of VM to assist in the integration of sustainability aspects in construction projects has not been fully realised and optimised.

In addition, in Malaysia, the VM technique was introduced in 1987 by Roy Barton, at UTM and then was promoted to create greater awareness in the country, but the VM technique is still at the early stage (Jappara, 2011). In addition, value management process has not been fully applied in sustainable construction projects, particularly in Malaysia. Therefore, it seems necessary for the construction projects to use the VM technique (Mat, 2002) towards sustainability. On the other hand, the shortage of literature treating this topic and the shortage of research-based papers are postulated as a lack of recognition of the potential of VM as a tool to improve sustainable construction and an unrealised relationship among VM objectives and sustainability vision (Abidin and Pasquire, 2005; Jappara, 2011).

According to Szekely & Knirsch (2005), one of the biggest problems of sustainability in variation among what clients say they do and what they really do is that “green” products might not fulfil client requirements regarding performance, price and quality. Environmentally friendly clients might not purchase green products because the products frequently fail to fulfil their goals or because they are not eager to pay the premium price (Szekely & Knirsch, 2005). In the construction project, the efficiency of implementing green strategy in building development is also extremely relied on client’s willingness. Client’s willingness is supplied by what she can obtain. In addition, despite the attempts to identify, develop, and promote SC, many construction projects and experts are not fascinated to sustainable construction development. Most believed that such reluctance could be related to the costs of executing sustainable construction (Chong et al., 2009). It could be difficult to show how utilize of sustainable elements is

economically practical over the life cycle of a project (Al-Saleh & Taleb, 2010). According to Williams and Dair (2007), lack of client commitment is one of the most important barriers to have sustainable construction project. It is necessary to demonstrate for client that there is the link among economic performance and sustainability and demonstrating how sustainability elements can promote the project value (Szekely & Knirsch, 2005).

Although sustainable construction development would increase the quality and value of the outcome, clients were identified as less keen on SC (Ding, 2008), because client is rarely familiar with the information of the building industry; she is miserable with the risk in the cost predictions; she would like to handle the reveal in the narrowest restrictions accessible; she fails to recognise that their project drivers required the consideration of sustainability issues (Manoliadis et al., 2007). But, value management process has inherent ability such as: gathering information, gathering idea; encourage creativity and innovation; provide the function to meet the required performance at the lowest overall cost; communication, team working; focus on the client requirements. Therefore, this research investigates that whether integration of value management and sustainable construction has any effect on client attitude.

Sustainable construction development involves several parties, numerous processes, various stages and phases, with the major purpose being to bring the project to increase value project performance (Hayles, 2004). The value construction project performance depends heavily on the client attitude, quality of the managerial and financial performance. The value project performance is much wider, incorporating the attitude of the clients, considering their contributions and understanding their requirements. The value project performance is achieved, when clients meet their needs (Takim and



Akintoye, 2002). However, sustainable construction projects suffer from poor value performance in terms of time, cost and quality (Meng, 2012). The reasons behind poor value performance have attracted the attention of construction practitioners and researchers. What needs to be done to improve value performance of project has been voiced as a perennial and troublesome problem in construction (Love et al., 2011).

Also, there are many academic researches on the topic of value management and SC development, but the integration of VM with SC is virtually none. Whilst the probability of integrating VM with SC has been theoretically suggested in the previous study, it has not yet been extensively put into practice all over the world. In addition, it has not yet tested in structural modelling.

Considering the above statements, this study aims to evaluate the effectiveness of integration of value management and sustainable construction on client attitude and value performance in Malaysian green construction projects.

### **1.3 Research Questions**

Research question is essential to understand what has been studied about a subject to date in order to more the information that has been previously gathered on a subject (Haynes and Epidemiol, 2006). A research question is a clear, concentrated, concise, complex and debatable question around which the researches center it. Accordingly, in-depth understanding about the topic generates a number of questions. Since the assessment of the relationship between integration of value management into sustainable construction on client attitude and value performance is the main goal of this research, therefore, the research questions are shaped as follows:

1. How value management can cover sustainable construction?
2. Does the integration of value management and sustainable construction practices have any relation with project value performance?
3. Does the integration of value management and sustainable construction have any effect on client attitude?
4. Does client attitude have any influence on the relationship between integration of sustainable construction in value management practices and project's value performance?

#### **1.4 Research Objective**

Research objective is an active statement about what is to be achieved by the research. This research is mainly studying the integration of value management into sustainable construction. The main aim of this research is, to find out the effect of the integration of value management and sustainable construction on client attitude, and evaluate their relationship with the value performance of GBI facilitators in Malaysia. Accordingly, the followings are shaping the objectives of the research:

1. To examine the modelling of the integration of value management and sustainable construction;
2. To examine the effects of integration of value management and sustainable construction practices on project value performance;
3. To examine the effect of integration of value management and sustainable construction practices on client attitude;

4. To examine the mediating effect of client attitude on the relationship between integration of value management and sustainable construction practices, and value performance of projects.

### **1.5 Significance of the Research**

There are barriers in relating sustainable construction development in the industry (unfamiliarity with sustainable construction technologies, long payback period, lack of training and knowledge in sustainability, lack of expressed interest, limited evidence of success, slow recovery investment, high initial cost and lack of client commitment). The 5<sup>th</sup> Prime Minister of Malaysia opined that “Malaysian should not forget the importance of managing and utilising its natural resources in a sustainable manner and developers are warned to ensure that environment must not be sacrificed in favour of economic development” (Chin, 2005). Therefore, it seems essential to note that developing countries such as Malaysia have to assess the performance sustainable construction development (Ugwu & Haupt, 2007). First objective of this study explores the integration of value management and sustainable construction practices in the industry. Investigating on value management caused to identify sustainable construction issues clearly, and develop sustainable construction in Malaysia.

On the other hand, one of the most important barriers of sustainable development is client commitment. According to Williams and Dair (2007), client doesn't interest in sustainable construction because of shortage knowledge about green technology and high initial cost of implemented sustainability. Dallas (2006) stated that value management provides an exceptionally powerful way of exploring clients' needs in

depth, addressing inconsistencies and expressing these in a language that all parties, whether technically informed or new to the construction industry, can understand. Therefore, integration of value management with sustainable construction may influence on client' attitude to make them more interested in sustainable construction development. The findings of the research encourage the clients to sustainable construction development.

## **1.6 Scope of the Research**

The scopes of the research are as follows:

1. The area of this study is limited to GBI facilitators;
2. This study is focusing on the idea “integration value management and sustainable construction and its effects on client attitude and value performance” as the basic topic for this research;
3. The primary data are collected through questionnaires mainly by postal to the selective groups of respondents (the facilitators of GBI projects).

## **1.7 Thesis Organization**

A brief synopsis of each of the chapters of this thesis is included below:

Chapter one presents the research background, research problem, question of the research, research objective, significance and scope of the study. Chapter two discusses the review of existing studies on value management, sustainable construction, integration of value management and sustainable construction, client attitude and value

performance as well as their relationships. Research gap and theoretical framework have been explained in this chapter. Methodology of the study explains in the third chapter. Chapter Three also includes the research design, research flowchart, rationale for the quantitative and qualitative approaches for this study, population and sample, response rate, questionnaire design and unit of analysis. Then, chapter Four presents the analysis of the questionnaire survey data and research. Chapter Five discusses the findings of results. Finally, key conclusions and recommendations are drawn in chapter Six.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Introduction**

Previous chapter discusses the research background, research problem, research question, research objective, significance of the research and scope of the study. This chapter discusses the current knowledge of value management (VM), sustainable construction development and integration of value management with sustainable construction within the available literature, which works like a platform for further research. Firstly, this chapter defines VM, its benefit, features of VM, challenges of VM and VM workshop. Then, it reviews the definitions of sustainability, sustainable development and sustainable construction, three issues of sustainable construction, and discusses the advantages and challenges of sustainability in the construction industry. Following that, it presents integration of value management and sustainable construction development. Furthermore the role of decision makers specially the clients on the integration of value management and sustainable construction is discussed. Client's attitude towards sustainability as well as project value performance in sustainable construction and the value performance index are also reviewed. Finally, the research gap is explained and the variables and theoretical framework of the study are drawn.

### **2.2 The Review of Value Management**

Value management has become further more common due to aggressive challenges on producers (Webb, 1993) and its extensive utilize was also anticipated by Green and

Moss (1998). Thus, it is well worth creating a systematic and standardized VM study, supporting to help brilliance in its performance. After the Second World War, VM blossomed in the USA, and was worked in the UK in the mid 1960s (Fong et al., 2001). It varied during the late 1960s and into the 1970s worldwide mainly through the industrialized sector into Italy, Canada, Australia, Japan and the UK (Dell'Isola, 1998). Several aspects also began to arise worldwide during the eighty decade with the use worldwide of VM in construction project. Some countries in industrialized took forward a franchised report of VM from the USA technique, such as Korea and Japan, while others took up the technique and consequently melded it to get accounts of their local cultures and markets.

So, VM is identified by Kelly and Male (1993, p 83) as “a creative, proactive, using a multi-disciplinary team-oriented approach, problem solving service to make clear the client’s value system utilizing function analysis to expose the relationship between time, cost, and quality. Strategic and tactical decisions are audited against the client’s value system at targeted stages through the development of a project or the life of a facility.” In other words, it is a technical process for developing the design project that gives the ideal value for any service or product. If essential, change or design is established after the performance procedure has been searched with the crucial system function analysis (Fong et al., 2001).

## 2.2.1 The Definition of Value Management

There are variety definitions presented for value management by practitioners. The author has practical VM in variety of conditions and has now recognized a sequence of general study styles. Table 2.1 summarizes some of the well-known definitions.

Table 2-1 Definition of Value Management

Definition of Value Management	Key Reference
Value management is concerned with defining what 'value' means to a client within a particular context. This is achieved by bringing the project stakeholders together and producing a clear statement of the project's objectives. Value for money can then be achieved by ensuring that design solutions evolve in accordance with the agreed objectives. In essence, value management is concerned with the 'what', rather than the 'how'.	Green, 1994
VM is a proactive, problem solving or seeking service, which maximises the functional value of a project by managing its development from concept to use through structured, team-oriented exercises, which make explicit, and appraise subsequent decisions, by reference to the value requirements of the clients.	Male et al, 1998
Value management is about how to create the best value of products or services on the basis that the function must be sustained. Also, it is a powerful technique to increase the value of a product or service by reducing its production or other costs.	Fong et al., 2001
Value management involves the use of a multi-disciplinary team to clearly identify the customer's value system, and a function analysis to expose the relationship between it and the owner's objectives.	Fong et al., 2001
Value management is aimed at the economic and managerial aspects of project development to focus the definitions of project goals which are obtained through the interaction between the client and the project team members.	Liua and Leung, 2002
Value Management (VM), is a systematic and structured process of team based decision making. It aims to achieve best value for a project or process by defining those functions required to achieve the value objectives and delivering those functions at least cost (whole life cost or resource use), consistent with the required quality and performance.	Hammersley, 2002



Value management is a style of management, particularly dedicated to mobilise people, develop skills and promote synergies and innovation, with the aim of maximising the overall performance of an organisation.	Hammersley , 2002
Value management is a powerful means of achieving compliance with such requirements as well as achieving stakeholder buy-in to the planning and approvals processes. Value Management is not a review process, but a means to assist in the better management of the procurement process.	Megalocono -mos, 2004
Value management is a structured and analytical process which seeks to achieve value for money by providing all the necessary functions for projects at the lowest cost consistent with required levels of quality and performance. It is a useful approach to reduce construction costs and improve construction performance (such as efficiency and quality) in the construction industry. Also, VM has been widely used to ensure value for money for construction projects.	Kelly et al, 2004
Value management is a useful tool to cope with the many challenges: budget constraints, safety issues, environmental impact, and after all, value for money. If implemented successfully, this group problem-solving methodology can reduce costs while maintaining or improving performance and quality requirements in a project.	Shen, 2006
Value management provides an exceptionally powerful way of exploring clients needs in depth, addressing inconsistencies and expressing these in a language that all parties, whether technically informed or new to the construction industry, can understand (at the outset of a project).	Dallas, 2006
VM offers a means for the client to contribute to a better built environment and the opportunity to stimulate improvements in the construction process. These tools are useful in eliminating unnecessary costs.	Abidin and Said, 2006
Value management is a methodological management style for enhancing value in projects. It draws together conceptual thinking on the project as a value chain with historical and international developments in value management and value engineering (VE).	Male et al., 2007
Value management focuses on value system evolution and resolution within projects, or organisational systems for that matter, by bringing the right team of stakeholders together at the right time.	Male et al., 2007
Value management is distinct from other management approaches in that it simultaneously includes attributes which are not normally found together. It brings together within a single management system an emphasis on teamwork and communication; a focus on what things do, rather than what they are (function approach); an atmosphere that encourages creativity and innovation; a focus on the end users' requirements and a requirement to evaluate options	Institute of Value Management , 2007

qualitatively to enable robust comparisons of options.	
Value management is a structured, organized team approach to identify the functions in a project, product, or service with recognized techniques and to provide the necessary functions to meet the required performance at the lowest overall cost. VM seeks optimal solutions from a group of people, often consisting of client representatives and various professionals.	Qiping et al., 2008
Value management is a style of management particularly dedicated to motivating people, developing skills and promoting synergies and innovation. It is based on the concept of value and function approach where there is: a continuous awareness of value; a focus on the objectives and targets of any given project, before seeking solutions; and a focus on functions, providing the key to maximise innovative and practical outcomes.	Hayles and Fong, 2008
Value Management is a structured, systematic and analytical process that seeks to achieve all the necessary functions at the lowest total cost consistent with required levels of quality and performance.	Al-Saleh and Taleb, 2010
Value management is a service that maximizes the functional value of a project by managing its development from concept to use through the audit of all decisions against a value system determined by the client.	Lin et al, 2011
Value management is a systematic methodology for developing and comparing alternatives to deliver the most satisfying solution to a predetermined problem.	Gillier et al, 2015

In overall, from the variety definitions, VM is a structured, systematic, analytical, and multidisciplinary process to examining a project's functions and a range of client' needs in order to increase the likelihood of achieving optimum value. The aim of value management is to adjust variations in perspective among external and internal customers, and stakeholders as to what represents value. Value management defined as a systematic, analytical and structured functioned-oriented method which searches for achieve best quality by supplying all needed functions at the least total cost; constant with necessary levels of performance and quality (AS/NZS, 1994). The VM study has viewed as being centre on a participatory workshop including a representative group of

people functioning together to find the high quality option for a specific condition. As a management model it has an extensive request and can be utilized to services, projects, products, administrative procedures of projects (Male et al., 2007).

The value management process is the guideline that there is more than one solution to reach project goals and objectives and that evaluation of the solutions will generate the most suitable final result. The main stage of the value management study is function analysis from the point of view of the program as an entire. The factors differentiate value management from other techniques of increasing quality (Megaloconomos, 2004). Also, as a creative problem-solving tool, value management is unique methods in that it concurrently contains features which are not usually identified together. It provides together within a management methods a concentration on communication and teamwork; an emphasis on what things do, rather than what they are (function analysis); an environment that encourages innovation and creativity; an emphasis on the end users' needs and a requirement to examine options qualitatively to enable powerful evaluations of options (Institute of Value Management, 2007).

In other word, value management is a type of management especially devoted to motivating clients, promoting expertise and offering synergies and innovation. It is based on the theory of value and function analysis approach where there is: a continuous recognition of value; an emphasis on the targets and objectives of any given project, before searching for solutions; and an emphasis on functions, supplying the key to maximise innovative and practical results. This can be done by executing a set of facilitated workshops, held through the duration of the building project or construction, from planning through to operation, and including all key stakeholders, involving the end user (Hayles and Fong, 2008).

Therefore, value management is a suitable and appropriate tool which can be easily used to improve the final result of any construction project, from main infrastructure to housing projects; supplying the appropriate time and resources allocated to decision making early on in the life cycle of the construction project (Hayles and Fong, 2008).

### **2.2.2 The Benefits of Value Management**

There is a rise of interest in value management process in the building and construction industry. For example many government departments and private enterprises in Hong Kong such as Civil Engineering Department, the Architectural Services Department, Kowloon-Canton Railway Corporation, and Mass Transport Railway Corporation have applied value management to ensure best value for money for their projects during the initial project feasibility study phase (Shen and Chung, 2000), because, the whole approach of a VM process is incorporated into the project management method to insert value to the project. The outputs of the VM process will contain issues such as time to reach decisions, quality of decision, and pleasure with the results. A VM process can result with several of intangible advantages such as enhanced realization of client needs and communication between stakeholders (Shen et al., 2006). It has been caused to improve the project value performance (Yang et al, 2009). Also, VM is a high profit performance with a low cost. If incorporated into the management strategy in the project development the cost can be minimal, as a result of decreased need for following reviews and options for replace VM for some of the program value determine and high quality inspect that are essential (Hammersley, 2002).

Value Management has a wide range of programs through the strategic procurement and planning processes. It is especially valuable in distilling or focussing priorities and objectives, and in creating alternative methods (Megaloconomos, 2004).

According to Value management guideline (2004), Hammersley (2002) and Hsiu-Min (2010) VM process has many benefits. These benefits have been summarized in a better comprehension of requirements and the functions necessary to meet those requirements; any ambiguities and misperceptions are resolved; a better definition of project objectives or program; clear definitions of roles and responsibilities; simple, clear definition of specific stakeholder needs; a better definition of performance standards and quality; clearer briefs; prevention of unnecessary expenditure through reducing waste and inefficiency; reduced wastage of resources; capital funds savings; enhanced operational efficiencies; improved team and client relationships; improved communications; improved teamwork with joint ownership solutions; strategies which and team building; create a climate of shared understanding; reduce risks and conflict; consideration of all options, alternatives and innovative ideas; foster joint ownership of problems and solutions; create new ideas for enhanced results; improve the skills of the participants; enhanced value culture.

Therefore, these benefits of VM process provides a firm structure on which to shape new practices, procedures and organisation by: demonstrating the true cost of operations; highlighting non productive / high cost elements; improving customer support by identifying “right first time” practices; enhances understanding by all of the true costs and functions of operations; improving the ability of all to contribute to cost management; increasing competitiveness (Gillier et al, 2015).

The profits of a value management study are supposed in terms of reduced cost and enhanced quality. Mutual understanding and consensus between clear objectives, stakeholders, decreased risk of modifications in opportunity and enhanced communications will assist ensure that the project matches the program objectives of the client and is done on time (Hammersley, 2002).

Therefore, the share of VM is to ensure that such choices are accountable, explicit and rational. The study assists as a consensus-building training between varied members. The rationality of VM assures that choices are designed as cautiously as possible in the available info. Nevertheless, the rationality on provide is not substantive, but procedural (Green and Moss, 1998).

### **2.2.3 The Features of Value Management**

Value management generally includes short and strenuous reviews at crucial points in the project's lifecycle by a group of reviewers not connected with the project. The concept and methods of value management attempt to gain the demanded high quality at ideal whole-life cost throughout the developing construction project. Value management strives to increase value project performance within cost, time and quality constraints and limitations (Liua and Leung, 2002). The underlying theory is to gain the necessary functions at the least probable cost without compromising quality. The goal is to kindle the finding and evaluations of high cost options and really motivate creativity, which should final result in generating much better solutions that can increase the quality of the service or product (Fong et al., 2001). The features of VM give better decision, enhanced effectiveness, increased services and products, improved competitiveness,

enhanced internal teamwork, communication and choices which can be supported by all members (British Standard EN 12973, 2000).

The main role of the value manager is determining, building and providing a study model adapted to a certain value problem within a project, organisational grouping or service. The problem is utilized in a natural sense to indicate an issue, conundrum or enigma. It has a strong connection with the concept of a mathematical puzzle and does not suggest a value-laden term such as problems. Building a process needs thought of the value problem tactically and rationally, using account of the various stages within the process, and the extent to which value systems (various member aspects) coalesce or conflict. Therefore, the abilities of the value manager contain the potential to comprehend a value problem, shape a procedure (manifesting during the pre-workshop phase), getting associates from contending value systems together and present enhancements consequently (via the workshop phase), and, assure that these positive aspects are implemented (through post-workshop phase). Value management as an advice-laden change-oriented method and expert service needs to be addressed, delivered and designed as such (Male et al., 2007).

#### **2.2.4 The Value Management Workshop**

VM study is methodical as it uses an organized job plan that instructions the team via problem solving and seeking in a coordinated method (Woodhead et al, 2001). In this process, value shift ascertains the project objectives which offer aims to modify over time throughout client modifies and improvements by designers, amendments to legislation etc (Liua and Leung, 2002).

Systems engineering recognizes 'the need or the objective to be attained', and systems analysis presents 'an ordered way for choosing the best between the alternative system which could complete that need' (Checkland, 1981). Additional research in the decision procedure is carried out for the recommendation of several alternatives for the decision-maker to make judgement and evaluation. VM is portrayed as induced by the external and internal input elements in the ecology leading to a decision-making procedure which generates results to describe the project objectives. Output of VM process becomes input to other systems, e.g. decision output of VM acts as input to more the management method. The modification of values and quality into project objectives as a decision making procedure contain objective analysis, objective setting (involving identifying an objective hierarchy) and solution assessment (Liua and Leung, 2002).

Therefore, the process offers a discussed communication and team decision making system which can support stakeholders changing info, creating presentation, making ideas, analyzing ideas, and prioritizing ideas in VM process. The study offers data analysis method such as a multiple criteria decision modelling tool and a simplified cost modelling tool to enhance the effectiveness of the VM study. However, these methods only present a solution for team members to assess details further more efficiently (Qiping et al., 2008). Several of the techniques and tools employed by value managers are not distinctive in the strategy, holding job plan process is in no method special, neither is facilitation of groups, and there are numerous techniques that have a systematic procedure to them (Male et al., 2007).

A VM process is a organized technique which comprises of pre-workshop, workshop and post-workshop. Each phase needs the input of prior phases and produces output for the following phases (Shen et al., 2006).



Previous studies (Hammersley, 2002; Shen and Chung, 2002; Qiping et al., 2008), show that value management is a developmental study with three main phase component (pre-workshop, workshop and post workshop). First, a value system that has interaction requirement to be created direct and aligned or re-aligned to enhance the value of money decisions to be designed adequately. Second, a related team-based approach including team members in a workshop scenario. Third, the use of function analysis stage in order to enhance a better and greater comprehending through value systems of why some factor is or is not necessary (Male et al., 2007). These cores will be detailed as follow:

- First core (pre-workshop): The client and project manager connect with the VM facilitator to explore how and whether VM could support a specific construction project. The project management process the conditions and distinct challenges of the project, the characteristics of the choices to be built, stage in the procurement programme and process. The Facilitator recommends suitable VM strategy, and achievable structure, time schedule for a VM process and knowledge necessity.

- Second core (workshop): Using methods particularly chosen for the workshop and Client's requirements, the facilitator manage the workshop throughout an extremely participative team decision making method, to attain the workshop targets placed at the Strategic Diagnosis gathering. The stages are: team briefing; function analysis; alternative choice and development; idea evaluation; idea development; decision making and implementation. Workshops usually continue from 1 to 2 days but may be longer. A VM workshop might have up to 16 people.

- Third core (post workshop): The project team members present the outcome of keep up activities coming from the workshop, and which are to be shown in the last statement. Also, the facilitator provides a primary statement for discourse by the main members.

This may take various shapes, from a short summary of the important points at each phase, decisions and activities, to a complete document appropriate for the public domain comprising all the working content and perspective to the decisions, and offering a comprehensive review trail (Roufechaei et al, 2012).

Previous studies have addresses various value management process structure. For example, the study by Hammersley (2002) organizes seven phase (Initiation and information; Function analysis; Speculative stage; Evaluate the ideas; Develop proposal; Present recommendation; Report). Fong et al. (2001) suggests five stages for value management process (Orientation stage; information and analysis stage; Speculate stage; Evaluate stage; Implementation stage). Also, Male et al., (2007) called these steps “Job Plan”. Job Plan is included:

- Information: clarification of the constraints and opportunities;
- Function: analysis of the functions and their associated cost and commercial value;
- Creativity: generation of alternative ways to improve value and to meet functional needs;
- Evaluation: evaluation of value performance and the cost–saving of all alternatives;
- Development: identification of tasks and actions required to reach the final value.

Table 2.2 shows the value management workshop process.