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**PERFORMANCE MANAGEMENT OF  
VALUE MANAGEMENT IMPLEMENTATION IN THE  
MALAYSIAN CONSTRUCTION INDUSTRY**

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**Performance Management of Value Management**  
**Implementation in the Malaysian Construction Industry**

**MOHAMAD RAMLY Zuhaili Bin**

A thesis submitted in partial fulfilment of the requirements  
for the degree of Doctor of Philosophy

**March 2015**

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## DEDICATIONS

*To my late father **Hj. Mohamad Ramly Bin Abdul Malek**,  
May Allah S.W.T grant you to the Jannah.*

*This thesis is dedicated to my beloved mother,  
**Arbiah Binti Mat Zain** and the entire family members for their endless  
love and understanding, care and supports.....*

## **ABSTRACT**

The criticism that the construction industry underperforms has attracted the interest of researchers in an effort to help improve the situation. Various methods, techniques, and tools have been introduced over the years to enhance the performance of projects. From these, value management (VM) has emerged as a strategic management approach to promote better value for projects and offer benefits to both the project itself and the project team.

Relevant literature reveals that the major focus of VM research is practices and awareness, support tools, and integration of VM with other management tools; there has been less emphasis on the development of VM theory and the performance of VM. Although there have been attempts to measure VM workshop performance through incorporating both quantitative and qualitative measures, in order to provide meaningful information the measured data needs to be transformed through performance evaluation and insightful management.

The aim of the research underpinning this thesis was to investigate the extent to which VM implementation can contribute positively towards the successful execution of projects. To achieve this aim, the Malaysian construction industry was studied with the objectives of identifying a set of critical success factors (CSF) and key performance indicators (KPI) for VM implementation; measuring and evaluating the efficiency and effectiveness of the processes and outputs of VM applications; exploring the critical issues encountered in implementing VM; and developing and validating a performance measurement model, a performance evaluation model, and a performance management framework for VM implementation in the construction industry.

The first stage of the research employed content analysis to explore knowledge gaps and identify CSFs and KPIs through statistical testing. In the second stage, a case study approach was adopted that involved analysing the application of VM in five public sector projects in Malaysia through observations, questionnaire surveys, and semi-structured interviews. Finally, the models and framework were developed and validated using structural equation modelling (SEM) and focus group meetings with VM practitioners in Malaysia.

The research identified ten CSFs and fifteen KPIs for VM workshop implementation in Malaysia. The performance measurement model was developed using SEM to present the interrelationships between the KPIs and VM performance, while the performance evaluation model was developed using the fuzzy synthetic evaluation to transform the performance data into valuable information. Based on overall scores from the questionnaires, the performance of VM implementation for the five case studies can be concluded as good. Findings from the semi-structured interviews and the observations supported this conclusion, as well as identifying the critical issues in VM implementation from the perspective of VM domains and stakeholders.

Both developed models were incorporated into the performance management framework, which will assist VM stakeholders in understanding the variables that may impact VM success and help to inculcate a VM learning culture among them. The overall findings of this research could have a profound impact on the way VM is applied within the construction industry in the quest to institutionalize VM as one of the best 'value for money' management practices. In addition to which, the discussions generated by this

thesis contribute to the literature on VM practices and could serve as a reference for practices in other countries.

## **PUBLICATIONS**

### **Refereed Journal Papers - Published**

1. **Mohamad Ramly, Z.**, Shen, G.Q.P., Yuan, Z., Yu, A.T.W., Chung, J.K.H., and Dong, T.Q. (2013). “Learning by Doing: A Hands on VM workshop for postgraduate students”. *Value World of SAVE International*. 36(1), 3-10.
2. **Mohamad Ramly, Z.**, Shen, G.Q.P., and Yu, A.T.W. (2015). “Critical success factors for value management workshops in Malaysia”. *Journal of Management in Engineering*, Vol. 31(2) 05014015.
3. Yuan, Z., Shen, G.Q.P., Chung, J.K.H., **Mohamad Ramly, Z.**, Yu, A.T.W., Wang, H. (2015). “An experimental study on virtual value management workshop in Hong Kong”. *Journal of Management in Engineering* [Ref. No. MEENG-998R2-Publication in progress].

### **Refereed Journal Papers – Under review**

1. **Mohamad Ramly, Z.**, Shen, G.Q.P., Yu, A.T.W., Yuan, Z. and Chung, J.K.H., Dong, T.Q. (2014). “Group decision support system for value management workshops: A case study in Hong Kong”. *Journal of Professional Issues in Engineering Education and Practices* [Ref. No. EIENG-581R2].
2. **Mohamad Ramly, Z.**, Shen, G.Q.P., and Yu, A.T.W. (2014). “Key Performance Indicators for value management workshops in Malaysia: An exploratory analysis”. *Facilities* [Ref. No. F-11-2014-0085].

3. **Mohamad Ramly, Z.**, Shen, G.Q.P., and Yu, A.T.W. (2015). “Evaluating the performance of value management workshop using fuzzy synthetic evaluation”. *Journal of Management in Engineering* [Ref. No. MEENG-1351].
4. Yuan, Z., Shen, G.Q.P., Chung, J.K.H., **Mohamad Ramly, Z.**, and Yu, A.T.W. (2014). “A comparative study of using remote group decision support system (GDSS) to support virtual value management workshop: An experimental study”. *Construction Innovation: Information, Process, Management* [Ref. No. CI-01-2014-0001].

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2. **Mohamad Ramly, Z.**, Shen, G.Q.P., Yu, A.T.W. and Yuan, Z. (2013). “A comprehensive review of scholarly research on value methodology in construction”. *Proceeding of the 2013 International Conference on Construction and Real Estate Management*, 10 -11 October 2013, Karlsruhe, Germany, 99-112.
3. Yuan, Z., Shen, G.Q.P., Chung, K.H. and **Mohamad Ramly, Z.** (2013). “A study of virtual value management workshop: Identifying risks of its implementation”. *Proceeding of the 2013 International Conference on Construction and Real Estate Management*, 10 -11 October 2013, Karlsruhe, Germany, 712-724.

4. **Mohamad Ramly, Z.**, Shen, G.Q.P., Yu, A.T.W., Zahari, R. and Emby, J. (2015). “Enhancing values in public construction projects: The Malaysian journey”. *Joint HKIVM-SAVE International Conference*, 8-9 May 2015, Hong Kong, 73-77.

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#### **Book Chapter**

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Finally, any errors or inadequacies that may remain in this work, of course, the responsibility is entirely my own.

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## LIST OF ABBREVIATIONS

AMOS	Analysis of Moment Structures
BSC	Balanced Scorecard
CAQDAS	Computer-Aided Qualitative Data Analysis Software
CIDB	Construction Industry Development Board
CSFs	Critical Success Factors
CVS	Client Value System
EFA	Exploratory Factor Analysis
EPU	Economic Planning Unit
FGM	Focus Group Meeting
FSE	Fuzzy Synthetic Evaluation
GDP	Gross Domestic Product
GFA	Gross Floor Area
GOF	Goodness of Fit
ICU	Implementation and Coordination Unit
IVMM	Institute of Value Management Malaysia
KMO	Kaiser-Meyer-Olkin
KPI	Key Performance Indicator
MAHB	Malaysia Airport Holding Berhad
MOF	Ministry of Finance
MYR	Malaysian Ringgit
NAD	National Audit Department
PWD	Public Works Department
QS	Quantity Surveyor
RICS	Royal Institution of Chartered Surveyors
SAVE	Society of Value Engineers
SEM	Structured Equation Modelling
SME	Subject Matter Expert
SOA	Schedule of Area
TNB	Tenaga Nasional Berhad
TQM	Total Quality Management
UCI	Union Cyclist International
VA	Value Analysis
VE	Value Engineering

VM Value Management  
VR Value Review



## **CHAPTER 1: INTRODUCTION**

### **1.1 Research Background**

Malaysia's economic success has been one of Asia's best since independence in 1957 due to a diversified economy anchored by the services and manufacturing industries. The Malaysian construction industry is among the sectors that continue to receive significant demand due to inadequacy of infrastructure and significant demand. It is considered a prime productive sector among the top three that also include manufacturing and agriculture (Abdul Razak et al., 2010). Despite a small contribution at 3.5% of the Gross Domestic Product (GDP) in year 2013, the construction industry is crucial to Malaysia's economy due to its role as a leading indicator and determinant of domestic performance by providing intermediate inputs such as the physical infrastructure for industrial production and reproduction. This scenario is known as the forward and backward economic linkages between various sectors in the economy. The backward linkages are measures of the demand created by one economic sector for the product of other sectors which is very significant in the case of the construction industry.

Bassioni et al. (2005) reported that the construction industry has been criticized for its under-performance and that this is a major competitive issue. Specifically, delays in construction are the most common problems across geographic regions in Malaysia. Sambasivan and Soon (2007) carried out research focusing on delays of construction projects in Malaysia, where they revealed sixteen causes of delays based on eight major factors: client, contractor, consultant, material, labour and equipment, contract, contractual relationship, and external factors. It was followed by the identification of 113

causes of delays under eighteen different clusters (e.g., stakeholders, design, materials, contractual, external) by Ramanathan et al. (2012). They reviewed various project management journals over the past fifteen years to present a more comprehensive coverage of different countries.

The top five categories that contributed to the delay of projects are the client, the contractor, design and equipment, labour and the contractual relationship. The delays indicate that there are many factors that may affect the project performance in terms of time. Delays are also directly connected to other two indicators: cost and quality. When the completion date is delayed, the projects will either be extended or accelerated. In both circumstances, it involves additional costs to all stakeholders, primarily for the client (Ramanathan et al. 2012).

Moving into the current era of globalization, recognition and promotion of new methods and approaches are required to improve the image of the industry. Aspects of construction practices, management, and technology must be enhanced and upgraded to meet the exacting standard required today. At this juncture, it is clear that fundamental changes are now needed in order for the industry to be more efficient and address the overarching challenges and demands. Moreover, clients nowadays are concerned with matters of value to achieve the best return on investments.

The introduction of value management (VM) can play vital roles in putting most of these issues together as a specific management tool in managing complex and multi-tasking construction projects, be it for technical or management aspects. VM was first introduced therefore as a value analysis (VA) technique by Lawrence D. Miles in 1942. He was

assigned to look into the problem of materials shortage due to the extensive use of materials during the Second World War. Miles analysed the primary function of the product by examining several alternatives that perform the same function without compromising the quality of the final product.

It was then widely used in the US and later in Japan, Italy, Australia, and Canada in 1970s with the term value engineering (VE) before it further gained interest in India, South Africa, England, France, Sweden, and Germany. However, the applications of VM do not seem to be well-embraced in the Southeast Asian countries even though it was present in Australia since 1970 and Hong Kong since 1988 (Yu, 2006). Nonetheless, VM is sound and possesses reliable applications within the construction industry in SEA (Cheah and Ting, 2005).

According to Jaapar and Torrence (2009), a construction project is a one-off activity, with one chance to achieve a satisfactory outcome. It is important to establish unambiguous objectives since it requires a significant commitment of time and resources although it may provide benefits far exceeding its cost. The objectives are supposed to be in line with technological advancement, uncertain economic conditions, social pressures, and fierce domestic and international competition. This is true where clients place more demand on project cost, time and value for money (Fong and Shen, 2000). Clear project objectives are also relevant in response to several issues and constraints faced by the construction industry as well as world economic crises in general, especially the shortage of resources such as labour and material.

In that sense, VM is believed to provide the basis for improving return on investment in construction which helps the industry to be more competitive, to provide better satisfaction, and be able to cushion the impact of globalization in the near future (Jaapar and Torrence, 2009). VM may increase the ability to satisfy client demands and requirements while at the same time to deal with the complexity and uncertainties in managing construction projects. Hence, VM provides the basis for improving value for money in construction to satisfy clients' needs and requirements (Jaapar and Torrence, 2009).

Latham's report 'Constructing the Team' (1994) highlighted the benefits of VM and included it as a critical factor to the success of the project in providing value for money. The Royal Institution of Chartered Surveyors (RICS) names VM as one of the ten critical success factors (CSFs) in seeking best value for money (Atkin and Flanagan, 1995 in Simister and Green, 1997). It is well recognized as a best practice within the UK construction industry based on the increasing number of applications. "A study of VM and Quantity Surveying Practices" published by RICS marked the significant development of VM applications in the construction industry since it was introduced in 1960's by Dell'Isola.

## **1.2 Research Problems**

A lot of companies in the construction industry waste resources in their projects. The waste occurs due to the complex supply chain with different stakeholders wanting to achieve their business goals instead of achieving overall project efficiency. The construction environment is dynamic with increasing uncertainty in technology, budget,

operational processes, and interaction between the processes among the stakeholders (Nurudupati et al., 2007). For this reason, the Latham and Egan report urged the industry players to put more effort in improving performance through performance measurement (PM) (Bassioni et al., 2005).

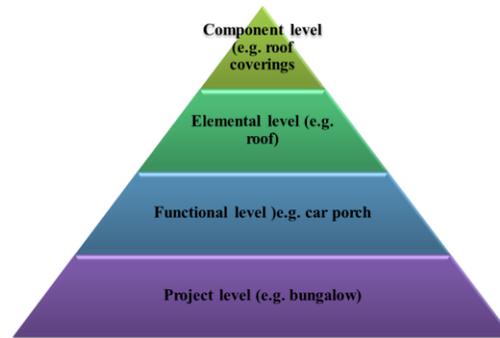
Over the past decade, three major indicators were used as tools to measure the performance of construction projects by many companies in the construction industry (Nurudupati et al., 2007). Atkinson (1999) introduced the “Iron triangle” (Figure 1.1) to assess the performance of construction projects. Timely delivery within budget and to the level of accepted quality standard specified in the contract is a common indication of successful project delivery. However, rarely projects can achieve those targets (Meng, 2012). The applications of VM aim at putting all these together to improve the value of the project.



**Figure 1.1 The Iron Triangle (Sources: Atkinson, 1999)**

VM methodology looks into the functions of the project in a broad perspective. It can be further scrutinized to identify the function of a particular element, components, system, and the item used in construction projects. Function refers to the performance characteristics that distinguish it from other things. In doing so, function analysis was adopted to identify the necessary functions required. In delivering construction projects, the design team must always refer to the client’s requirements in ensuring that the design

of the project provides what is required and necessary. Figure 1.2 illustrates the level of function analysis with an example of roofing a bungalow project.



**Figure 1.2 The levels of function analysis**

Since the introduction of VM into the construction industry, it has gained popularity among industry professionals and academic scholars. It has been applied in many countries by various stakeholders at different levels of project development with different tools in attaining return on investment. However, there is scarce research analysing the development of the field of VM in construction.

Reviews were conducted into the scholarly research in the discipline of VM in construction over the past two decades. Content analysis was carried out on 45 papers published in top journals in the area of construction engineering and management. Analysis focused on identifying the research trends in this field and identifying areas for future investigation, building upon the work of others such as Xue et al. (2012) on information technology applications in architecture, engineering, and construction projects, Hong et al. (2012) on partnering in construction, Yuan et al. (2011) on waste management, Tang et al. (2010) and Ke et al. (2009) on public-private partnership, Xue et

al. (2010) on collaborative working in construction, Holt (2010) on contractors' selection, and Lin and Shen (2007) on value management in construction.

A search was carried out using academic journal databases to retrieve published papers. Both Scopus and Science Citation Index Expanded were used because some of the journals were not indexed by each other. By assuming that author(s) may be keen to publish their papers in first-tier journals based on the quality of the journals (Bröchner and Bjork 2008), the search results were further refined by making reference to the journal ranking list recommended by Chau (1997) in the area of construction engineering and management and institutional journals listed. This procedure enabled me to determine which of the journals to be included. The authors used a similar approach to those previously adopted by Bröchner and Björk (2008) for construction management related journals and McKercher et al. (2006) for tourism and hospitality related journals.

To explain the search of journals in detail to facilitate an in-depth illustration of VM related research, this research adopted a three-stage literature review method to analyse the published papers between 1993 and 2013. A comprehensive desktop search conducted under the title/abstract/keywords of value management, value engineering, value methodology, and value analysis, with a specific inclusion of construction. Papers with these keywords included in the title, abstract, or keyword were considered to have met the initial requirements. The full search code was as follows.

```
(TITLE-ABS-KEY("value management")OR TITLE-ABS-KEY("value engineering")  
ORTITLE-ABS-KEY("value methodology")OR TITLE-ABS-KEY("value Analysis")  
ANDTITLE-ABS-KEY("construction"))AND PUBYEAR > 1992 AND (LIMIT-
```

TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "re")) Search result: 424 (Searched on 1 March 2013)

**Table 1.1 Number of papers in the selected construction journals**

<b>Journal title</b>	<b>No. of papers</b>	<b>Percentage (%)</b>
Journal of Construction Engineering and Management	27	24.8
Journal of Management in Engineering	17	15.6
International Journal of Project Management	15	13.8
Construction Management and Economics	14	12.8
Engineering, Construction and Architectural Management	8	7.3
Automation in Construction	7	6.4
Building Research Information	7	6.4
Canadian Journal of Civil Engineering	4	3.7
Facilities	3	2.8
Journal of Professional Issues in Engineering Education and Practices	3	2.8
Building and Environment	2	1.8
Journal of Computing in Civil Engineering	2	1.8

Based on the result of the desktop search from both search engines, 424 papers were identified. By cross-referencing the top journals as described earlier, only 109 papers were selected. Table 1.1 presents the details of findings according to the journals. The Journal of Construction Engineering and Management published by The American Society of Civil Engineers recorded the highest number of papers (27), followed by Journal of Management in Engineering with 18 papers from the same publisher. Other journals with a significant number of papers include International Journal of Project Management (17) and Construction Management and Economics (14).

The search progressed by detailed screening in the second stage. Focus was given to analysing the entire abstract and identifying the keywords used in the entire paper. The objective of this process was to identify papers that are relevant and exclude irrelevant ones based on these keywords. Finally, 45 papers were identified for details analysis in a third stage. Tabulation of the selected papers is presented in Table 1.2.

**Table 1.2 Number of papers in the selected construction journals**

<b>Journal title</b>	<b>No. of papers</b>	<b>Percentage (%)</b>
International Journal of Project Management	10	22.2
Construction Management and Economics	7	15.5
Journal of Construction Engineering and Management	7	15.5
Journal of Management in Engineering	6	13.3
Automation in Construction	5	11.1
Building Research Information	2	4.5
Canadian Journal of Civil Engineering	2	4.5
Engineering, Construction and Architectural Management	2	4.5
Facilities	2	4.5
Journal of Computing in Civil Engineering	1	2.2
Journal of Professional Issues in Engineering Education and Practices	1	2.2

In analysing the selected papers, a citation index was used to identify papers considered highly influential and the effect they had on other researchers within the subject area. The number of citations of each paper was easily identified from the function provided by both search engines. As indicate in Table 1.3, the paper entitled “*Critical success factors*

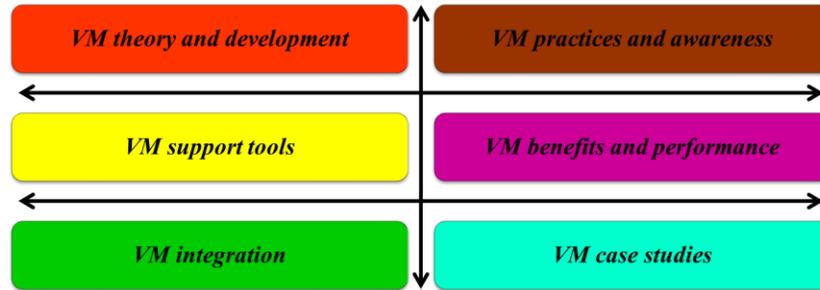
*for value management studies in construction*” by Shen and Liu (2003) was cited thirty-six times over the period covered by this research.

The highest number of citations reflects scholarly areas of expertise and it is interesting to note that in terms of geography, 20 papers originated from Hong Kong, compared to five from the UK and four each from USA and Korea. Clearly Hong Kong has the most productive scholarly community in this field of research.

**Table 1.3 Most cited VM related papers**

<b>Title of paper</b>	<b>Author(s)</b>	<b>Year</b>	<b>Total Citation</b>
Critical success factors for value management studies in construction	Shen, Q. and Lin, G.	2003	36
Developing a soft value management model	Liu, A.M.M. and Leung, M-Y	2002	27
A group decision support system for value management studies in the construction industry	Shen, Q. and Chung, J.K.H.	1996	21
Managing value as a management style for projects	Male, S., Kelly, J., Gronqvist, M., and Graham, D.	2007	20
Holistic appraisal of value engineering in construction in United States	Palmer, A., Kelly, J. and Male, S.	1996	20

In analysing the papers, each paper was grouped under one main theme. Finally, six themes were identified as illustrated in Figure 1.3 and presented in the following subsections. Based on the identified theme, VM performance is one of the most attractive and inspired this research.



**Figure 1.3 Themes of research in the field of value management**

Several papers highlighted the benefits of applying VM, which can be evaluated by measuring the performance. Promotion of benefits and success stories of VM applications can enhance its reputation. To start with, Shen and Liu in 2003 identified and distinguished the CSFs for VM workshops' implementation according to their degree of importance. Fifteen CSFs were identified under four main clusters, namely: VM team requirements, client influence, facilitator's competence, and relevant department impact. Clear objectives of the workshop and professional experience and knowledge of the participants have been identified as new significant success factors, compared to previously identified CSFs by Male et al. (1998).

The identified CSFs were further refined and adopted in developing performance measurement frameworks for VM workshops in 2007. Lin and Shen examined the strength and weaknesses of the existing measurement frameworks. Among those reviewed were the Balance Scorecard, The European Foundation for Quality Management, the Excellence Mode, the Malcolm Balridge National Quality Award, and Key Performance Indicators. Lin and Shen's main argument was to incorporate the non-financial indicators in measuring the workshops' performance. Hence, they proposed a

framework consisting of *predicting* indicators, *process performance* indicators, and *outcomes performance* indicators (Lin et al. 2011).

Drawing on the work of Lin and Shen (2007), Chen et al.'s work in 2010 attempted to measure the performance of VM workshops by claiming that previous work had not brought a fair evaluation since they focused only on key influences on causes of the VM workshops. Their proposed model consists of four performance assessment aspects, comprising 23 performance assessment criteria. They applied the proposed model into two VM workshops of large-scale transportation projects in Taiwan. Both works of Lin et al. (2011) and Chen et al. (2010) are similar in general. Apart from the terminologies being used, it is found that the latter provides more detailed criteria/indicators for the evaluation. Previous work by Fong et al. (2007) focused on the benefit of knowledge creation. Fong et al.'s works showed that the knowledge of different stakeholders involved in the VM workshops creates new knowledge throughout the processes that require proper management. That has subsequently been highlighted partly by Zhang et al. (2009) about the VE-Knowledge Management System.

### **1.3 Identification of Research Gaps**

In past decades, scarce research was conducted into the performance aspect of VM studies. However, the previous research provides a good platform for this research to kick-off.

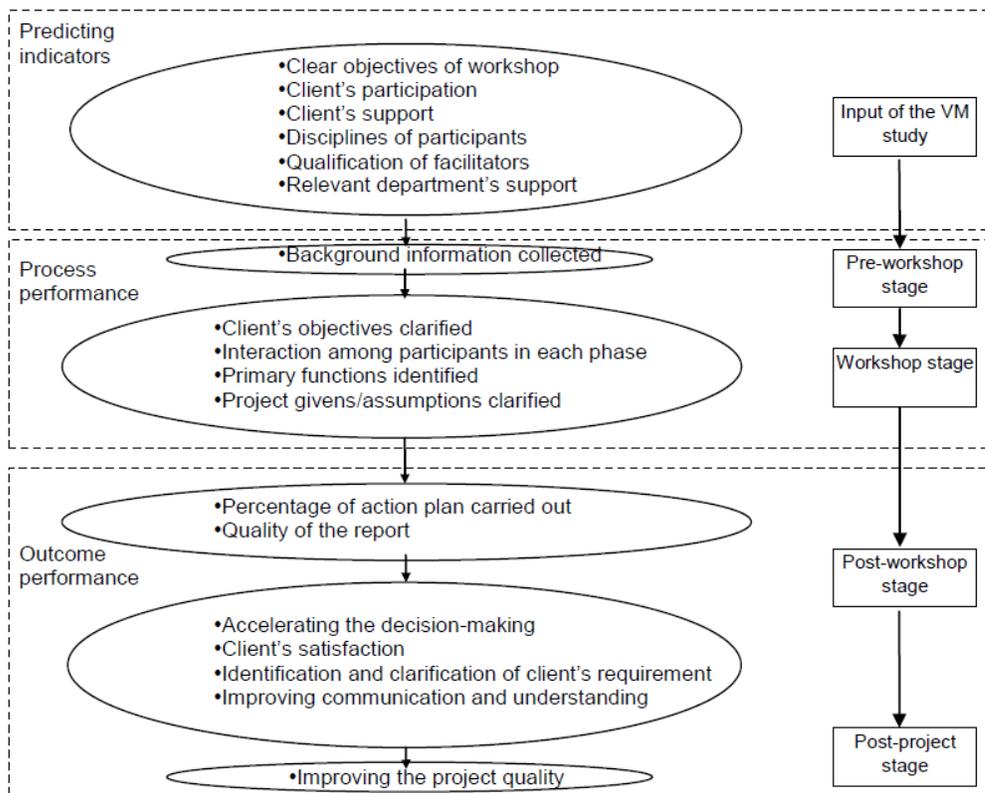
Kelly and Male (1993) and Palmer et al. (1996) introduced the performance measurement framework that merely focuses on cost reduction. Palmer et al.'s concluded that the

success of VM workshops depends primarily on the leader's personality, workshop timing, and the interaction of the VM team members. Through a benchmarking study, Male et al. (1998) highlighted ten CSFs for VM studies. The research team concluded that client satisfaction would be a good indication of the performance of VM applications. Data related to the project collected after the applications of VM could be added to give an overall indication of the performance of VM.

Shen and Liu (2003) reviewed the literature on factors affecting the success of VM studies and identified 15 CSFs grouped in four clusters: value management team requirements, clients' influence, facilitator competence, and relevant department's impact. They argued that each VM study is unique according to the uniqueness of the target project, which calls for a flexible measurement. It should be prompt and cost-efficient because of the time and resource limitations of VM studies. Chen et al. (2010) quoted previous works of Chen et al. (2003) that has identified three main factors that may affect the workshop performance. It includes the integration of the workshop in the project, the team factors (e.g., leadership, dedication, communication) and, finally, it is most influenced by the project characteristic and attributes.

A study of the CSFs of VM by Lin and Shen (2007) reviewed the literature on PM in a hierarchical way by exploring the generics of PM and its development in various industries. The extensive review covered 324 articles pertinent to PM in general and VM in construction in particular. From these articles, they identified 23 factors that affect the successful implementation of VM workshops. The same study conducted a survey of experienced construction practitioners in Hong Kong, the USA, and the UK identifying 15 CSFs for VM workshops.

VM studies conducted on a process-based, structured methodology to achieve the goals and objectives. The development of PM frameworks provides guidance on what to measure, how to measure, and also to make best use of the measures (Nudurupati et al., 2011). However, it was found that the process-related performance is seldom being given attention and considered when measuring performance.



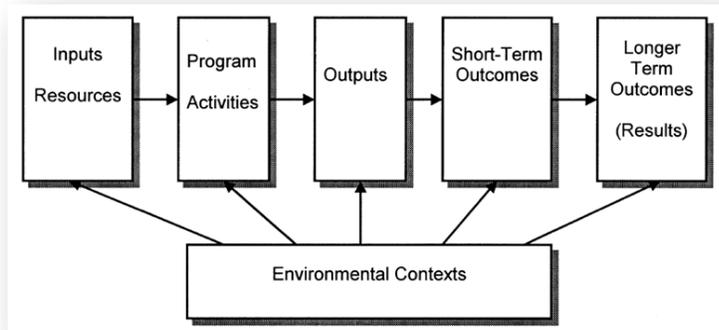
**Figure 1.4 KPIs for measuring the performance of VM studies (Source: Lin, 2009)**

Lin (2009) proposed a framework for measuring the performance of VM studies in construction by taking a different approach to measuring the performance to be in line with the nature of VM studies. Through a review of available literature and previously conducted VM reports, Lin determined the factors which have an influence on the performance of VM studies based on the nature of VM studies, the overall process of the

construction project, and also the basic principle of measuring the performance. There are 13 major factors deemed to have an impact on the performance of VM studies presented in the Figure 1.4. Based on the proposed PM framework, the indicators as the parameter to quantify the efficiency and effectiveness of the processes and outputs were determined.

It is likely that some of the indicators determined by previous studies may be applicable within a Malaysian scenario. However, Pasquire and Maruo (2001) and Hunter and Kelly (2007) argued that geographical differences may result in different indicators that are relevant to a specific location. Aspects such as political, economic, cultural, and project delivery systems may influence the perceived level of agreement on a particular performance indicator. Using Lin and Shen's findings as a basis, this research was carried out to identify and propose the critical success factors and key performance indicators that can be adopted to suit the Malaysian construction industry.

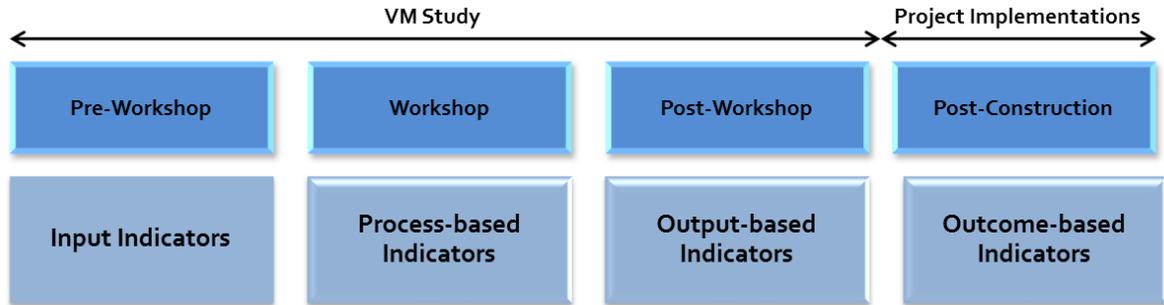
On top of that, the theory and literature of performance provide a justification for this research to further refine the PM framework for VM studies and how to manage the performance of the VM team, the project team, and finally to the client organization as the owner of the project.



**Figure 1.5 Example of Logic Model (Source: Scheirer, 2000)**

Figure 1.5 presents the sample of the logic model that would help to improve understanding of the strength of the relationship between potential indicators and the desired outputs and outcomes in any process or system. However, it is crucial to understanding the distinction between outputs and outcomes so that they can be used appropriately. Outputs measure what the process or system have produced, and outcomes represent why the process/system are in place. Outputs are associated with the direct immediate term result associated with the process that can be obtained immediately after completing the process. Meanwhile, outcomes associated with medium-term effect and consequences of the process after quite sometimes, depending on the nature of the process.

On the other hands, Figure 1.6 presents the application of the logic model for managing the performance of the VM implementation. The model presents a process-based structure framework to represent the full spectrum of processes involved in VM methodology.



**Figure 1.6 A logic model of evaluating the performance of VM**

Based on the logic model of VM studies presented, it will be mapped into the proposed PM framework for VM studies in construction. This framework is an extension of the PM framework by Lin (2009) into a broader scope of performance which in total provides a clear picture on how to manage the performance of VM studies and how it impacts construction projects. From the literature review, a clear theoretical framework presently does not exist to identify the relationship between the performance measurement and evaluation of VM studies to the successful implementation of the construction project.

Hence, this research is proposed to determine, develop, and validate the framework for performance management of VM studies in the construction industry and to fill the gap in knowledge by adopting previous research work by Lin (2009) as a stepping-stone and further explore performance management as a variable. The goal of this research is to have an in-depth study of the performance management of the VM studies in the construction industry. The effort to manage the performance is to ensure that the benefits offered by the VM methodology will give impact to the projects and directly satisfy the stakeholders of the project, especially the client.

#### **1.4 Research Aim and Objectives**

The aim of this research is to investigate to what extent successful VM implementation can contribute positively toward the successful execution of projects. Hence, the hypothesis is: successful VM implementation will contribute positively toward the successful execution of projects.

The specific objectives of this research are as follows:

1. To identify a set of critical success factors and a set of key performance indicators for VM implementation from Malaysian construction industry perspectives with reference to international practices.
2. To measure and evaluate the efficiency and effectiveness of the processes and outputs of VM applications in Malaysia.
3. To investigate the critical issues encountered in implementing VM in Malaysia.
4. To develop a performance measurement model and a performance evaluation model for VM implementation in the construction industry
5. To develop and validate a performance management framework for VM implementation in the construction industry.

## **1.5 Research Scope**

The scope of this research was confined to the development of the performance management framework for VM studies in the construction industry. The following is the major focus combined in this research: value management and performance management.

VM was widely practiced in various countries in the different parts of the world and introduced in Malaysia in 1986. However, the level of the application was not that encouraging until the issuance of a circular from the Economic Planning Unit (EPU). It was claimed that VM was applied in the private sector as well. However, there was doubt due to the nature of the contracting parties. Hence, the focus moved to the public project implementation. Since VM was conducted in three various stages for public projects, the case studies were then focused on the value analysis implemented by EPU, which the workshops were carried out back to back in every week.

Performance has been a hot topic and interest to both academicians and industry players. As there were debates on arguing the theory behind this topic, my research is not intended to create one. The deductive approach was selected where the intention is to explore how those theories fit into the VM application within construction projects.

In terms of the level of the assessment, this research is not confined to individual, operational, or strategic levels. The intention is to look from a more holistic perspective that combines these levels together where it is deemed appropriate since most of the available literature were from the manufacturing industry where the use of three different level of performance is very common.

Meanwhile in this research, some consolidations were made to see how three different level of performance may applicable within the parameter of the VM implementation. Therefore, the VM team has been regarded as an "organisation". At this juncture, the performance at the individual level represent the individual participant, performance at operational level represent the overall VM team members, and finally performance at strategic level represent the achievement of the workshop's objectives.

The proposed model will incorporate all identified indicators that mostly belong to the operational level where the workshop used as the platform. The identified indicators were mapped into the relevant phases of the VM implementation. During the workshop, each participant has to work in a team with the other stakeholders of the project to collectively achieve the workshop's objectives. Hence, the performance of each may directly impact the performance of the workshop's team. Ultimately the attainments of the workshop's objectives are important in addressing the client's goal at the strategic level.

Even though this research uses the VM workshops carried out in Malaysia as the basis, generalization of the performance frameworks and causal relationship model to the construction industry in other countries is possible with minor modifications. The framework also consisted of several sub-frameworks that may be easily separated to fit certain parameters.

## **1.6 Research Methods**

To achieve the identified objectives of this research, several methods have been selected which is deemed to be appropriate to obtain the required data for analysis. Those methods

commonly applied in construction management research will be discussed in the following sub-chapters.

### **1.6.1 Content Analysis**

Content analysis defined as the process of analysing data in a systematic, objective, and quantitative manner. Krippendorff (2004) defined content analysis as ‘a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use. It is a technique for examining information or content in written materials of descriptive research. It has been widely used in qualitative research. This research employed conventional content analysis, in which the data are derived directly from the text data.

In this research, content analysis was used to analyse the CSFs and KPIs in the previous studies. The process of retrieving the journal articles is via comprehensive desktop search discussed earlier. Papers with relevant terms were considered to have met the requirements of this research. The identified CSFs and KPIs then were screened and filtered before included in the questionnaire survey.

### **1.6.2 Questionnaire Survey**

Questionnaires are probably the most widely used data collection technique for surveys. It consists of questions for the purpose of gathering data from respondents. This kind of data collection is most suitable since in most cases the questions are pre-determined to ease the process of analysing the data. Questionnaires have been widely used for descriptive and analytical surveys in order to find out facts, opinions, and views on what is happening, who, where, how many, or how much.

In this research, the survey used stratified sampling to reach a particular group of respondents that have been exposed to VM and are therefore familiar enough with it to answer questions about it. Apparently, random sampling to the entire population may increase the number of samples, but it may end up with less quality in the samples due to the lack of familiarity of the respondents with the VM subject. It is expected that the samples provide the most valid and credible results because they reflect the characteristic of the population that is important and relevant to the research focus on VM.

### **1.6.3 Case Study**

Case studies are an ideal methodology when a study involves a holistic and in-depth investigation. Often, the data was collected over a period within their context to provide an analysis and to illuminate the theoretical issues being studied (Hartley, 2004). This approach is most suitable when the researcher intends to support the argument by an in-depth analysis of a person, a group of persons, an organization, or a particular project (Naoum, 1998).

Case studies are also designed to bring out details from the viewpoint of the participants by using multiple sources of data. This research will adopt specific types of case studies, namely explanatory case studies to investigate the causal relationship between variables. Yin (1994) proposed a standard protocol to conduct a study research. The protocol should include the following sections:

- An overview of the case study project - this will include project objectives, case study issues, and presentations of the topic under study

- Field procedures - reminders about procedures, credentials for access to data sources, location of those sources
- Case study questions - the questions that the investigator must keep in mind during data collection.
- A guide for the case study report - the outline and format for the report.

In this research, the case study method was used to gain in-depth understanding of the process and performance of the VM workshop studies conducted for public projects in Malaysia. The use of case studies allows the process of comparing the performance of each workshop and determines any specific problems encountered during the workshop implementation. The selection of projects should be in the same nature to avoid biases in comparison of the performance of a different nature of the project may have different limitations that may influence the process of VM workshop.

#### **1.6.4 Observation**

Observation is widely used in dealing with research related to the subjective nature. It allows the researcher to closely monitoring the subject of the study. In theory, there are two common approaches into doing observations: either by the researcher, the independent observer, or a combination of both. Considering the nature of this research that involves a specific topic on VM, with a specific focus on the aspect of performance, observations are most suitable. The triangulation of observation and the other two methods of data collection: survey and semi-structured interviewing is crucial to avoid bias while reporting the findings.

### **1.6.5 Semi-structured Interview**

A semi-structured interview is a verbal interchange where one person as the interviewer attempts to elicit information from another person by asking questions. Although the interviewer prepares a list of pre-determined questions, semi-structured interviewing unfolds in conversational manners that offer the flexibility to the participant to explore issues that they feel relevant and important to a particular topic in an informal tone. The process normally is self-conscious, orderly, and partially structured. It is suitable for a range of research in conjunction with a variety of other methods. Prior to the interview session, the interviewer has to formulate the questions, select and invite the interviewees, determine and prepare the venue, and get ready to record the data. Semi-structured interviews make a significant contribution to geographic research, especially when it comes to the topic related to definition, identification, subjectivity, and knowledge, etc.

In this research, semi-structured interviews will be adopted in the process of evaluating the performance of the VM workshop and trying to investigate the problems encountered during the workshop implementation. The interviews sought both qualitative and quantitative feedback and rating of the performance (Bassioni et al., 2005). These may provide a better platform for this research to identify the problems associated with VM implementation and suggest the recommendation for further improvement for future applications.

### **1.6.6 Focus Group Meeting**

Focus groups are carefully planned discussions stimulated within a predefined group environment to obtain perceptions about a defined area of interest in a permissive, non-judgmental environment (Krueger and Casey, 2009). This approach allows the

participants to disclose and share more ideas and concern about the topic discussed. According to Morgan (1997), this approach enables the researcher to collect data about similarities and differences in participants' opinions and preferences in a relaxed and flexible environment. This is particularly useful for highly unstructured data and involves categorizing communication content into its parts (Berg, 1989).

In this research, focus group meeting (FGM) allowed the researcher to present the proposed performance management frameworks to the VM steering committee of the Economic Planning Unit (EPU), Prime Minister Department of Malaysia. During this meeting, the authors may explore participants' attitudes, beliefs, and feelings about the proposed VM framework.

### **1.7 Rationale of Research**

The rationale of this research is explained to provide a better understanding of how the research aim and objectives influenced the choice of research methodology adopted in this research. The main focus of this research concentrated on the VM workshop implementation with an emphasis on physical projects. The construction industry is known as the main contributor to national growth when there is strong demand for infrastructure and facilities development. On average, the construction industry contributed about 5% to Malaysia's GDP in the past ten years. Focus was given to the public projects because the motive is more on fulfilling the responsibility to serve the public and deliver value for money for the investment. In contrast, private projects were mostly commercial oriented with a priority for gaining maximum profit and benefit while spending the minimum investment for it.

Since VM is believed to be a good management tool for improving the project's value, it was introduced as a mandatory requirement for a public project amounting MYR 50 million or more. However, the question remains regarding how to ensure that the implementation of VM can bring significant benefit to the public projects. Therefore, it is necessary to assess the performance of the VM workshop and eventually identify how the success of VM workshops may contribute to the success of the project.

This research project identifies the potential way of measuring, evaluating, and managing the VM workshop performance in contributing to the successful implementation of public projects. Case studies were implemented to examine the practicality level of the performance assessment. After the case studies and feedback from the VM workshop stakeholders had been collected, the performance management framework was developed with the causal performance modelling in assisting the implementation of VM workshop in the future. Finally, the proposed frameworks and model to determine the extent of its applicability in practice were carried out and validated.

## **1.8 Structure of the Thesis**

The following are the proposed chapters of the thesis. The thesis consists of several components of a scientific research and additional chapters on a relevant topic for the literature review. The overall structure of this thesis presents the overview of the process involved and information flow from the inception of this research work until the conclusion. Brief synopses of the chapters are described below:

## Chapter 1: Introduction

*Chapter 1 outlined the background information and identified knowledge gap, the aim and objectives of the research, with the scope and an overview of the methodology and the structure of the thesis.*

## Chapter 2: Value Management and its Application in the Construction Industry

*Chapter 2 provides critical reviews and information to support the argument in this research, particularly in the applications of VM in the construction industry. Detail information for the applications on VM for public projects in Malaysia was described to give a clear picture on the scoping of this research.*

## Chapter 3: Performance Management

*Chapter 3 provides critical reviews and information to support the argument in this research, particularly in the aspect of performance management theory. The reviews include the examples of application in other industries, apart from detail reviews from the perspective of the construction industry in general, and from the perspective of the VM studies in specific.*

## Chapter 4: Research Methodology

*Chapter 4 outlines several methods adopted in carrying out this research. The methods inclusive of content analysis, a questionnaire survey, case study, semi-structured interview, observation, and FGM deemed to be suitable and inclusive in attaining the research objectives.*

## Chapter 5: Critical Success Factors for Value Management Implementation

*Chapter 5 present findings of the research from the first stage of data collection in identifying the CSFs for value management workshops in particular from the perspective of construction projects in Malaysia.*

## Chapter 6: Key Performance Indicators for Value Management Implementation

*Chapter 6 present findings of the research from the first stage of data collection in identifying the KPIs for measuring the performance of the value management implementation in particular from the perspective of construction projects in Malaysia.*

## Chapter 7: Case Studies of Value Management Applications for Public Projects in Malaysia

*Chapter 7 presents a summary of case studies carried out for five public projects in Malaysia. The data collected during these case studies based on the findings of the first stage data collection as presented in Chapter 5 and Chapter 6. The performance aspect of the VM workshops will be discussed from both quantitative and qualitative perspectives to provide a more holistic approach to measuring and evaluating the performance of the VM workshops.*

## Chapter 8: Performance Management Framework for Value Management Implementation in the Construction Industry

*Chapter 8 showcases the theoretical framework for managing the performance of VM studies in the construction industry, and the causal performance modelling that shows the interrelationship between the variables of VM workshops.*

## Chapter 9: Conclusions

*Chapter 9 concludes the research findings based on the identified objectives and findings from the data collection and case studies. In addition, this chapter reflects the knowledge contributions from this research and future research works that are possible to be carried out in the future.*

### **1.9 Summary of the Chapter**

This chapter started with the background of the research works and highlighted the problems encountered. The aim and objectives of the research were presented with the relevant research methods to attain the objectives. The final part of this chapter introduced the whole structure of the thesis to provide some overview to the readers before proceeding into details.

## **CHAPTER 2: VALUE MANAGEMENT AND ITS APPLICATIONS IN THE CONSTRUCTION INDUSTRY**

### **2.1 Introduction**

This chapter will enrich understanding of the value management (VM) methodology and application in general, and specifically within the construction industry perspective. As the research focuses on the applications in Malaysia, detailed guidelines on VM implementation will be described.

### **2.2 Definition of Value Management**

Dell' Isola has innovated VM into the UK's construction industry in the 1960's to promote better project delivery. At that time, VM was seen as a strategic management tool that could help in bringing stakeholders of the project to achieve "value for money" to the client. Due to its essential methodology that enables major stakeholders to discuss and clarify their needs, to have a better understanding of the project, to ease the communication, build trust, ownership, and commitment among various stakeholders (Shen and Yu, 2012).

c

*"The application of systematic process used by a multidisciplinary team to improve the value of project through the analysis of function to achieve strategic value improvement"* Society of American Value Engineer (SAVE)

*"A value-focused management style within an integrated framework based on the relationship between satisfying needs, expectation and the resources required to*

*achieve them to create sustainable value through unique combination of management principles and proven tool by focusing on objectives and function to enhance innovation” Institute of Value Management United Kingdom*

*“A structured and analytical process seeks to satisfy customers need by all necessary function are provided at the lowest total cost while maintaining the required level of quality and performance” Institute of Value Management Australia*

*“A philosophy together with its associated tools and techniques, emphasizes the need to consider function and cost in a structured and systematic way as part of strategic decision process” Hong Kong Institute of Value Management*

Researchers and academia in the field of VM also defined as such in their research:

*“A proactive, creative, problem-solving or problem seeking services which maximizes the function value for a project, product, services, system or facilities by managing its development from concept to use. The process uses structured, team-oriented exercise that make explicit and appraise existing or generated solutions to a problem by reference to the value requirements of the client” Male et al. (1998)*

*“An organized function-oriented team approach directed at analysing the functions of a product, system or supply for the purpose of enhancing its value by identifying and eliminating unnecessary costs and achieving the required performance at the lowest life-cycle project cost” Fong and Shen (2000)*

*“A rigorous, systematic and innovative methodology with multidisciplinary approach to achieve better value for project, products, facilities and system without sacrificing the required performance level. Is a creative way of working together in achieving client and stakeholder’s requirements” Che Mat (2010)*

Although many definitions are used to describe the nature of this subject matter, the basic premise mainly serves to improve the value without sacrificing its intended purpose still underpins as it was introduced. VM becomes a blanket term and encapsulates the other associated terms such as value planning, value engineering, value analysis, and value review, where it was used interchangeably. For the sake of simplicity, the term VM will be used in this thesis.

### **2.3 Value Management Approaches**

As conceptualized in most of the definitions, VM approach is not going away from the aspect of the function, cost, and quality. Figure 2.1 – 2.4 illustrate several relationships to reflect the concept of VM application within the construction industry.

$$value = \frac{function}{cost}$$

**Figure 2.1 Illustration of the relationship between value, function, and cost**

$$value = \frac{worth}{cost}$$

**Figure 2.2 Illustration of the relationship between value, worth, and cost**

$$value = \frac{function + quality}{cost}$$

**Figure 2.3 Illustration of the relationship between value, function, quality, and cost**

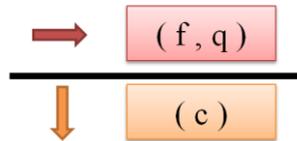
$$value = \frac{function}{resources}$$

**Figure 2.4 Illustration of the relationship between value, function, and resources**

While in terms of the implementation of VM into the construction project, there are several approaches for the consideration of the client with the consultation from the facilitators. Often, the approach is selected based on the objectives of the VM workshop. The approaches are described as follows:

### 2.3.1 Cost Reduction Approach

Cost reduction approach aims to reduce the cost but to maintain the function and quality of a particular item or product. Figure 2.5 illustrates the relationship. For example, the selection of material may be reviewed to identify other options that can provide the same function at a lower cost.

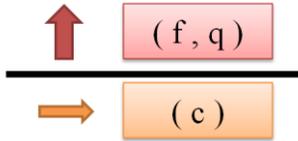


**Figure 2.5 Illustration of the relationship between function, quality, and cost in cost reduction approach**

### 2.3.2 Function Increase Approach

Function increase approach aims to increase either the function or quality or both, but maintaining the cost of a particular item or product. Figure 2.6 illustrates the relationship. For example, the idea of providing central lab facilities may help the client to increase their service efficiency and ease the monitoring process. No changes in terms of the cost

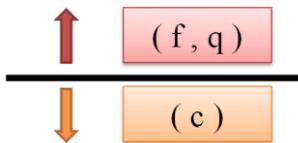
since the requirements provided are still in one central location instead of at a different location.



**Figure 2.6 Illustration of the relationship between function, quality, and cost in function increase approach**

### 2.3.3 Compound Approach

Compound approach aims to reduce the cost and at the same time increase the function and quality of a particular item or product. Figure 2.7 illustrates the relationship. For example, all the supporting functions need to be reviewed to determine how significant it is in line with the perceived value of the client. The overall cost of it will be reduced by eliminating the unnecessary functions.

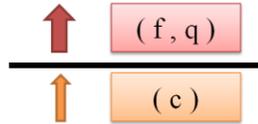


**Figure 2.7 Illustration of the relationship between function, quality, and cost in compound approach**

### 2.3.4 Expanded Growth Approach

Expand growth approach aims to increase the minimum cost that results in improving the function and quality of a particular product or item in a higher proportion. Figure 2.8 illustrates the relationship. For example, the design team can propose some new green

technology that is certainly higher in cost in the electrical components of the project that in return may reduce the total electrical cost and promote sustainability of the building.



**Figure 2.8 Illustration of the relationship between function, quality, and cost in expanded growth approach**

## **2.4 Types of Functions**

The concept of VM emphasizes on the function of the project, element, component, space, or unit of production. The identification of the functions is determined by the *function analysis* phase of the workshop. In order for the workshop to clearly identify the function that an item or product is needed to perform, several categories of function were introduced as discussed in the following:

### **2.4.1 Basic Function**

The purpose or performance features that must be attained if an item is to work or perform. It is an absolute must that the type of objective is that it is the feature of the item that is the primary reason for existence from the users' view.

### **2.4.2 Required Secondary Function**

It has functions that must be achieved to meet specific codes, standards, or mandatory requirements imposed by a regulatory body of a particular jurisdiction.

### **2.4.3 Supporting Function**

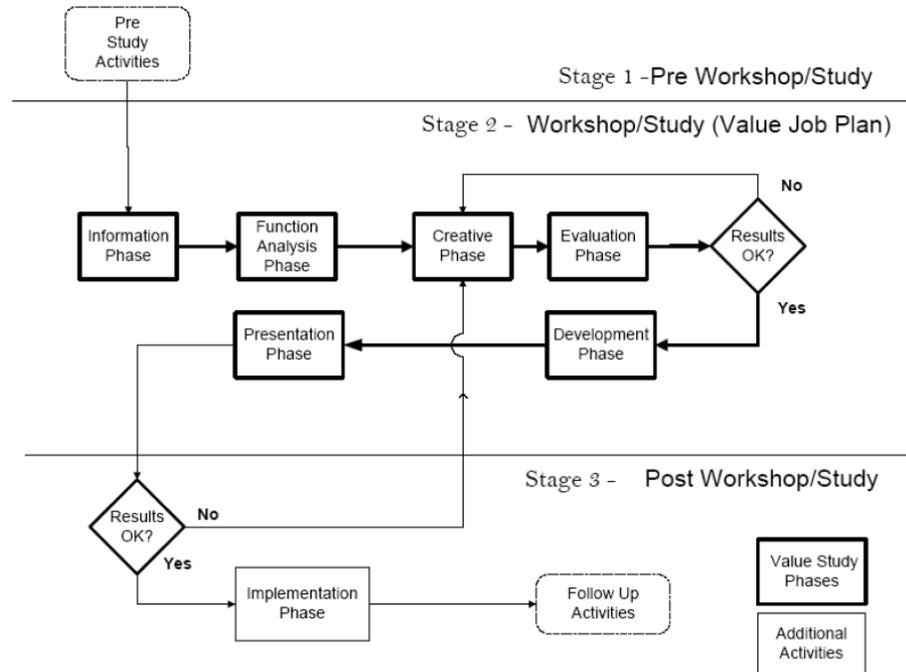
Any characteristics of an item that are not essential to the user for the desired application of the item and does not contribute directly to the accomplishment of the basic function.

### **2.4.4 Unnecessary Function**

An element or characteristic that is not necessary for the item to work or sell. Unnecessary functions are usually the result of honest wrong beliefs and assumptions, or the perpetuation of obsolete requirements.

## **2.5 Value Management Methodology**

The workshop usually follows an organized and systematic job plan, which is strongly emphasized by VM methodology. While the precise number of stages and specific names of these stages in the job plan often vary, the general process is always similar. One of the commonly used VM methodologies is the VM job plan of the Society of Value Engineers (SAVE) as shown in Figure 2.9. Among others, the participants of the VM workshop may include stakeholders to the project such as a client, end user, subject matter expert (SME), implementing agency and government agencies, local authority, consultants, etc.



**Figure 2.9 Typical process of a VM workshop at different stages and different phases (Source: Save International 2007)**

### 2.5.1 Pre-workshop Stage

The main purpose of this stage is to allow the process of planning and organizing the VM study. The pre-workshop provides an opportunity for all stakeholders to prepare and equip themselves so that they will understand project issues and constraints, and therefore to give and receive information beforehand. Clients commonly appoint the facilitators, either internally or externally, to organize and facilitate the whole VW processes. Facilitators play the role to assist clients in defining the scope and objectives of the study. Most of the standard guidelines usually draw up a list of information to ensure sufficient information is available for the studies.

At the end of this stage, it is expected that all stakeholders will have a clear understanding what senior management of the client organization needs to have addressed, what the strategic priorities are, and how improvement will increase organizational value. It is during this phase that a view as to whether subsequent phases are likely to yield sufficient value to justify the cost of the study within the terms set. It may be appropriate to increase or decrease study parameters at this time. All of the stakeholders should nominate their representative to participate in the workshop. All the logistic aspects such as the date, venue, duration, and workshop's program should have been agreed at this point.

### **2.5.2 Workshop Stage**

Workshop stage will be carried out in six different phases with its purpose and desired outcomes, as well as identification of suitable techniques and tools.

#### **2.5.2.1 Information Phase**

The main purpose of the information phase is to provide a platform for all workshops' participants to understand the current state of the project and constraints that influenced project decisions. By inviting all stakeholders to give a presentation specifically on their relevant scope of the project, it is hoped that this sharing of information will help them to understand the project in a better way from both tactical and operational contexts.

The process of verbal presentations also eliminates misconceptions that might have existed between the various disciplines and to provide a better understanding to the participants who have been less involved in the project prior to the workshop. Moreover, some of the participants do not belong to the project team who are not involved directly

in the project implementation, but may have the influence to ensure the smooth running of the project in the later stage. For example, a typical VM workshop may have invited representatives from the local authority, service providers, and the existing owner of the adjacent site.

Yu (2006) summarizes that this phase ensures that all members of the team fully understand the background, constraints, and limitations of the study so as to broaden their perspectives beyond their particular area of expertise. Eventually, it may help the participants to make any decision and clarifies the assumptions during the workshop process.

Through the facilitation provided by the facilitators, the objectives are established at the end of the information phase. At the end of this phase, it is expected that all participants will arrive at a common, basic level of understanding of the project, including tactical, operational, and specifics of the subject. The functional understanding establishes the basic case to identify and benchmark alternatives and mismatches and set the agenda for innovation.

Kelly and Male (1993) suggests five categories of specific information that is deemed to be crucial during this information phase:

1. Client needs
2. Client wants
3. Project constraints
4. Financial constraints
5. Time constraints

A representative from senior management of the client is at the best able to provide critical information about the project to provide an immediate sense of purpose towards having the VM study.

### **2.5.2.2 Function Analysis Phase**

The main purpose of the *function analysis* phase is to understand the project from a functional perspective, by simply identifying what are the functions of the project rather than how the project is currently conceived by all stakeholders. In identifying the functions of the project, it is also important for the stakeholder to understand how the different functions are related to each other in achieving the project's objectives.

This phase is a major difference that distinguishes VM from other management tools that specifically examines the functions. It forces a broader and more comprehensive understanding of the project by stimulating intense discussion and compelling team members to view aspects they might not normally have considered. The functions are presented using the hierarchical format and displayed on a function diagram. FAST diagram is another way of structuring this phase. The functions of the project are presented in a hierarchical sequence.

The functions of the project are arranged in levels in a hierarchical sequence. Kelly and Male (1993) identifies the following levels of functional analysis:

- Level 1- Task. It represents the first stage in which the client organization perceives a problem
- Level 2- Space. The stage where the architect or the whole design team are engaged in the preparation of the brief

- Level 3- Elements. Stage in which building assumes a structural form
- Level 4- Point where elements take an identity in terms of the built form

Functions are classified as either basic or secondary which can be a difficult and subjective process. After establishing all the functions, they are then priced to get a cost to worth ratio to identify areas of poor value.

At the end of this phase, it is expected that the teams managed to validate the functions that the project has to perform in order to achieve its objectives. Through this phase, it is hoped that the team will be able to identify the value-mismatched functions on which to focus upon in order to improve the value of the project.

### **2.5.2.3 Creativity Phase**

The main purpose of the creativity phase is to generate a quantity of ideas related to other ways to perform functions that have been identified in the previous function analysis phase (Male et al. 1998a).

This phase is a creative type of effort, totally unconstrained by habit, tradition, negative attitudes, assumed restrictions, and specific criteria. As suggested by Fan et al. (2007), no judgment or discussion should occur during this activity. The quality of each idea will go through the evaluation phase.

There are a few basic principles of the creative phase that form the backbone of this phase. These principles are:

- **Creative thinking** techniques like brainstorming where team members are pushed to innovative solutions

- **Postponement of judgment** where judgment of the ideas that are put forth are not allowed, no matter how bizarre the idea seems
- **Positive environment** is whereby people are convinced that their ideas will lead to positive improvements, and negative thinking is eliminated
- **Large quantity** of ideas is more important at this stage than the quality.
- **Hitchhiking of ideas/cross-fertilization of ideas** is where the different ideas are combined and the improvement of other ideas that seemed farfetched initially, but formed the basis for another idea

At the end of this phase, it is expected that the team managed to identify a broad array of ideas that provide a wide variety of possible alternative ways to perform the functions in improving the value of the project.

#### **2.5.2.4 Evaluation Phase**

The main purpose of the evaluation phase is to screen through and reduce the quantity of ideas that have been identified during the creativity phase to a short list of ideas with the highest potential to improve the value of the project. Hence, it is crucial for the team to make their mutual judgment in determining which ideas are feasible and worth spending more time to be developed further. It involves the team's joint efforts to evaluate and prioritize the ideas that they think is worthwhile and can add value while dismissing ideas that are not likely to add value to the project.

One of the most common techniques is by using the evaluation criteria, usually by referring to the client value system (Male et al. 1998) to sort out the ideas and identify how well the ideas meet those identified criteria.

At the end of this phase, it is expected that the team produces a focused list of ideas that warrant quality time to develop into value-based solutions that can be implemented into the project.

#### **2.5.2.5 Development Phase**

The main purpose of the development phase is to analyse further and develop the prioritized ideas and developing those with merit into value alternatives. More efforts through in-depth knowledge and experience sharing across disciplines are required in identifying an informed description of each selected idea and what the rationale is for making this change. All the information shall be recorded and formed as part of the workshop report.

Among others, the information can include the justifications for the selection, cost implication, and technical information with relevant sketches to ease referencing in the future (Kelly and Male, 1993). Hence, these could be very time-consuming phases that require ample supporting documents and references to develop a good alternative proposal. At the end of this phase, it is expected that the team can create alternatives and low, medium, and high-risk scenarios and offers these alternatives to senior management as options that address the VM strategic objectives.

#### **2.5.2.6 Presentation Phase**

The main purpose of the presentation phase is to achieve an agreement by all the participants to take that recommendation as a collective decision. This is important to avoid possible issues at a later stage during the implementation of the project. It is also providing a platform of buying in process for the team to convince the top management

on the proposed alternatives to be implemented into the project. At this juncture, it is necessary for the client to ensure that the proposals fit well with their strategic objectives and plans.

Through the presentation, all participants are welcome to give their feedback before it is deemed to agreement by all. The workshop report will be then prepared accordingly. All details and outputs generated in every stage and phase of the workshop shall be compiled and properly documented.

### **2.5.3 Post-workshop Stage**

The main purpose of the development phase is to monitor and ensure that the recommendations of the VM workshops are implemented. It is important for the key stakeholders to ensure that the project team can manage and materialize the agreed proposal in order to reap the fruits and maximum benefits of the VM study.

During this stage, the action plan will be the best tool to be used in monitoring the implementation of the works assigned to the responsible stakeholders within the agreed time. It is also recommended that a workshop evaluation be conducted to obtain feedback from all participants in the workshop implementation. Another function of this phase is to provide an opportunity to identify and collate lessons learned in the VM process and to help improve future VM studies. In summary, the post-workshop stage can be divided into the following three steps:

1. Preparing the VM workshop report
2. Monitoring the implementation of the proposal
3. Follow up with all stakeholders

At the end of this phase, it is expected that the team can determine the changes in the project as a result of the VM workshop. These are changes to the original proposal prior to the workshop that will be incorporated in a future stage of the project development. If there is a poor implementation rate, VM can be considered a failure and a process that just wasted everybody's valuable time.

## **2.6 Benefits and Critiques of Value Management Applications**

### **2.6.1 Benefits of Value Management Applications**

As one of the management tools in managing the project, specifically looking at the aspect of the value, VM was introduced and aimed to benefit the project and the project's team at different levels, different stages of development, and from various perspectives.

Norton and McElligott (1995) argued that VM provide a forum for all stakeholders to be involved in an authoritative review of the project as a whole by examining the project brief and identifying the constraints and problems that may have been neglected.

According to Shen and Chung (2002), VM helps the client to save costs, establishing a clear project objective, and providing creative thinking for design improvement. While Fong (2003) pointed out the early application of VM will enable the project team to recognize the strengths, weaknesses, opportunities, and threats created by identifying the best options for the project to proceed. It encourages the strong commitment of the client and allows them to clarify their needs and wants based on their objectives. VM helps the project team to understand better through thorough discussions and cross-discipline input. Specifically looking from the perspective of the public projects, Fong believes that VM

can improve the accountability, feasibility, and thoroughness of the study as all options are considered and evaluated.

Yu (2006) closely relates the benefits of VM with the involvement of all stakeholders of the project. VM process incorporates principles of stakeholder selection, knowledge creation, and team learning, which enables all stakeholders to have a proactive, open, and cooperative discussion with representatives of stakeholders where issues of public concern are involved. Yu (2006) also pointed out that the team approach of VM involves an interactive pooling together of the knowledge of all the different stakeholders. Individuals in the VM team need to share information, knowledge, and experience effectively and build on each other's knowledge in order to create new knowledge or solutions and re-use existing proven knowledge to solve new problems/issues.

In order to develop an understanding among the project stakeholders of common or conflicting values, learning within the VM team must occur. Through the application of a proper VM job plan, a team learning environment is established which enhances the development of creative ideas and alternatives leading to value-added outcomes that are owned and learnt by the participating stakeholders as a team. In turn, this gained knowledge can be poured back into the larger organization, resulting in the whole organization learning together.

As a multidisciplinary management approach, VM promotes robust management style that can drive for innovation and change in terms of how the project was implemented by examining how the project and its components are functional. Early interception provides a platform to the client to clarify their need and value system. The interception would

give an opportunity for the project team to identify the quality and design criteria to satisfy the clients.

VM is believed to be an effective method and tool in putting all stakeholders together and promoting dynamic human interactions among them. The dynamic process involved stakeholders from different backgrounds and disciplines that may positively contribute to the improved value of the project.

From the perspective of the stakeholders, the client may be the most benefited party when VM is successfully implemented. The processes with the strong support of the other stakeholders help the clients to have a clear and better understanding of their business objectives, needs, and value system that is regarded as their main priority. Hence, the decision to proceed with the project would be a competitive and better decision.

On top of that, the end user could have enjoyed a better product when their voices were heard and taken into consideration during the workshop implementation and later on materialized into the project. The participation will eventually increase their level of satisfaction during the operational stage of the project.

Looking into the specific outputs of the project, VM helps the stakeholders to identify the project deliverables that are aligned with the identified functions. By doing so, the team also will be able to eliminate or reduce the unnecessary cost to the project. All the potential risks were identified and managed to minimize the impact of the project. Cross disciplinary experiences may facilitate a better design development and also improve the construction methods and performance. The performance might be during the construction stage or the use stage if the operational performance was given proper

attention during the workshop. Ultimately, VM can improve the outputs after those factors being considered and necessary action taken. Last, but not least, VM in general improves the communication and collaboration between stakeholders in which they may have not openly discussed on how they perform their task in managing the project.

In particular for public projects in Malaysia, there are several major concerns in relation to the fund allocated for development each year through the development expenditure. Some of the major concerns are deliberated as follows:

- Capital is not a free commodity

The capitals used and allocated for each project were traded by the financial system. Since the resources are limited, hence it is not possible for the government to cater all needs. Thus, it is important for the capital to be carefully managed and the right decision made for such investment where it involves a big capital, huge manpower, and spread over a longer period.

- Scarcity of fund

It is limited and needs to be shared by all. Determining the best out of the best to maximize the benefits to the public in general through prioritizing the projects.

- Poor value occurs in previous projects

Project reports, research findings, and news reports have been criticizing the poor value in projects' implementation. It is also obvious and well known that the public projects were seriously delayed. As a consequence, it involved huge losses to the government as higher cost occurred and to the public as a whole where the facilities were not ready and

completed on time. The delay has forced the public to continuously suffer due to lack of facilities such as the roads, highways, schools and hospitals as basic and common needs.

- Unnecessary cost existed in previous projects

Cost has been the most significant and clear indicators of project's performance. While previously all design teams worked in a silo, VM enables them to sit down together and review the design with more input and comments from other stakeholders who were not directly involved with the design development. It is even more challenging when it involves a big scale of projects where there was a lack of planning and monitoring throughout the planning, design, and construction stage.

- Dissatisfaction of various stakeholders happened for previous projects.

In general all parties wouldn't be happy when the project was not able to achieve its goals within the expected timeframe as per the planning. The clients suffer the loss and the project team's image and reputation were tarnished due to bad performance. Most obviously, it gave impact to the end user. When referring to the public projects, the end users are the most affected party.

## **2.6.2 Critiques of Value Management Applications**

Although VM has been applied in construction for about 40 years and has obtained a high reputation, critiques on it have never ceased. Typical critiques of VM in the construction industry can be summarized as follows:

### **i) Definitions and Terminologies**

As VM has been the practice in different parts of the world, in different industries and at different levels, there were burdens in defining the definition of VM and the

terminologies used closely related to VM. Furthermore, Green and Liu (2007) acknowledged that VM is lack of theory to support its applications.

When the client decided to embark into VM, it is important to identify what is to be achieved by employing VM. Perhaps the professional guide and facilitation from the VM facilitators may shed some light in ensuring the most benefits gained from VM.

**ii) Misconception and Misconduct**

The negative attitudes and perceptions towards VM may also contribute to the negative result of the VM implementation. It is important for the facilitators to play bigger roles in addressing the critical points on VM and ensure that the processes were carried out as devoted to the theory.

**iii) Involvements**

The implementation of VM workshop could be very time consuming. Taking the SAVE 40 hours' job plan, it is very demanding to have all stakeholders, especially the top management to be present and commit for such a long period of their daily hectic schedule. A particular workshop may also involve a big number of participants and few supporting manpower to manage the logistic aspect. That is apart from the cost to host the workshop itself. So in total, there was a huge amount of money spent and being used in order for the VM workshop to take place. It is normally difficult to assemble key project participants for such a long period and retain their attention from other things throughout this period of five days. Moreover, considerable time is needed by the design team for reviewing VM proposals and redesigning after the workshop. Sometimes the time for these processes is not allowed in a crowded design schedule (Kelly and Male, 1993).

To overcome this, the clients need to clearly identify the objective and focus of the VM workshop so it will be something that is meaningful and achievable given the specific and agreed on the timeframe. For instance, VM workshop for public projects in Hong Kong is only held at a strategic level within a two-day workshop.

**iv) Intervention**

Many researchers have advocated that VM should be implemented as early as possible to maximize its results (Green, 1994; Dell'Isola, 1997). It has been argued that the common challenges in applying VM is to find the best point of intervention during the project development. Kelly et al. (2008) proposed several possible interventions of VM into the project. At any point of intervention, there will be pros and cons. What is best for the team to decide on the intervention may depend on the objective of embarking into VM and the level of information available at that particular point.

**v) Information and Assumptions**

As the VM aims to critically identify the functions and propose the best alternative to achieve it, the decision will be made based on the information available at that time. The information may come directly from the participants based on their knowledge and experience, or other sources from the third party. However, it is crucial for the team to distinguish between the information and the assumption. It is acknowledged that sometimes the information was not made available, and assumptions were required in order for the process to keep going. Hence, the assumption should be made based on the most possible condition with the highest probability as possible.

**vi) Liability**

In the event where the VM intervened where the designs are made available during the workshop, there is potential for proposals to change the design. The adversative attitude of the design team is not easily eliminated. Many designers have argued that within a short period the VM team could not be expected to fully understand the project and the proposed concept and design. It is then important for the team to assess to what extent the changes may affect the overall aspects. If the changes are significant, there could be issues with regard to the design liability, as it is but one of many thorny issues in VM applications (Kelly and Male, 1993).

In doing so, the design team should give serious thought before agreeing to any ideas and suggestions and finally acknowledge their liability towards those changes.

**vii) Motivation**

There are sayings that VM could be another red tape exercise and design audit process to the proposal. The design team may also consider the effects of such changes, especially when it is closely related to the cost as their professional fees could have been significantly varied due to the adjustment of the estimated cost. It will be an even more challenging scenario if the contractor has been appointed and formed part of the VM team. Any matters related to the cost could be their main concern. Hence, the client should have been thinking of some motivation and try to find a balance between all parties. The ultimate goal is to achieve the project objectives, as well as the VM objectives.

The above items cannot display all critiques of VM in construction in literature, but they are listed to indicate the necessity to develop and perfect the traditional VM approaches.

## **2.7 Value Management Applications in Malaysia**

Cheah and Ting (2005) reported that VM is not well embraced in Southeast Asia. Particularly in Malaysia, it is claimed that, Professor Roy Barton of Australia was first introduced VM in Universiti Teknologi Malaysia in 1986. Since then, it slowly progresses with efforts to promote these new applications to organizations such as Ministry of Defence and PETRONAS (Che Mat, 2010). In order to further introduce and increase the awareness towards VM, a national seminar on VM was successfully organized in 1999, followed by an awareness road tour to several cities in Malaysia.

After more than 20 years since being introduced, Jaapar and Torrence (2009) conducted a survey and found that 78% of the respondents have knowledge about VM. However, only 16% of respondents had a good understanding of VM after attending the training. In terms of the VM workshop conducted, most of it occurred within the project cost range of 11-50 million MYR that lasted for three days and was mainly facilitated by an internal facilitator. The workshop was conducted at the outline proposal stage of the project development cycle.

Numerous organizations claimed that they had applied VM before, but it did not sustain long due to the failure of the VM workshop to achieve the objectives. This reason explains why the take up of VM practices in Malaysia has not been large. However, the conclusion was made without proper assessment whether the VM was conducted by means of proper VM methodology to assess the performance. According to Shen (1997),

it is extremely often that people claimed they had applied VM, but what they did was merely cost cutting. VM puts more focus on both cost and function (including performance), while cost cutting is more toward reducing the cost taken throughout part of the scope of the project or function and reducing performance of a specific item.

Nevertheless, there was the successful implementation of VM in Malaysia. According to Che Mat (2010), VM has proof not only reducing the cost, but also by improving the effectiveness of the design, improving the return on investment (ROI), and identifying areas for improvement for the whole project. For instance, Malaysia Airport Holding Berhad (MAHB) wholly adopts VM in the organization since 1994 for projects above MYR 300,000.00 (MAHB, 2011). The applications are not limited to the new projects, but extended to the facilities' management and procurement chain. Tenaga Nasional Berhad (TNB) adopted VM to their projects and procurement amounting 10 million RM and above. Both organizations claimed to achieve cost optimization in their business activities.

In order to strengthen the efforts of disseminating and promoting VM locally, the Institute of Value Management Malaysia (IVMM) was established in May 2000. The establishment of the institute is among others, aimed to promote the value culture and to create widespread awareness of VM in Malaysia. Since then, the institution conducted a series of professional training, conference, and published material for reference (<http://www.ivmm.org.my>).

### **2.7.1 Government Policy and Guidelines**

As highlighted by Cheah and Ting (2005), the government as a policy maker, together with the other construction-related authorities should develop the strategies to promote VM comprehensively. According to Dell’Isola (1975), the obligation of VM by government has made valuable contributions. The same scenario for VM development in China in the late 1980s, US Navy Bureau of Ships in 1954, and Architectural Services Department of Hong Kong in 1996 (Shen, 1997; Yu, 2006). The Economic Planning Unit (EPU) in Malaysia issued the mandatory VM circular in December 2009. Details on the various government policies and instructions on VM application is presented in Table 2.1.

**Table 2.1 Government policy/instruction in relation to the VM applications**

<b>Country</b>	<b>Year of 1<sup>st</sup> Introduced</b>	<b>Government Policy/Instruction</b>	<b>Guideline/ Standard</b>
USA	1947	US Congress Bills (1993)	Value Standard & Body of Knowledge (2007)
UK	1960	HM Treasury Guidance Publication No.54 (1996); and Cabinet Office - Management of Value Initiative (2010)	European Standard – BS EN 12973 : 2000
Australia	1960s	Australian Capital Territory Associations Incorporation Act (1991); and Total Asset Management System Manual : NSW Government (1993)	Australian Standard – AS 4183 (2007)
Hong Kong	1988	Work Bureau Technical Circular (1998 and 2002); and The Construction Industry Review Committee (2001)	Nil
Malaysia	1986	Economic Planning Unit Circular No.3 (2009) of Prime Minister’s Department	VM Implementation Guidelines for Public Projects and Programs (2011)

VM practices are somehow different in terms of its approach and to what extent it is emphasized in different countries (Woodhead, 2000). According to Yu (2006), Roy Barton determined that VM in the US will be applicable in Australia, but subject to some changes where necessary to reflect cultural differences. Similarly in Hong Kong, Fong et al. (1998) suggested that VM had a place within the industry, but it needs to be adapted to suit the local practices. For example, most of the VM workshop in HK was conducted within two days because the rental rate for organizing the workshop is extremely expensive if it will take as much as a 40 hour workshop in the US (Shen, 1997). The differences between VM practices are presented in Table 2.2.

**Table 2.2 Comparison of VM practices in different countries**

	<b>US</b>	<b>Australia</b>	<b>Malaysia</b>
<b>Job Plan</b>	Information, Function Analysis, Creativity, Evaluation,	Information, Analysis, Creativity, Judgment Development	Information, Function Analysis, Creativity, Evaluation, Development
<b>Duration</b>	40 hours	8-24 hours	Not specify
<b>Stage of applications</b>	Sketch or Detail design	Feasibility or Concept design	Feasibility, Design development, after completion
<b>Facilitation</b>	Not essential	Essential	Not essential
<b>Participants</b>	5 - 8	15 - 30	8 - 10

Research by Lin and Shen (2005) discovered that lack of national VM standards is among the factors of difficulties in applying VM. The existence of the guidelines helps to sustain the superiority in its applications (Fong et al., 2001). Until 2005, Jaapar and Torrence claimed that there is no specific guideline on VM existing in Malaysia and proposed the

VM guidelines to help the construction industry to adapt well to the local context in the near future (Jaapar et al., 2009).

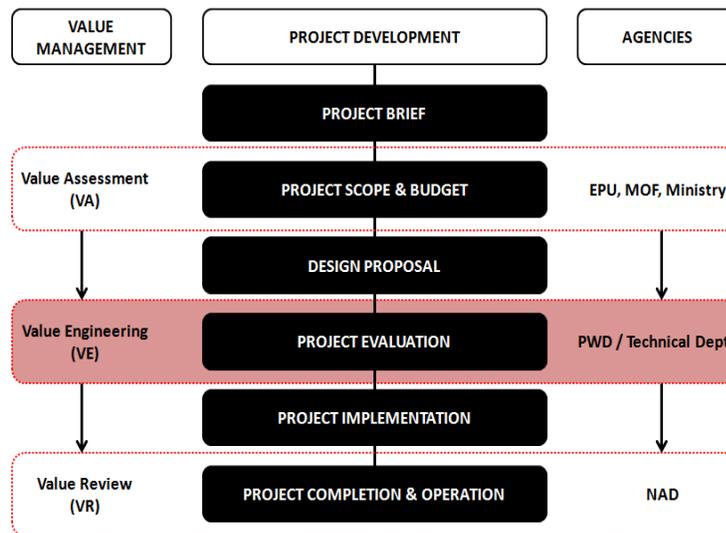
At the international level, there were plenty of references to VM implementation in the form of guidance notes, standards, manuals, books, and papers written and published by academics, practitioners, governments, professional institutions, and several VM gurus. Although these frameworks have many similar components, the variety of these models reflects the fact that the approach to the implementation of VM should be tailored according to different purposes, perspectives, users, and contexts.

EPU recently published the VM Implementation Guidelines for Public Projects and Programs in May 2011 as the main reference about the circular issued previously. The guidelines serve in providing an overall concept of VM applications from a Malaysian perspective, the methodologies and techniques, processes and also roles of every participant (EPU, 2011). Other than the first batch of 55 projects undergoing VM studies stated previously, it is reported that another series of VM workshops have been carried out for another 99 projects in March 2011, bringing the total number to 154 projects that have been conducted prior to the establishment of these guidelines.

### **2.7.2 Value Management Approach for Public Projects**

The approach on VM adopted in Malaysia consists of three stages: value assessment (VA), value engineering (VE), and value review (VR). These three stages of the workshop will be implemented at different stages of the project development cycle (EPU, 2011). Figure 2.10 and Table 2.3 present the different objectives of three different stages

of VM application in Malaysia. Hence, it is important to distinguish the type of VM studies as practiced worldwide using different terminologies related to it.



**Figure 2.10 Mapping of VM applications into project development cycle**

**Table 2.3 Three different stages of VM applications for public projects in Malaysia**

	<b>Value Assessment (VA)</b>	<b>Value Engineering (VE)</b>	<b>Value Review (VR)</b>
<b>Leading Agency</b>	Economic Planning Unit (EPU)	PWD or Technical Department	National Audit Unit (NAD)
<b>Objective</b>	To determine projects scope and budget allocation and ensure the objectives of the ministries/agencies with the optimum cost.	To evaluate and finalize design to achieve the determined functions and objectives	To learn and continuously improve the weaknesses and effectiveness for projects in the future
<b>Participants</b>	Representative from EPU, MOF & Ministry (Owner/Stakeholder), External VM Facilitator, Design Team, Relevant Expert	Representative from EPU, MOF & Ministry (Owner/Stakeholder), External VM Facilitator, Design Team, Relevant Expert	Representative from NAD, EPU, MOF, ICU, Ministry & End User, External VM Facilitator, Design Team, Owner/Stakeholder, Relevant Expert

### 2.7.3 Framework for Value Management Development

As quoted by Shen (1997), challenges can always coexist with opportunities. There are many hurdles ahead for VM to flourish in Malaysia from its infancy stage. Hence, it is critical to develop a framework to support the development of VM in Malaysia. Reference was made to Jaapar et al. (2009) that presented the WH (What, Why, How, When, Who, Where, and How much) questions as the roadmap of the VM implementation guidelines.

#### i) Knowledge

According to Fong and Shen (2000), knowledge and understanding are favourable for VM to be developed in the future. However, it may not be adequate to ensure the correct applications and implementation to maximize the potential benefits of VM. Hence, long-term plans should be established to disseminate the knowledge. The introduction of VM courses in tertiary education is relevant to future graduates (Shen, 1997).

For instance, Universiti Teknologi Malaysia offered an elective two credits course on VM to quantity surveying and construction students since 1993 (Che Mat, 2010). The subject aims to equip the future graduates with knowledge of VM applications, particularly in the construction industry. However, the delivery method of the course is mainly based on the lecture and group assignment. In contrast, City University of Hong Kong adopted a project-based approach with an action-learning method since 2002 (Leung, 2006). The students were assigned to play various roles in the project team to solve problems for real construction projects as case studies. In addition, the course is equivalent to Module I and recognized by SAVE International. The introduction of a VM course is a good selling point for the course as future graduates may have an interest to gain extra benefits.

Therefore, it is recommended that the universities in Malaysia should look at the possibility of developing such courses. On the other hand, there is a need to ensure that the syllabus of the course is relevant to the international practices. IVMM should step in and accredit such courses. It can also be offered at higher degree levels where the potential students are among those with industrial experiences as conducted by a few universities in Hong Kong (Leung, 2006).

On the other perspective, the input of VM that has been introduced in several universities in Malaysia and Hong Kong, for instance, are limited to students majoring in courses primarily in quantity surveying, building surveying, building, and construction (Leung (2006; Che Mat, 2010). According to Fong et al. (2001), VM concept is relatively general and can be applied to various natures of industries. It is possible then, to introduce the VM course as an elective that can provide opportunities for those who have an interest and intend to specialize in VM in their field.

**ii) Training**

Knowledge serves as the theoretical and practical basis for something that is inclusive of the facts, information, descriptions, or skills in a particular subject. Jaapar et al. in their survey in 2005 found that some of them may have heard about VM before, but only a few had a comprehensive knowledge on VM.

Training and Continuous Professional Development (CPD) is part of a continuous process to enhance the understanding and mastering of a particular knowledge. Basic training is designed for an individual to acquire knowledge and understanding of VM while professional training designed toward leading to a particular certification system to be recognized as a VM practitioner by a particular VM society. Table 2.4 summarizes examples of VM professional training programs offered by different VM organisations.

**Table 2.4 Formal VM professional training**

<b>Country</b>	<b>Training Program(s)</b>
USA - SAVE	Module I : Fundamental concept Module II : VM Application
Australia - IVMA	Module I : VM course

Module II : Advance VM Facilitation course	
United Kingdom - IVMUK	VM Foundation course VM Advance course I & II Train the Trainer course
Hong Kong - HKIVM	Module I : VM Methodology course Module II : Advance VM course
Malaysia - IVMM	Module I : VM Methodology Module II : VM Workshop & Facilitation

At the best of the authors' knowledge, private organizations such as MCM Value and Value Management Academy in Malaysia provide extensive courses related to VM applications to feed the increasing demand. The courses provide a good opportunity for those who seek to have a better understanding of VM applications. To further promote the VM, IVMM may jointly organize the training with the other professionals' bodies and institutions (e.g. Board of Quantity Surveyors Malaysia, Institution of Engineer Malaysia) as part of their CPD programs. By doing so, it is possible they can increase the awareness and knowledge by narrowing down the target to the construction professionals as the strategic action plan.

### **iii) Certification**

The unique approach of the VM is that the whole processes are facilitated by the facilitator. The roles of the facilitator are extremely important to ensure the smooth running and achievement of the workshop objectives. It is a fact that a VM facilitator is one of the CSFs for the workshop implementation (Fong et al., 2001; Shen and Liu, 2003; Lin et al., 2011). The approach of having unqualified and less experienced facilitators would lead to unsatisfactory outcomes of the workshop (Jaapar and Torrence, 2009). In

addition, the use of internal facilitators should be avoided to alleviate bias and conflict of interest between responsibilities and power.

Hence, the establishment of the certification system is indeed crucial for certifying the competency of the VM facilitators (Shen, 1997; Leung, 2008). This is necessary to ensure that those facilitators are equipped with the necessary knowledge and have ample experience and exposure. Based on the discussion with the advisor of the IVMM, the institution is currently working in hand with the Construction Industry Development Board of Malaysia (CIDB) in developing the certification system of the value manager in Malaysia. The framework of the certification has been approved by the council members of IVMM. It is hoped that it will be in place very soon.

#### **iv) Procurement and Incentive Clause**

Procurement is an important aspect that will influence the practicality of applying VM because such arrangements that are not flexible will not favour VM applications. Fong et al. (1998) concluded that it was very challenging to implement VM in HK since conventional procurement is dominant. It is the same situation in Malaysia to the authors' best knowledge. Conventional arrangement splits between two major processes of preconstruction and post-construction in which the contractor is not involved with the design. According to Shen (1997) and Cheah and Ting (2005), the presence of the contractors is vital to improve the constructability of the projects through their experience and expertise.

Meanwhile, flexibility in contract provision is also an important factor in the initial selection of procurement methods. Cheah and Ting (2005) added that the more flexible

the contractual provision, the higher possibility of engagement into VM. To start with, the policy makers need to consider the possibility of incorporating the VM incentive clauses into the standard condition of the contract. Reasonable incentives also can be offered to various stakeholders involved to motivate them. Since the private sector may opt to avoid this by considering the risk and profit issues, the government then can take the lead to propose the VM incentive clause within the provision of the public contract.

**v) Research and Development**

Research and Development is one of the significant areas to be explored. The exploration will give an opportunity to do better, gain more benefit from it (Fong et al., 2001), and lead Malaysia on forecasting trends in the future. There are areas that can be improved, and it is good to learn from other developed countries that had long ago applied VM. For example, there is a strong debate on whether the VM is standalone knowledge, or it is just another branch of management aspects (Fong, 2004).

However, it is important to ensure that the gap between academic research carried out and applications is at a minimum level. This is to avoid the rejection of the potential applications in the future. To deal with, joint-research between the academics and industry players sound to be more practical in approaching research in the VM area (Shen, 1997). Malaysia should consider adopting and exploiting previous research findings overseas, and see how it can be implemented in local scenarios and perspectives.

**vi) Professional Institution**

Most of the professionals in Malaysia govern by the statutory regulation to invigilate the overall aspect of the profession. Since VM is not widely recognized as a profession (Fong,

2004), IVMM was established to play the same roles in embracing VM in Malaysia. With an increasing VM community, it is the time for IVMM to set blueprint strategies to continuously promote VM. Among others, area that needs to be focused on are welcoming more memberships and increasing the awareness via organizing seminars, conferences, and learning workshops (Shen, 1997). The best possible way is to jointly organize such activities with the other professional institutions as discussed before. This includes collaboration with the other VM societies from different regions.

Standard and guidelines will drive to a consensus effect of a particular process. From the academic research point of view, Jaapar and Torrence (2009) proposed the VM implementation guidelines. EPU on the other hand published the guidelines for the implementation of the public projects. While MAHB also have their guidelines to be used in their business activities towards optimizing value (<http://www.malaysiaairports.com.my>).

The existing guideline is only used for public projects and MAHB respectively, and it needs to be reviewed from time to time based on the effectiveness of the applications in previous workshops. A special working group may be established to study and propose the common standard based on the core VM methodology. A detailed and specific guideline might be further scrutinized to suit specific needs based on the nature of the industry.

Meanwhile, institutional publication is one of the mediums to spread knowledge and related information. Comprehensive and interesting contents are necessary to be provided to gain the interest of the reader. IVMUK published the “Value News” as their monthly

publication. This is similar to the “Value World” by SAVE, “The Value Times” by IVMA, and “The Value Manager” by HKIVM. Meanwhile the web contents should be updated and maintained from time to time. It can serve as a “one-stop” data centre to obtain information related to VM, its application, activities, and related projects. Both a publication and website will acquaint towards the profession and embrace a good image to the public.

Promotional and marketing activities are amongst the best approach to disseminating knowledge and increase the awareness on VM. Fong and Shen (2000) further stressed that it is crucial and indispensable. Various channels can be used to achieve this such as web based internet. Again, collaboration with other professional institutions and approaching the government department and agencies are the quickest way to achieve the target and potential users.

Additionally, conference and seminar are among the common approaches to knowledge sharing. According to IVMM advisor, there have been several conferences held in the past. However, it is required more and more nowadays since the current situation is demanding. In later years, it is good to see that the private entities also would gain interest and can see how VM can help them in achieving better value of their investments, not particularly in construction, but also some other industries. On the other perspective, Cheah and Ting (2005) suggested the development of a precedence database to track the success and failures of VM applications. This is possible in Malaysia where the IVMM may collaborate with CIDB. The mechanism is that all construction projects in Malaysia should be registered with CIDB after the award. Through this channel, information on the VM applications on a particular project can be determined.

## **2.8 Summary of the Chapter**

This chapter provides reviews on VM in general, including its history, development, value concept, and its applications. In a later part of this chapter, specific information related to the application of VM for public projects and programs in Malaysia was introduced. At the end of this chapter, several areas were suggested to be given special attention to ensure the positive acceptance and development of VM applications in Malaysia.

## **CHAPTER 3: PERFORMANCE MANAGEMENT**

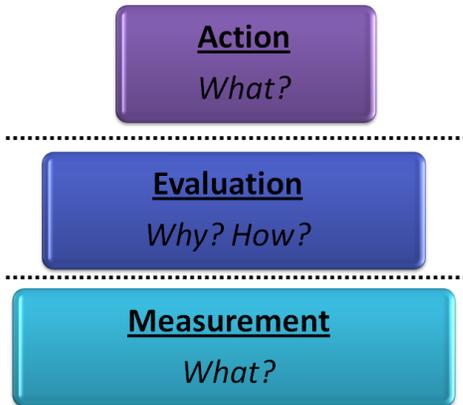
### **3.1 Introduction**

Chapter one provides some insight and brief explanation on the aspect of performance of the VM. Hence, this chapter aim to provide more reviews and foundation on the performance management to support this research. The literatures in general arguing that performance measurement and performance evaluation are subset to the performance management at strategic level.

### **3.2 Rediscovering Performance Management**

According to Brudan (2010), management as a science and as an art agree on its ultimate role in getting things done, or accomplishing desired goals. Hence the aspect of managing the performance has emerged over time as a discipline that assists in establishing, monitoring and achieving individual and organisational goals.

Folan et al. (2007) argued that not everyone understands when it comes to the topic on the performance measurement, performance evaluation and performance management. The variability is usually seen to reside in the secondary term: measurement, evaluation and management. The concept when the terms are being used differently from one to another. However all contain the common denominator term of performance, which suggests that some similarities are to be expected. However, this has not been seriously examined, where research is usually carried out in isolation from each other. Spitzer (2007) illustrates the difference from a broader perspective in Figure 3.1.



**Figure 3.1 Performance paradigms in an organisation (Source: Spitzer, 2007)**

Perrin (1998), Davies (1999), Nielsen and Eljer (2008) attempt to discuss thoroughly the comparison between performance measurement and performance evaluation, in which generally look like the same in nature but different in application and function. They argued that performance measurement and performance evaluation are complementary even they are different. Both of it have a mutually beneficial relationship and share many features in fulfilling the role as a management tool in managing the performance at the strategic level.

Perrin (2011) presents the differences of monitoring and evaluation which he claims still not fully appreciated in Figure 3.2. Monitoring as presented by Perrin is seen as measurement in this research that usually takes the form of the tracking of indicators that can provide an indication of progress in accordance with plans. The performance evaluation in contrast has the potential to identify why it happens so and how it can contribute further to the overall goals and also to take a constructive approach in providing learning that can inform future directions.

Monitoring	Evaluation
<ul style="list-style-type: none"> <li>• Periodic, using data routinely gathered or readily obtainable, generally internal</li> <li>• Assumes appropriateness of programmes, activities, objectives, indicators</li> <li>• Tracks progress against a small number of pre-established targets/indicators</li> <li>• Usually quantitative</li> <li>• Cannot indicate causality</li> <li>• Difficult to use by itself for impact assessment</li> </ul>	<ul style="list-style-type: none"> <li>• Generally episodic, often external</li> <li>• Can question the rationale and relevance of the programme and its objectives</li> <li>• Can identify unintended as well as planned impacts and effects</li> <li>• Can address 'how' and 'why' questions</li> <li>• Can provide guidance for future directions</li> <li>• Can use data from different sources and from a wide variety of methods</li> </ul>

**Figure 3.2 Comparison of basic characteristics between measurement (monitoring) and evaluation (Source: Perrin, 2011)**

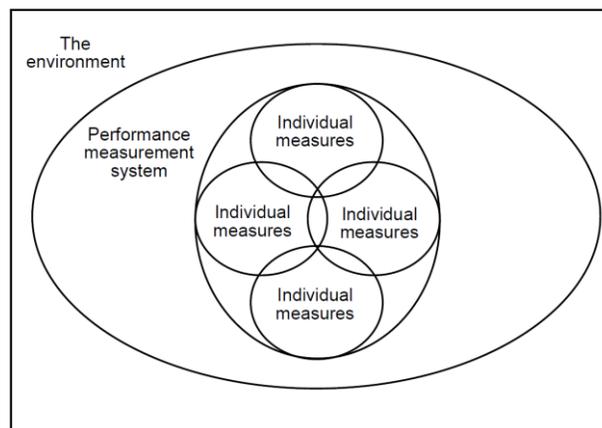
Venkatraman and Ramanujam (1986) argued that the academic community has been pre-occupied with discussions and debates about issues of terminology, level of analysis, and conceptual bases for assessment of performance. With the volume of literature continuously increasing, there appears to be little hope of reaching any agreement on terminology and definitions.

Hence, this research set the proposition that performance measurement, performance evaluation, and performance management are different. The premise of this research is formed by arguing that there are several stages in managing the performance that require clear parameters in defining those terms due to its subjective and interpretive nature (Lebas 1995; Wholey, 1996) .

### **3.3 Performance Measurement**

Performance measurement is a process of quantifying the effectiveness and efficiency of a particular process or system by using the set of metrics for quantification purposes (Neely et al., 1995). The measurement involves identification of any deviations from the

expected results of the pre-determined indicators. According to Lopez et al. (2005), the performance data provides early feedback about the efficiency of a learning process and ultimately effects on how an organisation continues to learn. By measuring the performance, areas that need attention can be identified: to increase the motivation of sub units and to strengthen the accountability (Perrin, 1998) and guide steady advancement toward identify shortfalls or stagnation.



**Figure 3.3 A framework for performance measurement system design (Source: Neely et al., 1995)**

The measurement process of the individual measure generates data that will form part of the measurement system (Figure 3.3). According to White (1996), data exist in two types: objective and subjective. Objective measures are easily quantifiable and straight forward based on independently observable fact. However, it is always not possible to gather accurate and standard performance data (Nemetz, 1990). Meanwhile the subjective measures are judgmental, complex and often difficult based on the opinions and perceptions where the objective measure can rely on.

The data become information only when they are used in a decision-making model or when they are transformed into some kind of predictive parameter value to be used in

decision-making. Hence, the data must be transformed into performance information via the performance evaluation for further actions by the management of the organisation as depicted in Figure 3.4.



**Figure 3.4 Major tasks in capturing information (Source: Nudurupati**

**et al., 2011)**

Since performance measurement is getting more popular over the years, Perrin (1998) found that there are increasing evidence that the performance measurement approach are repeating the mistakes in the past; Management by Objectives, Program Planning and Budgeting Systems and Management by Results in the 1970s and early 1980s. Nurudupati et al., (2007) supported this claim that the concept of performance measurement that is developed to improve the performance can sometimes mislead the management. Perrin criticise the use of indicators in performance measurement from these perspectives:

i) Definition of term

The indicators used in measurement process can be interpreted in various ways across the different users in different level in an organisation. Moreover, many organisations poorly defined the indicators which then create a lot of misunderstanding. On top of that, Winston (1999) found that organizations attempted to have their own guidelines which added to the burden of definitions that were already in circulation.

Hence, it is crucial to provide a clear and unambiguous definition of common term such

as the input, process, outputs, outcome, indicator, measure, efficiency, effectiveness and productivity by empirically review and test to achieve a consensus and acceptable definition (Kueng and Krahn, 1999). Training, assistance and other form of supports by the management must be provided to the individuals directly involved with the measurement and recording the data to reduce the misconception (Perrin, 2011).

ii) Goal displacement

There are tendency that the indicators become the objective when too much emphasis put on the process in achieving the targeted indicators without actually improving the overall outputs. Moreover, heavily depend on quantitative indicators can disguise and mislead rather than inform what is really happening. There is also potential of data manipulation to make it look good, sound reasonable and meet the pre-identified indicators (Kueng and Krahn, 1999).

As a result, the performance indicators frequently distort the direction of programs, diverting attention away from what the outcomes should be. The seriousness of this illustrated by Perrin (1998) with the legislative enforcement by the government in North America where the performance measurement is a compulsory exercise to be carried out to all public funded projects and programs.

iii) Meaningless and irrelevant indicators

Meaningless and irrelevant indicators are often developed and used (Perrin, 1998; Bernstein, 1999; Fellar, 2002). Davies (1999) added that one of the reason is the indicators are chosen in haste without sufficient consideration.

Newcomer (1997) indicates that the danger of indicators representing a particular perspective is enhanced when only a small number of indicators are used to supposedly

reflect the outcomes of a complex undertaking. For governmental and social project, this is even more critical because their very natures are complex and intangible and cannot be reduced to a numerical figure.

Also possibility of the rejection of the top management on indicators which it was not intended, by their own interpretations on the indicators. Hence, it is clear that the development of those indicators require commitment from senior management throughout the design, implementation and finally when it come to the use of those data to inform and give picture on the overall performance (Nudurupati et al., 2011).

To overcome this, Kueng and Krahn (1999) suggest that working based on the process goals is a good starting point for determine the right indicators. The indicators selected have to be accepted not only by the process owner and the other member of the organisation but also by the higher management level as they are the one who will decide the organisation's direction further.

#### iv) Cost saving vs. cost shifting

According to Perrin (1998), indicators used in performance measurement are invariably short term in nature. Hence, short-term benefits and outputs may result in future requirements and increased costs over the longer term, thus shifting into another costs in the future. But Bernstein (1999) in a view that this is something that is unavoidable especially for the public projects and programs.

#### v) Decision-making and resource allocation

The use of indicators focus more towards the processes and outputs and has less focus on the outcomes and innovation which lead the organization for better improvements. According to Newcomer (1997), performance measurement typically captures

quantitative indicators that will tell what is occurring with regard to program outputs without address how and why questions. The used of indicators incorrectly also assume causality, inferring that the identified outcomes are direct result from program activities because the indicators doesn't tell what else can be done or how can it be done better.

The causality between the processes, outputs and outcomes can only be accessed through use of an appropriate evaluation design that aims at understanding the “why” the indicators results are as such and “how” do we go about it to improve or make better.

Even Perrin (1998) criticise a lot, he offer strategies to minimise this risk of misuse of performance indicators. The identification of the indicators should take into account who is likely to make use of the indicators, identify the potential misinterpretation, develop indicators that are general enough to minimize actual misuse and test those indicators in advance to anticipate potential misapplications. Besides that, multiple indicators within a reasonable number also should be established to examine the variety of process aspect as well as the outputs and outcomes.

As the organisation will keep on growing, the indicators must be frequently reviewed, revised and updated at certain interval to match with current needs, circumstances, opportunities and priorities and keep it in line with the organisation's goals and objectives (Bernstein, 1999; Nudurupati et al., 2011).

Hence in this research, criticisms by Perrin were given serious attention during identification and selection to avoid inappropriate use of the performance indicators. At the very beginning, this research has identified who is likely will used these indicators. The indicators were defined to avoid misinterpretation. More general indicators have

been proposed and minimise the quantitative indicators such as the number of ideas and the cost optimisation. The potential misinterpretation was anticipated prior to the performance survey where each indicator was mapped against the various phases of the VM workshop to mark clearly the relevance of the indicators in every related activity of the workshop.

### **3.4 Performance Evaluation**

To overcome some pitfalls of performance measurement, Perrin (2011) suggested that performance evaluation can play a role to contribute primarily on the technical issues and problems of performance measurement. Performance evaluation is usually conducted to assess how well a process is working by providing substantive know-how causality assumption by identifying how and why those indicators used in monitoring can contribute to the overall goals.

Performance evaluation can be taken as a constructive approach in providing learning that can inform future directions to the organisation (Davies, 1999). The management at strategic level can consider whether to continue the program and strategies as well as reviewing the organisation's objectives, despite identifying the unexpected consequences (Perrin, 2009). As quoted by Nielsen and Eljer (2008), the performance evaluation discipline has key insight and tool to offer performance measurement.

Perrin (2011) added that there are several performance evaluation methods such as contribution analysis and realist evaluation. However, he raised concerns on the inappropriateness of performance evaluation which often produces a body of knowledge

that appears too late and too long to be useful as a management tool, especially when it comes to a financial matter within a short period of times is the concern of Nielsen and Eljer (2008). This inappropriateness will lead the option to the performance indicators instead which is both timely and brief for the faster decision-making process. Hence, this research explores the possibility of Fuzzy Synthetic Evaluation (FSE) approach to evaluating the performance based on multi-criteria decision-making of various performance indicators identified by the evaluation methods described earlier only relevant to the manufacturing industries.

### **3.5 Performance management**

Traditionally, organisational performance management has been concerned with control, by setting and monitoring achievement of targets at strategic, operational and individual levels. Measurement has its benefits, as it provides valuable information and measuring in itself stimulates higher performance.

Empirical evidence shows that the focus on measurement for control in the context of performance management has started to diminish in the 1990s, driven by the increase in popularity of the Balanced scorecard (BSC), knowledge management and systems thinking (Neely, 1999). As illustrated above, even the BSC was first presented in 1992 as a measurement tool, promoted by the management accounting school and having roots in the quality movement. The first Balanced Scorecard was developed in 1987-1988 at Analogue Devices, by their Quality and Productivity team (Schneiderman, 1999). However it gradually evolved to become a complete management system supporting

strategy execution as a core competency. As a performance management tool, the BSC enables not only measurement and control, but also communication and learning.

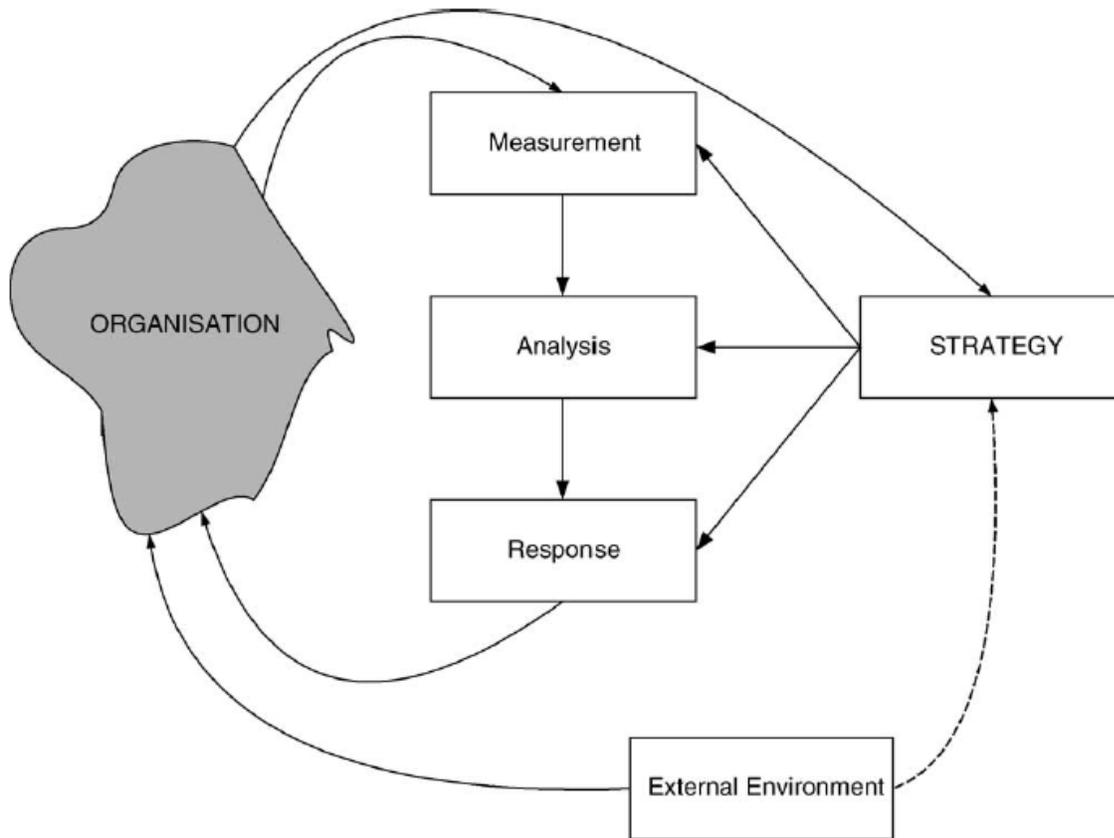
Thus the systems thinking approach to performance management, coupled with the emphasis on learning, highlight the need for an integrated approach to performance management. Effective performance management requires more than measuring and reporting in isolation. An integrated approach, linking together the performance measurement, performance evaluation, and performance management becomes a necessity for both research and practice to facilitate the understanding and usage of performance management systems.

According to Waal (2010), the art of management is not to know everything that is happening in an organisation, but to know what the key issues of the business are, keep track of them, and take action on them. Focusing on what is truly important entails: focusing on CSFs and KPIs that are crucial to the business, focusing on exceptional events or figures, analysing financial and non-financial results, making corrective action plans, and estimating the impact of those action plans.

Lebas (1995) argued that the performance management philosophy which is supported by the performance measurement and performance evaluation cannot be separated. Performance evaluation can be defined as the use of performance measurement information to effect positive change in organisational culture, system and processes, by helping to set agreed-upon performance goals, allocating and prioritising resources, informing managers to either confirm or change current policy or programme directions to meet those goals and sharing result of performance in pursuing those goals

(Amaratunga and Baldry, 2002). It was argued by Perrin (1999) that the best way to control for limitation of one to another is by using combination of complementary methods. So the integration between measurement, evaluation and management is sound and possible.

In order to have an effective performance management, it requires two key components; the right organisational structure which facilitate the effective use of performance measurement results through performance evaluation and also the ability to use performance evaluation results to bring about change in the organisation. The effective transformation of performance measurement and the ability to use performance evaluation results will bring about significant change in the organisation to remain competitive and growing by learning from the organisation's experience and other competitors. This culture is where its work as an enabler of a circle of learning as depicted in Figure 3.5 where the organisation whose structures and processes are aimed at enhancing learning and improve its ability to react to, adapt to and capitalise on changes in its internal and external environments.



**Figure 3.5 Schematic presentation of performance management process**

**(Source: Smith and Goddard, 2002)**

### **3.6 Summary of the Chapter**

This chapter provided reviews on the aspect on the theory on performance. The understanding of the theory is important to lay the foundation and to incorporate the relevant theories into the performance management framework for VM implementation in the construction industry that will be discussed in detail in the following chapters.

## **CHAPTER 4: RESEARCH METHODOLOGY**

### **4.1 Introduction**

The previous three chapters provide critical information that has motivated this research and where this research was based upon. Based on the overall aim and objectives to be achieved in this research, this chapter lays out the methods used in doing so. Those methods are commonly applied in construction management research and will be discussed in the following subchapters.

### **4.2 Research Framework**

To guide the research process, the framework has been developed by highlighting the major components of the research with associated methods of data collection and analysis methods. According to Shields and Tajalli (2006), it helps the investigators to approach the problems and gives direction on ‘what’ and ‘how’ to collect and analyse the data. Fellows and Liu (2012) added that the ‘what’ concern with facts and conclusion, while the ‘how’ concern on the scientific approach that is critical in analysing the data to draw the conclusions.

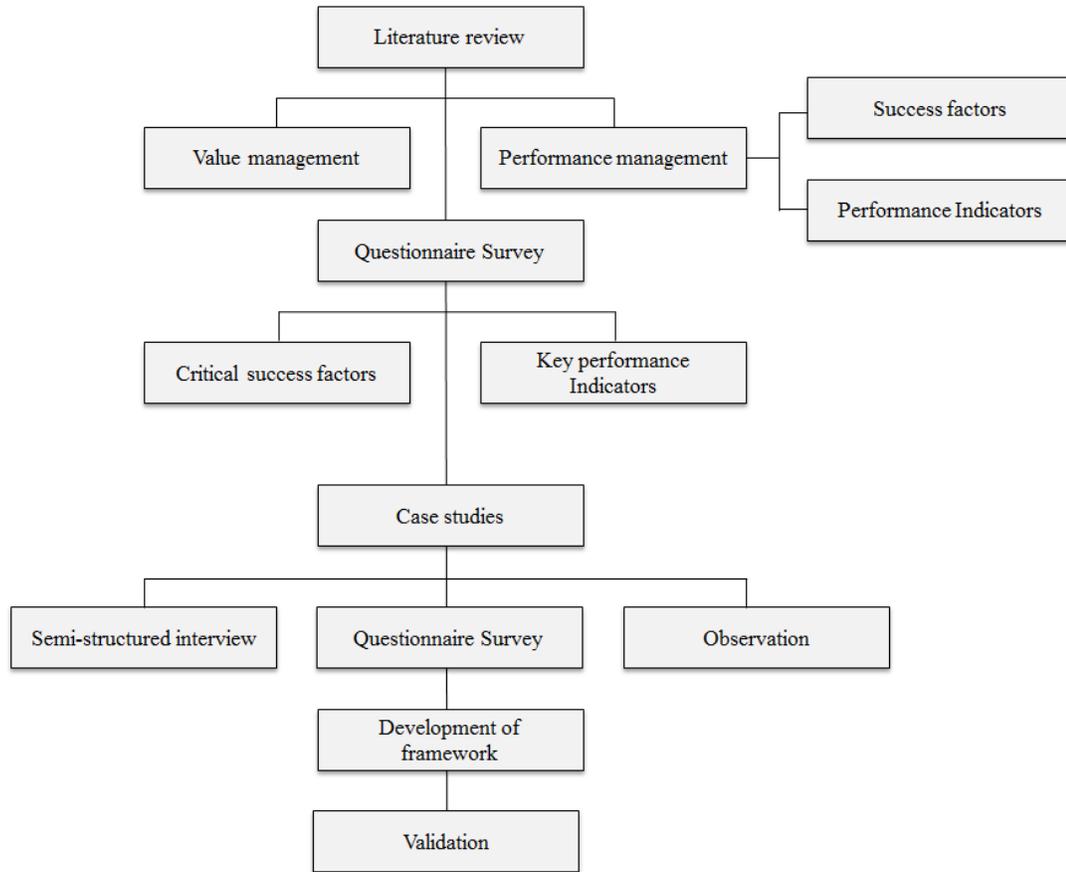
Based on the overall aim and the objectives of the research as identified in Chapter 1, this research is classify as applied research that is geared towards practical applications of VM in the construction industry by examining the issues and trying to propose the practical solutions. Meanwhile, the interpretivism paradigm is the main focus to indicate the reality of applications in the industry, especially when it was made a mandatory

requirement for public projects implementation. The next is fundamental issues in designing the research.

### **4.3 Research Design**

Emory and Cooper (1991) argued that eight different perspectives: degree of problems, methods of data collection, variables, purpose of the research, time dimension, the topical scope, the research environment, and the subject's perceptions should be considered in developing a research design. Research can be divided into two main approaches: quantitative and qualitative research. Quantitative approach has been attached to the scientific activities that combined the use of numbers, deduction, and hypothesis testing, and dominantly used in social science research. Meanwhile, qualitative approach has been attached to the scientific activities that use non-numerical data, induction, and are exploratory in nature. This approach allows the researcher to make sense of, or interpret a phenomenon.

However, triangulation of both quantitative and qualitative can be very powerful to gain insight and results, to assist in making inferences and in drawing conclusions to the research (Fellow and Liu, 2012). Moreover, both approaches can complement each other to reduce or eliminate the disadvantages of another. Earlier work of Jick (1979) claimed that triangulation able to enhance the external validity between the methods and enhance internal reliability within the method. Figure 4.1 presents the framework and design of this research.



**Figure 4.1 The research framework**

The process began with exploring the literature reviews in the field of VM in the construction industry and performance management. Thorough analyses have been conducted for articles published in leading journals in the field of construction management and engineering. The focus then moved to the VM implementation within the Malaysian construction industry. Further reading on government circulars, guidelines, and previous VM workshop reports were done to gain further understanding of the approach of applications in Malaysia. Based on the secondary data collected, the questionnaire survey was developed to identify the CSFs and KPIs for VM implementation within the practices in Malaysia.

The data collected were analysed, and finally the CSFs and KPIs were identified. The KPIs identified were then used in case studies of five VM workshops through an observation during the workshop, a questionnaire survey of all participants and semi-structured interview to several stakeholders' representatives. Both quantitative and qualitative data gathered during the case studies were analysed. As the results, performance measurement model and performance evaluation model were developed and formed part of the performance management framework. The proposed framework was validated by the practitioners within the industry to ensure its usefulness and practicality.

#### **4.4 Data Collection Approach**

To achieve the identified objectives of this research, several methods have been selected which are deemed to be appropriate to obtain the required data for analysis. Those methods are commonly applied in construction management research and will be discussed in the following subchapters. The data collection for this research involved two stages as follows:

##### **4.4.1 First-stage Data Collection**

###### **4.4.1.1 Content Analysis**

Content analysis is defined as the process of analysing data in a systematic, objective, and quantitative manner. Krippendorff (2004) defined content analysis as a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use. It is a technique for examining information or content in written materials of descriptive research. It has been widely used in qualitative

research. This research employed a conventional content analysis, in which the data are derived directly from the text data.

In this research, content analysis was used to analyse the CSFs and KPIs that have been determined by previous studies. The journal articles reporting on CSFs and KPIs of VM studies were retrieved through comprehensive desktop search. Papers with relevant terms were considered to have met the requirements of this research. The identified CSFs and KPIs were then screened through before being included in the questionnaire survey.

#### **4.4.1.2 Pilot Survey**

The survey was piloted in May 2012 to the potential respondents. They were selected from various diverse backgrounds, so as to ensure that the questionnaires were phrased appropriately to achieve their purpose. The survey was handed over to the architects, engineers, quantity surveyors, and project managers in both the public and private sectors and researchers in the field of construction management from four universities. Sixteen respondents provided feedback and Table 4.1 presents the respondents' profiles.

The main area of concern of the respondents was the use of even-point scales in this survey (in this case, a four-point scale), as these provide no mid-point in the range. However, even-point scales were still considered as necessary to determine the respondents' tendency to agree with the identified performance indicators (Bell, 2010). Another feedback was indicators related to the end user. Some terminologies used in the survey have also been changed to make them more relevant to the local context.

**Table 4.1 Background of respondents for pilot survey**

<b>Sector</b>	<b>Background</b>	<b>Years of experience</b>
Government	Quantity surveying	14
Government	Architecture	19
Government	Quantity surveying	11
Government	Civil engineering	12
Government	Quantity surveying	8
Government	Quantity surveying	8
Government	Electrical engineering	31
Private	Quantity surveying	8
Private	Construction management	24
Private	Quantity surveying	7
Private	Quantity surveying	28
Private	Electrical engineering	12
Academic	Construction management	24
Academic	Quantity surveying	18
Academic	Quantity surveying	26
Academic	Quantity surveying	8

The main area of concern of the respondents was the use of even-point scales in this survey (in this case, a four-point scale), as these provide no mid-point in the range. However, even-point scales were still considered as necessary to determine the respondents' tendency to agree with the identified performance indicators (Bell, 2010). Another feedback was indicators related to the end user. Some terminologies used in the survey have also been changed to make them more relevant to the local context.

#### 4.4.1.3 Questionnaire Survey

Questionnaire is probably the most widely used data collection technique for surveys. It consists of questions for the purpose of gathering data from the respondents. This kind of data collection is the most suitable since in most cases the questions are predetermined to ease the process of data analysis. Questionnaires have been widely used for descriptive and analytical surveys in order to find out facts, opinions, and views on what is happening, who, where, how many, or how much.

**Table 4.2 Tabulation of respondents in different clusters**

<b>Cluster</b>	<b>Description</b>	<b>No. of Respondents</b>
A	Received formal training and attend VM workshop	63
B	Attended VM workshop without any formal training	51
C	Received formal training but haven't attended VM workshop	25
D	No formal training and not participated in any VM workshop	56

In this research, the survey adopted stratified sampling to reach a particular group of respondents that have been exposed to VM. Apparently, random sampling of the entire population may increase the number of samples, but it may end up with less quality of samples due to the incapability of the respondents in the VM subject. It is expected that stratified sampling able to provide the most valid and credible results as they reflect the characteristics of the population that are important and relevant to the research focus on VM. Based on the valid responses received, the respondents are divided into four clusters (Table 4.2) based on their VM knowledge and experience in VM application.

#### **4.4.2 Second-stage Data Collection**

After completion of the first-stage data collection, the CSFs and KPIs for VM workshop implementation for public projects in Malaysia were identified and established. These have allowed the research to proceed with the second stage of data collection through case study approach.

Case study is an ideal methodology when it involves a holistic and in-depth investigation (Fellows and Liu, 2012). Often, the data were collected over a period within their context to provide an analysis and to illuminate the theoretical issues being studied (Hartley, 2004). According to Naoum (1998), this approach is the most suitable when the researcher intends to support the argument by an in-depth analysis of a person, a group of persons, organisation, or a particular project.

It is also designed to bring out the details from the viewpoint of the participants by using multiple sources of data. This research has adopted specific types of case studies, namely explanatory case studies to investigate the causal relationship between variables. Yin (1994) proposed a standard protocol for conducting the case study research. The protocol should include the following sections:

- An overview of the case study project - this will include project objectives, case study issues, and presentations of the topic under study
- Field procedures - reminders about procedures, credentials for access to data sources, location of those sources
- Case study questions - the questions that the investigator must keep in mind during data collection

- A guide for the case study report - the outline and format for the report.

In this research, a case study approach was used to gain in-depth understanding of the process and performance of the VM workshop studies conducted for the public projects in Malaysia. The case studies allow the process of comparing the performance of each workshop and determine any specific problems encountered during the workshop implementation. The project to be selected should be of the same nature to avoid biases in a comparison of the performance because a different nature of the project may have different limitations that may influence the process of VM workshops.

To maximise the opportunity to collect as much information from the case studies, this research employed triangulation methods during the second stage of data collection. Deliberations on those methods are as follows:

#### **4.4.2.1 Observation**

Observation is widely used in dealing with research related to the subjective nature. It allows the researcher to closely monitor the subject of the study. There are two common approaches to doing observation: either by the researcher himself or herself, the independent observer, or a combination of both. Considering the nature of this research that involved a specific topic on VM, with a specific focus on the aspect of performance, it was decided that own observation is the most suitable. To avoid biases in the reporting, the findings were then triangulated with the remaining two methods of data collection: survey and semi-structured interview.

The researcher observed all VM workshops selected as the case studies in this research. In total, there were five VM workshops. The observer was present during the whole

duration of the workshop. The observer was an independent participant who was only authorised to observe, but not to take part during the workshop process. In doing the observation, the observer observed the whole process, specifically focusing on the CSFs and KPIs identified during the first stage of data collection. The observation form was developed to assist the observation process.

#### 4.4.2.2 Questionnaire survey

At this stage, the questionnaire survey developed during the first stage of data collection was amended to include those KPIs only as the main focus of the survey. Each KPI was deliberated to provide some guide for the participants to rank the workshop performance. Apart from that, the respondents were also asked to provide some feedback on the overall performance of the workshop as well as their personal information.

**Table 4.3 Distribution of the questionnaire survey for case studies**

	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>	<b>P5</b>	<b>Total</b>
<b>Total participants</b>	47	43	50	47	31	218
<b>Total survey distributed</b>	25	35	32	31	20	143
<b>Total survey returned</b>	17	23	26	21	16	103
<b>Rate of return</b>	68%	66%	81%	68%	80%	72%

The number of respondents from each workshop depended on the total number of participants who were available until the final day of the workshop. It is important to note that the number of respondents was relatively smaller than the total number of participants of the workshop (Table 4.3). This was mainly due to the absence of some

participants who were not able to stay for the whole duration of the workshop. It was also observed that the representatives from the local authorities and the service providers were given exemption to leave the workshop after the information phase. However, they would be contacted in the case of further clarification required from their organisations on certain issues.

#### **4.4.2.3 Semi-structured Interview**

A semi-structured interview is a verbal interchange where one person as the interviewer attempts to elicit information from another person by asking questions. Although the interviewer prepares a list of predetermined questions, semi-structured interview unfolds in a conversational manner that offers the flexibility to the participants to explore issues that they feel relevant and important to a particular topic in an informal tone.

The process is normally self-conscious, orderly, and partially structured. It is suitable for a range of research in conjunction with a variety of other methods. Prior to the interview session, the interviewer has to formulate the questions, determine and invite the interviewees, determine and prepare the venue, and get ready to record the data. Semi-structured interview makes a significant contribution to geographic research, especially when it comes to the topic related to definition, identification, subjectivity, knowledge, etc.

During this stage, a total of twenty semi-structured interviews were carried out with the representatives from various stakeholders of the projects involved in the VM workshops. To obtain a wider coverage and different perspectives on the workshop performance, different interviewees from different stakeholders of the project were selected. For each

case study, four interviewees were approached. In all cases, the interviewees represent the client organisation and the VM workshop facilitator. In some of the cases, the interviewees represent other stakeholders to a project such as the end users, government agencies, local authorities, or project consultants. In addition, another four interviews were carried out with the representatives from two government departments that oversee the implementation of VM workshops for public projects in Malaysia.

The interview process begins with a formal invitation to the potential interviewees. Once they agree, the interview questions were sent ahead of the interview session to allow the necessary time for preparation. The interviewees were also required to sign a consent form for their participation. All the interviews were digitally recorded during the sessions. Apart from that, notes were taken when the interviewer observed any signs from the interviewees' body language that were closely related to the questions. After the session has completed, the transcription process begins, and the transcripts are sent over to the interviewees for their review and confirmation. Further clarifications were conducted when it was deemed to be necessary. To protect the privacy of the interviewees, they were made anonymous in this research that does not affect the intended knowledge transfer. From then on, the transcripts were analysed using the NVivo 10 software. This software supports the qualitative and mixed methods research works by analysing the contents from various formats such as text, audio, video, and image.

#### **4.4.3 Validation**

Validation is an important process in this research in order to validate the proposed framework that has been developed based on the finding of the first three objectives of the research. In doing so, focus group meeting (FGM) was deployed in validating the framework.

Focus groups are carefully planned discussions stimulated within a predefined group environment to obtain perceptions about a defined area of interest in a permissive, non-judgemental environment (Krueger and Casey, 2009). This approach allows the participants to disclose and share more ideas and concern about the topic discussed. According to Morgan (1997), this approach can collect data on similarities and differences in participants' opinions and preferences in a more relaxed and flexible environment. FGM is a technique particularly useful for highly unstructured data and involves categorising communication content into its parts (Berg, 1989).

In this research, FGM allowed the researcher to present the proposed performance management framework to the VM steering committee of the EPU, Prime Minister's Department of Malaysia. During this meeting, the researcher presented the initial theoretical framework of the research and the proposed framework for managing the performance of VM studies for public construction projects in Malaysia. During the meeting, the researcher was able to engage the participants to give input and comments on the proposed framework.

#### **4.5 Statistical Analysis Techniques**

All quantitative data are subject to statistical analyses using the SPSS software. Among others, the statistical tests employed in this research include the following:

#### **4.5.1 Normality Test**

A normality test was conducted to determine whether the data fitted a normal distribution. The result revealed that the data collected through this survey were not modelled by a normal distribution, in which the sigma value of Shapiro-Wilk test is below 0.05 (Chen and Chen, 2007). The finding is not unusual in these kinds of studies because respondent views in terms of agreeing or disagree tend to push the mode to one end.

#### **4.5.2 Descriptive Analysis**

Descriptive analysis was conducted to determine the main features such as frequency, mean, and standard deviation. This provided simple summaries about the samples in the form of an initial description and as part of a more extensive statistical analysis.

#### **4.5.3 Mann-Whitney U Test**

With the assumption that the respondents can be categorised into different clusters based on their VM knowledge and experience, *Mann-Whitney U* tests were conducted to examine whether statistically significant differences existed among the different clusters. This test is deemed to be appropriate for the data that are not classified as a normal distribution and measured by using an ordinal scale of measurement (Love et al., 2004).

#### **4.5.4 Exploratory Factor Analysis**

Exploratory factor analysis (EFA) was first introduced by Thurstone in 1931 and is widely used for data reduction purposes to get a smaller set of variables by removing redundancy or duplication, and to detect structure in the relationships between variables. This analysis can be performed either exploratory where there are no predefined ideas on the structure of the variables, or confirmatory when it is used to test a specific hypothesis about the structure of the variables.

#### **4.5.5 Scale Ranking Analysis**

Ranking analysis was conducted in order to rank the list according to their hierarchical order. The mean values were used to compare each of the factors to rank the list. In the case whereby two factors have an equivalent mean value, the lowest standard deviation was assigned the highest ranking (Field, 2005) because the value indicated that the data points tend to be very close to the mean.

#### **4.5.6 Kendall's Concordance Test**

The Kendall's concordance test was carried out to explore further on the level of agreement within each cluster. The W values of  $\geq 0.05$  means that we can reject the null hypothesis that the respondents' sets of rankings are independent of each other within the same cluster (Chan et al., 2011). Hence, it can be concluded that there is a strong consensus among the respondents in each cluster. The strong consensus indicates that respondents with the same background of formal training and workshop experience have a mutual agreement in ranking the indicators.

#### **4.5.7 Spearman's Correlation Test**

*The Spearman's rank correlation* was employed to investigate further on the correlation between groups of respondents (Kog and Loh, 2012; Parl, 2009). Since there are two clusters selected for detailed analysis, the *Spearman's rank correlation* test was carried out to test the correlation on ranking between these two clusters. According to Chan et al. (2011), this correlation test can help in identifying the consistency of the ranking between two clusters. The positive coefficient value ( $p \geq 0.05$ ) of 0.815 suggests that the null hypothesis can be rejected. Hence, it can be concluded that there is a significant correlation between clusters A and B in ranking the indicators.

#### **4.6 Summary of the Chapter**

This chapter provided the details of the research methodology employed in this research. The methods were identified to address and achieve the objectives as specified in Chapter 1. The overall research design was presented in the earlier part of this chapter, followed by a detailed explanation of the associated process involved in both the quantitative and qualitative data collection throughout this research. The methods explained in this chapter provide a logical process for the development and validation of the proposed framework.

## **CHAPTER 5: CRITICAL SUCCESS FACTORS (CSFs) FOR VALUE MANAGEMENT IMPLEMENTATION**

### **5.1 Introduction**

This chapter outlines the process of identifying the CSFs for VM workshop implementation and finally presents its findings. The identification of CSFs is important to clarify and enable the stakeholders involved in any VM workshop to give full attention to these factors in ensuring the successful implementation of the VM workshop.

### **5.2 Identification of Potential Critical Success Factors**

One of the objectives of this research is to determine the CSFs for VM workshops in the Malaysian construction industry. The CSFs should be manageable in a number of success factors that are critical to the successful implementation of VM workshops. In this research, the conventional approach was adopted as recommended by Lu et al. (2008).

The first step was to discover a comprehensive range of success factors by conducting a thorough literature review. It was followed by a questionnaire survey of experienced practitioners in the Malaysian construction industry to determine their level of agreement with each of the success factors. Finally, as suggested by Yu et al. (2006), the data collected from the survey was statistically analysed to determine the CSFs. According to Chau et al. (1999), the last step is particularly effective when factors were subjective in nature and when hard performance data was not available.

The search online was carried out using search engines on the internet to retrieve the published papers. Both Scopus and Science Citation Index Expanded (SCI) were used

because some of the journals were not indexed by each other. By assuming that the author(s) may be keen to publish their papers in a first-tier journal based on the quality of the journals (Bröchner and Bjork 2008), the search results were further refined by making reference to the journal ranking list recommended by Chau (1997) in the area of construction engineering and management and the institutional journals listed in order to determine the journals to be incorporated. The authors used a similar approach to those previously adopted by Bröchner and Björk (2008) for construction management related journals and McKercher et al. (2006) for tourism and hospitality related journals.

Table 5.1 presents the summary of the literature on success factors for VM implementation. The summary provides an overview of what is constituted as the CSFs in previous research studies that are geographically dispersed and were based on different characteristics of VM methodology. Among others, previous work by Shen and Liu (2003) identified the CSFs according to their importance about the success of the VM studies. They performed extensive reviews and shortlisted twenty-three factors that may affect the successful implementation of the VM workshop. The surveys conducted for experienced construction practitioners in Hong Kong, the USA, and the UK, from which fifteen CSFs for VM workshops were identified.

For continuity with the previous research, the authors decided to build on the findings of Shen and Liu (2003) since they have extensively covered the literature on this subject. However, it was subject to an additional review of the recent relevant works. Those CSFs were revisited and cross-checked with the recent work (e.g., Chen et al. 2010) because there is no other work of a similar scope as the previous studies.

**Table 5.1 Success factors of VM workshop from previous research**

<b>References</b>	<b>Success Factors</b>
<b>Romani (1975)</b>	Working experience and scope of the service of the value engineers, professional training, and cost of conducting the value engineering workshop.
<b>Dell’Isola (1982)</b>	Function analysis.
<b>Maurer (1996)</b>	Client support, integrating VM into the objectives of the organization, independent VM facilitator, training of workshop facilitators, implementation of the workshop proposal, and cooperation within the organization.
<b>Palmer et al. (1996)</b>	Personalities of the participants, the competency level of the facilitator, the timing of the study, the interaction among workshop participants, the input of the original design team, and the role of the client.
<b>Male et al. (1998)</b>	Multidisciplinary team mix, skill of the facilitator, structured approach, VM knowledge of the participants, the presence of decision makers in the workshop, participant ownership of the VM process outputs, pre-workshop studies, the use of functional analysis, support and participations by participants and senior management, and an implementation plan for the outcomes.
<b>Pucetas (1998)</b>	Logistics, team selection, orientation meeting, workshop processes according to the VM job plan, implementation meeting.
<b>Shen and Liu (2003)</b>	Client’s support and active participation, clear objective of VM study, multidisciplinary composition of team, qualified VM facilitator, control of workshop, preparation and understanding of related information, plan for implementation, function analysis, timing of study, interaction among participants, professional experience and knowledge of participants in their own discipline, personalities of participants, adequate time for VM study, VM knowledge and experience of participants, and cooperation from related departments.
<b>Chen et al. (2010)</b>	Job plan execution, team leader personality, client input, workshop plan and relationships within the design team, nature of the project.

The pilot surveys were carried out in Malaysia to ensure the applicability of the factors within the context of VM applications within the Malaysian construction industry. As a result, nineteen new success factors were selected in this research. The list of nineteen success factors and their definitions are presented in Table 5.2. There were additional

factors identified, and some of the success factors were rephrased to reflect the real practice of the VM workshop as compared to the list of Shen and Liu (2003). Hence, it is clear that this research is unique in nature because the data, respondents, and findings are different from those of previous studies.

**Table 5.2 Potential success factors and their definition**

<b>Code</b>	<b>Success Factor</b>	<b>Definition</b>
<b>SF1</b>	Clear objectives provided for the VM workshops	Extent to which the objectives of the workshop are identified by the client with the help of the facilitator
<b>SF2</b>	Client's participation (representation) in the VM workshops	Extent to which the client's representative participates throughout the workshop process
<b>SF3</b>	Client's support of the VM workshops	Extent of the support provided by the client in terms of the financial, information and human resources
<b>SF4</b>	End user's participation (representation) in the VM workshops	Extent to which the end user's representative is involved throughout the workshop process
<b>SF5</b>	Discipline and attitude of the participants	Extent of the teams discipline in terms of punctuality and attitude to work during the workshop process
<b>SF6</b>	Background information collected	Extent of the information obtained about the project
<b>SF7</b>	Decision-making authority granted to each participant by their respective organization	Extent of the power to make a decision by the participants on behalf of their organization as the stakeholder for the project workshop process
<b>SF8</b>	Team mix of the participants	Extent to which the discipline mix of the participants from various backgrounds represents project stakeholders
<b>SF9</b>	Input from the relevant governmental departments and local authorities (e.g.: local planning)	Extent of support provided by the relevant stakeholders that have no direct relationship to the project but who may affect the smooth running of the workshop and the project

<b>SF10</b>	Years of experience of the facilitator in VM workshops facilitation	Number of years of experienced gained by the facilitator in facilitating workshops
<b>SF11</b>	Professional qualification of the facilitator	Professional qualification of the facilitator through accreditation by relevant VM societies.
<b>SF12</b>	Pre-workshop meeting conducted	Number of meetings conducted prior to the workshop
<b>SF13</b>	Workshop intervention into project development cycle	Extent to which the workshop takes off at different stages of the project development cycle
<b>SF14</b>	Years of relevant experience of the participants in their own field	Number of years of experienced gained by the participants in their discipline
<b>SF15</b>	VM knowledge of the participants	Extent of knowledge about VM among the participants
<b>SF16</b>	Site visits conducted	Number of site visits conducted prior to the workshop
<b>SF17</b>	Academic qualification of the facilitator	Level of academic qualification of the facilitator
<b>SF18</b>	Number. of VM workshops facilitated by the facilitator and average duration of each workshop	Number of previous workshops facilitated by the facilitator and the duration of each workshop to provide an accurate level of experience in workshop facilitation
<b>SF19</b>	Venue of the VM workshops	Venue where the workshop is held

### **5.3 Quantitative Analysis of Potential Critical Success Factors**

A normality test was conducted to determine whether the data fits a normal distribution. The result revealed that the data collected through this survey was not modelled by a normal distribution, in which the sigma value of the Shapiro-Wilk test is below  $t_{0.05}$  (Chen and Chen, 2007). The result is not unusual in these kinds of studies because respondent viewpoints in terms of agreeing or disagreeing tend to push the mode to one end.

Descriptive analysis was conducted to determine the main features such as frequency, mean, and standard deviation. The analysis provides simple summaries about the samples in the form of an initial description and as part of a more extensive statistical analysis.

On the basis of the prediction that the samples will fall into different clusters, Mann-Whitney U tests were conducted to examine whether statistically significant differences existed among the different clusters. According to Love et al. (2004), this test was suitable for data that were not classified by a normal distribution and were measured using an ordinal measurement scale. It was followed by the Exploratory Factor Analysis (EFA) to determine the underlying themes from the many instances of success factors.

Finally, the scale-ranking analysis was conducted to rank the success factors on the basis of the mean value of each factor. In the case where two or more success factors had an equal mean value, the standard deviation of each success factor would determine the ranking. Factors with the lowest standard deviation were assigned the highest ranking (Field, 2005) because the value indicated that the data points tend to be very close to the

mean. The statistical analysis was performed using the *Statistical Package for Social Sciences* (SPSS 20.0).

#### **5.4 Identification of Critical Success Factors**

As previously described in Chapter 4 of this thesis, the questionnaire surveys were developed, piloted, and distributed to the construction professionals within the Malaysian construction industry. Stratified sampling was adopted to reach a particular group of respondents that have been exposed on VM. Out of 503 surveys distributed, 195 valid responses were received and divided into four different clusters based upon two basic variables: formal VM training and participation in the VM workshop.

Table 5.3 presents the initial descriptive analysis that includes the initial findings of the surveys. Surprisingly, the findings from different clusters are essentially similar, despite the difference of VM background among the respondents. The five success factors from each cluster that obtained the highest mean value are shown in Table 5.4.

The top three success factors were as follows: clear objectives provided for the VM workshops, client support of the VM workshops, and client participation (representation) during the VM workshops. All three fall within the client's influence as found by Simister and Green (1997) and Shen and Liu (2003). Previous works by Simister and Green identified that client participation in the workshop was important to ensure that the workshop's decision aligned with the client organisational objectives.

Similarly, Shen and Liu (2003) identified factors such as the client's support and active participation and provided a clear objective that impeded the successful implementation

of the VM workshops. As the project's main stakeholder, the client should initiate VM workshops and determine workshop objectives in consultation with the workshop facilitator. As various processes within the VM workshop involved important decisions that often needed to be made immediately, the presence of a client representative was vital to ensure that the direction of the workshops was geared toward the agreed objectives. Other factors found to be critical include background information collected, discipline and attitude of workshop participants, the facilitator's academic and professional qualifications, and the facilitator's previous experience in facilitating workshops.

Previous research (Male et al. 1998; Shen and Liu 2003; Fong et al. 2001, Chen et al. 2010) did not include the end-user's participation in VM workshops. However, this research considered that the end-user's participation was vital because they will occupy and use the building. Taking a hospital project as an example, the end users involved in the daily operation of the hospital would be able to provide better views regarding the functional aspects of a particular space or room. In this situation, the involvement of the management representative of the hospital, the clinical staff, and the maintenance company would provide beneficial input for a VM workshop. End-user participation is among the critical success factors in Cluster A and Cluster B because the background and experience of the respondents in these clusters has provided them with a clearer picture of who should be involved in VM workshops.

The success factors for a VM workshop suggested by respondents of Cluster C and Cluster D should be considered. Although two of their top success factors are related to the competency of the facilitator, very few facilitators have been certified by the CIDB of

Malaysia, which is currently working closely with the IVMM to develop a framework for VM facilitators' certification.

**Table 5.3 Success factors and their scores and ranking in different clusters of respondents**

No.	Success Factor	Cluster A			Cluster B			Cluster C			Cluster D			Combined Cluster		
		Mean	SD	Rank	Mean	SD	Rank									
1	Workshops intervention into project development cycle	3.27	0.515	11	3.06	0.544	16	3.20	0.500	14	3.07	0.322	10	3.15	0.480	12
2	Venue of the VM workshops	2.87	0.660	19	2.88	0.653	19	2.60	0.500	19	2.66	0.668	19	2.78	0.648	19
3	Client's support of the VM workshops	3.67	0.508	2	3.57	0.608	2	3.44	0.583	4	3.25	0.611	5	3.49	0.595	3
4	Client's participation (representation) in the VM workshops	3.67	0.539	3	3.65	0.522	1	3.56	0.507	1	3.25	0.548	4	3.53	0.559	2
5	End user's participation (representation) in the VM workshops	3.52	0.618	4	3.51	0.543	4	3.36	0.757	8	3.14	0.616	8	3.39	0.636	4
6	Clear objectives provided for the VM workshops	3.68	0.563	1	3.57	0.608	2	3.56	0.507	1	3.43	0.568	1	3.56	0.574	1
7	Professional qualification of the facilitator	3.24	0.560	13	3.20	0.601	14	3.32	0.557	9	3.36	0.554	2	3.27	0.568	9
8	Academic qualification of the facilitator	3.05	0.633	17	2.98	0.616	18	3.12	0.600	17	3.27	0.587	3	3.10	0.617	16
9	Years of experience of the facilitator in VM workshop facilitation	3.24	0.588	14	3.35	0.522	8	3.44	0.583	4	3.21	0.680	7	3.29	0.600	7
10	Number of VM workshops facilitated by the facilitator and average duration of each workshop	3.02	0.635	18	3.02	0.547	17	2.92	0.572	18	2.80	0.644	18	2.94	0.611	18
11	VM knowledge of the participants	3.08	0.630	16	3.12	0.683	15	3.36	0.569	6	3.00	0.688	14	3.10	0.658	17
12	Years of relevant experience of the participants in their own field	3.25	0.621	12	3.25	0.688	10	3.16	0.473	15	2.93	0.462	16	3.15	0.595	14
13	Team mix of the participants	3.37	0.517	8	3.22	0.541	12	3.24	0.597	11	2.96	0.466	15	3.19	0.540	11
14	Discipline and attitude of the participants	3.51	0.564	5	3.37	0.631	6	3.36	0.569	6	3.23	0.539	6	3.37	0.582	5
15	Decision-making authority granted to each participant by their respective organization	3.41	0.586	7	3.35	0.658	7	3.32	0.627	10	3.05	0.553	12	3.28	0.615	8
16	Input from the relevant governmental departments and local authorities (e.g.: local planning)	3.33	0.568	9	3.31	0.648	9	3.24	0.663	12	3.07	0.568	11	3.24	0.608	10
17	Background information collected	3.43	0.499	6	3.39	0.603	5	3.44	0.507	3	3.11	0.593	9	3.33	0.570	6
18	Pre-workshop meeting conducted	3.32	0.563	10	3.22	0.610	13	3.12	0.440	16	2.91	0.549	17	3.15	0.577	13
19	Site visit conducted	3.13	0.582	15	3.24	0.651	11	3.24	0.663	12	3.02	0.587	13	3.14	0.615	15

**Table 5.4 Success factors among different clusters**

<b>Rank</b>	<b>Cluster A</b>	<b>Cluster B</b>	<b>Cluster C</b>	<b>Cluster D</b>
1	Clear objectives provided for the VM workshops	Client's participation (representation) in the VM workshops	Clear objectives provided for the VM workshops & Client's participation (representation) in the VM workshops	Clear objectives provided for the VM workshops
2	Client's support of the VM workshops	Client's support of the VM workshops & Clear objectives provided for the VM workshops	-	Professional qualification of the facilitator
3	Client's participation (representation) in the VM workshops	-	Background information collected	Academic qualification of the facilitator
4	End user's participation (representation) in the VM workshops	End user's participation (representation) in the VM workshops	Client's support of the VM workshops & Years of experience of the facilitator in VM workshops facilitation	Client's participation (representation) in the VM workshops
5	Discipline and attitude of the participants	Background information collected	-	Client's support of the VM workshops

### 5.4.1 Mann-Whitney U Test

The differences in scoring for each success factor by different clusters have been explored further (Yuan et al. 2009). Pairwise comparisons using the Mann-Whitney U test were carried out on each of two clusters (Yu et al. 2008) (Table 5.5). In total, six tests were conducted on the basis of the following hypothesis [with a 0.05 ( $\alpha = 0.05$ ) level of significance]:

*Null hypothesis: No difference exists between the two clusters, so they have the same mean ( $H_0: 1 = 2$ )*

*Alternative hypothesis: A difference exists between the two clusters, so they have different means ( $H_1: 1 \neq 2$ )*

**Table 5.5 Schedule of pairwise comparison of Mann-Whitney U test**

	A	B	C	D
A		Test 1	Test 2	Test 3
B			Test 4	Test 5
C				Test 6
D				

However, Cluster A was treated as the best cluster of respondents to the survey because they had received formal VM training and participated in VM workshops. Hence, Test 4 (between Cluster B and C), Test 5 (between Cluster B and D), and Test 6 (between Cluster C and D) were discarded. The results of the tests were interpreted by the  $p$ -value as presented in Table 5.6. If the  $p$ -value is less than 0.05,  $H_0$  was

rejected, and a significant statistical difference was concluded to exist between the clusters. Hence, Test 2 (between Cluster A and C) was accepted and clusters A and C (88 responses) were treated as one category of valid samples to represent the population for further analysis to rank the success factors.

**Table 5.6 The Mann-Whitney U test result between three clusters**

Success factors	Asymp. Sig. (2-tailed) of pair wise comparison		
	Test 1	Test 2	Test 3
	A and B	A and C	A and D
SF1	0.042*	0.558	0.011*
SF2	0.911	0.059	0.111
SF3	0.408	0.074	0.000*
SF4	0.759	0.272	0.000*
SF5	0.705	0.363	0.001*
SF6	0.256	0.181	0.006*
SF7	0.739	0.542	0.251
SF8	0.566	0.631	0.057
SF9	0.330	0.142	0.946
SF10	0.923	0.437	0.073
SF11	0.647	0.060	0.581
SF12	0.858	0.401	0.001*
SF13	0.160	0.396	0.000*
SF14	0.257	0.249	0.006*
SF15	0.721	0.539	0.001*
SF16	0.977	0.592	0.014*

SF17	0.906	0.923	0.003*
SF18	0.394	0.097	0.000*
SF19	0.308	0.392	0.352

\* Where  $\alpha \leq 0.05$

#### 5.4.2 Exploratory Factor Analysis

EFA is the best mean to classify the success factors into a smaller number under several themes. The initial analysis was conducted to ensure the data was suitable or not suitable for EFA analysis. The Kaiser-Meyer-Olkin (KMO) index of sampling adequacy for factor analysis was explored to ensure the sufficiency of covariance in the scale items to warrant factor analysis. The Bartlett's test for sphericity was also applied guaranteeing that the correlation matrix was not an identity matrix.

A KMO index for analysis of success factors was 0.781, while almost all KMO values for an individual factor were  $> .670$  (range: .670 to .862), which is above the acceptable limit of .50 (Field, 2009). Bartlett's test for the sphericity for this analysis was sufficiently large ( $\chi^2(136) = 703.242, p < .001$ ) indicating that the correlation matrices for the factors were not identity matrices (Field, 2009; Hair et al. 2010).

Hence, the initial analysis for the success factors was appropriate to conduct the EFA analysis, the numbers of factors to be extracted for each variable were accessed through parallel analysis where the eigenvalues from factor analysis were compared with eigenvalues from a Monte Carlo simulation. The number of factors was retained if the eigenvalues from factor analysis exceeded the simulated eigenvalues (Watkins, 2006). A result from parallel analysis in Table 5.7 indicates that four factors exist.

After rotation, all factors that had been constrained to a four-factor solution, explained 60.56% of the variance with 17 out of 19 items exceeding the minimum cut-off load 0.55 required, therefore, statistically significance (Table 5.8). The two items were removed from the EFA because they did not meet the desired factor loading (Workshops intervention into project development cycle = .489: Years of relevant experience of the participants in their own field = .495). Two items having communalities values less than 0.50 were remaining (End User's participation (representation) in the VM workshops = 0.478; Team mix of the participants = 0.458) because the factor loading for both items was high (0.636 and 0.630 respectively).

Finally, the four-factor structures under the success factors are named as client and end users (Construct 1), facilitator (Construct 2), all participants (Construct 3), and process (Construct 4). The internal consistency of the extracted factors was satisfactory. The Croanbach's Alpha value varies from 0.757 to 0.774, indicating that the consistency of items grouped was acceptable (Nunnally and Bernstein, 1994).

**Table 5.7 Result of parallel analysis**

<b>Variable</b>	<b>Component Number</b>	<b>Actual eigenvalue from factor analysis</b>	<b>Criterion value from parallel analysis</b>	<b>Decision</b>
<b>Success factors</b>	1	<b>5.477</b>	1.804	<b>Accept</b>
	2	<b>2.350</b>	1.632	<b>Accept</b>
	3	<b>1.539</b>	1.512	<b>Accept</b>
	4	<b>1.507</b>	1.408	<b>Accept</b>
	5	1.015	<b>1.320</b>	Reject

**Table 5.8 Result of EFA on success factors**

Item	Construct 1	Construct 2	Construct 3	Construct 4	Communalities
Client's support towards the VM workshops	<b>.788</b>	.167	-.006	-.054	.652
Client's participation (representation) in the VM workshops	<b>.766</b>	.191	.217	.084	.677
Clear objective(s) provided for the VM workshops	<b>.747</b>	.004	.226	.140	.628
End User's participation (representation) in the VM workshops	<b>.636</b>	.043	.141	.227	.478
Professional qualification of the facilitator	.103	<b>.796</b>	.285	-.062	.729
Academic qualification of the facilitator	.057	<b>.759</b>	.143	.073	.606
Years of experience of the facilitator in VM workshops facilitation	.111	<b>.671</b>	.207	.057	.509
No. of VM workshops facilitated by the facilitator & average duration of each workshop	.092	<b>.593</b>	-.119	.400	.534
Venue of the VM workshops	.128	<b>.568</b>	-.433	.358	.655
VM knowledge of the participants	-.039	.328	<b>.658</b>	.065	.546
Disciplines and attitudes of the participants	.292	.060	<b>.632</b>	.348	.608
Team mix of the participants	.147	.147	<b>.630</b>	.132	.458
Input from the relevant governmental departments and local authorities	.294	.087	<b>.619</b>	.295	.564
Decision-making authority granted to each participant by their respective organization	.467	-.048	<b>.614</b>	.040	.599
Years of relevant experience of the participants in their own field			<b>.495</b>		
Pre-workshop meeting conducted	.105	.166	.166	<b>.853</b>	.793
Background information collected	.284	-.152	.253	<b>.715</b>	.679
Site visit conducted	-.017	.297	.179	<b>.678</b>	.581
Workshop intervention into the project development cycle					

Eigenvalue	5.120	2.235	1.528	1.413
% Variance Explained (60.56%)	30.11	13.15	8.99	8.31
Cronbach's Alpha Statistic	.774	.757	.769	.758
KMO Measure of Sampling Adequacy Statistic	0.781			
Bartlett's Test of Sphericity	$\chi^2 (136) = 703.242^{**}$			

Note: \* The EFA analysis was based on Principal Component extraction method with Varimax rotation method.

\*\* p<.001.

Two items were removed due to the loading below 0.55.

#### **5.4.2.1 Client & End Users (Construct 1)**

The first construct consisted of factors that are relevant to the client and end users of the project. By definition, client refers to a party that provides the funding and manages the execution of the project. In that sense, the client does not always will the user of the constructed project. Hence, the end users are the party that will be using the constructed facilities during the operational phase.

Within this construct, factors such as the support and participation of both client and end users are critical to providing necessary input and make the necessary decision during the VM workshop implementation. Upon deciding to embark into VM, the client should have nominated the individuals to overlook the matters. Among others, things such as the financial support, human resource support, and the availability of the project information are crucial. The client first needs to establish the workshop objectives with the consultation of the VM facilitator. Again, during the workshop, the client's representatives should be around at all times and bring together the end users.

#### **5.4.2.2 Facilitator (Construct 2)**

The second construct consisted of factors that are relevant to the VM facilitator(s). By definition, VM facilitator refers to an individual that is appointed by the client and responsible for facilitating the VM study in total. As such, the facilitator is expected to be someone that has obtained vague facilitation training from any VM professional organization.

The facilitators experience in terms of number of years of facilitation, the number of workshops, and total duration of facilitation would play important factors that may affect the performance of the VM study. Even though the facilitation can be learning

through experience, somehow the academic qualification plays an important role that would influence how critical the facilitator could be in facilitating the workshop. The facilitator is also expected to advise the client in terms of the logistical aspect of the workshop implementation, such as recommending a suitable venue for the workshop to be held.

#### **5.4.2.3 All Participants (Construct 3)**

The third construct consisted of factors that are relevant to all participants of the VM workshop. The participants are among the representatives elected by their respective organizations as the stakeholders to the project. As an individual participant, discipline such as punctuality and positive attitudes throughout the various processes and phases of the workshop is crucial as any decision made during the workshop is supposed to be a collective decision. It is also critical to have a representative that is well-experienced in their field of expertise to enable the decision-making process on behalf of the organization they represent. VM knowledge through formal training at the tertiary education level or professional training while working will be extra points as they would have acquired some basic VM knowledge.

Sometimes, the workshop may also involve one or more relevant governmental departments and local authorities that are responsible for a particular matter related to the construction project. Therefore, their input is crucial in order for the VM team to deal with such limitations and problems faced by the project and come up with the best solutions to increase the value to the project.

#### **5.4.2.4 Process (Construct 4)**

The fourth construct consisted of factors that are related to preparatory works prior to the VM workshop implementation. At this point, the VM facilitator should have

played important roles in advising a client on various matters. A pre-workshop meeting would be a good platform to start with where it usually involves the facilitators and the clients' representatives. The basic consideration would be the intervention of VM to identify to what extent the project has gone so far. The considerations would then be translated into the objective of the VM study as well as the objectives of the VM workshop.

Upon arriving at a decision to proceed, the background information related to the project must be collected. Since the client may not have all the required information, at this point the other stakeholder may be required to get involved. The readiness of the information will then determine when the VM workshop will be carried out.

It is also a good approach to organizing a site visit prior to the workshop. The site visit is important as to enlighten all stakeholders as some of the stakeholders may not have been to the site, and all this while working based on the drawings and documents. The site visit may help the participants to visualize the site condition, site topography, the existing facilities, surroundings, etc.

#### **5.4.3 Scale Ranking Analysis**

The final stage of data analysis involved scale-ranking analysis to rank the nineteen success factors. The success factors were then ranked according to their mean score values (Chen and Chen, 2007; Ahadzie et al., 2008; Lu et al., 2008; Yu et al., 2008; Li et al., 2011). The ranking results are shown in Table 5.9.

**Table 5.9 Success factors and their mean scores**

<b>Rank</b>	<b>Construct</b>	<b>Success Factors</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Variance</b>
1	Client & End users	Clear objectives provided for the VM workshops	3.65	0.548	0.300
2	Client & End users	Client's participation (representation) in the VM workshops	3.64	0.529	0.280
3	Client & End users	Client's support of the VM workshops	3.60	0.537	0.288
4	Client & End users	End user's participation (representation) in the VM workshops	3.48	0.660	0.436
5	All participants	Discipline and attitude of participants	3.47	0.566	0.321
6	Process	Background information collected	3.43	0.498	0.248
7	All participants	Decision-making authority granted to each participant by their respective organization	3.39	0.596	0.355
8	All participants	Team mix of the participants	3.33	0.541	0.292
9	All participants	Input from the relevant governmental departments and local authorities (e.g.: local planning)	3.31	0.594	0.353
10	Facilitator	Years of experience of the facilitator in VM workshop facilitation	3.30	0.590	0.348
11	Facilitator	Professional qualification of the facilitator	3.26	0.557	0.310
12	Process	Pre-workshop meeting conducted	3.26	0.536	0.287
13	Process	Workshops intervention into project development cycle	3.25	0.509	0.259
14	All participants	Years of relevant experience of the participants in their own field	3.23	0.582	0.339

15	All participants	VM knowledge of the participants	3.16	0.623	0.388
16	Process	Site visit conducted	3.16	0.604	0.365
17	Facilitator	Academic qualification of the facilitator	3.07	0.621	0.386
18	Facilitator	Number of VM workshops facilitated by the facilitator and average duration of each workshop	2.99	0.616	0.379
19	Process	Venue of the VM workshops	2.80	0.628	0.394

### 5.5 Critical Success Factors for Value Management Implementation

Success factors with means of 3.00 or more were considered to be CSFs: seventeen success factors achieved a value of  $\geq 3.00$ . In order to present a manageable number of CSFs, the top 10 success factors are presented at the top of the list in Table 5.10 (Rank 1-10). The top three (Rank 1-3) dominated by the client's and end users' influence, which shows the critical role that the client and the end users play in the successful implementation of VM workshops. According to Shen and Yu (2012), VM effectiveness of the workshop increases when the objectives are clearly aligned with the goals of the client's organization.

Five of the remaining seven CSFs fall under all the participants' construct. The participants represent different stakeholders of the project. They play important roles to ensure the success level of a particular workshop in achieving the goal. Typical VM workshops involved stakeholders such as end-user, consultants, government departments, government agencies, and the local authorities. These stakeholders participate in a dynamic process that demand their commitments (Leung et al. 2013) and active participation (Green, 1999) to meet the workshop objectives (Leung et al.

2002). Achievement of these objectives in the end could contribute the smooth running of the project development, either directly or indirectly. Fong et al. (2007) adds that the complex nature of projects in recent years demands creative and innovative ideas that depend on the participant's behaviours to work collectively as a team to improve the value of the project.

Background information refers to the project information gathered during the pre-workshop stage and the information phase of the workshop. Finally, CSFs with the lowest score are the facilitator's experience in facilitating the VM workshop. The best practice of VM workshop is the engagement of the facilitator to facilitate the processes according to the VM job plan. Many researchers highlighted the structured process and the job plan as the core values of VM that differentiate it from other management tools. The facilitation provided by the facilitator enhances the productive outputs of every phase of the workshop (Fong et al. 2007) and keeps the essential elements within the time constraint. Thurnell (2004) contended beforehand that VM facilitators need to possess attributes that include leadership qualities, competence in a variety of management skills related to human dynamics, and high emotional quotient in dealing with different characters and attitudes of the workshop participants.

The remaining two factors that scored below 3.0 were "number of VM workshops facilitated by the facilitator and average duration of each workshop" and "venue of the VM workshops". These two factors are least critical and have minimum effect on the success of the workshop. The findings from this research are in agreement with the findings of Simister and Green (1997), Male et al. (1998), Shen and Liu (2003), Fong et al. (2004), and Chen et al. (2010) as presented in Table 5.1.

**Table 5.10 CSFs for VM implementation**

<b>Rank</b>	<b>Construct</b>	<b>Critical Success Factors (CSFs)</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Variance</b>
1	Client & End users	Clear objectives provided for the VM workshops	3.65	0.548	0.300
2	Client & End users	Client's participation (representation) in the VM workshops	3.64	0.529	0.280
3	Client & End users	Client's support of the VM workshops	3.60	0.537	0.288
4	Client & End users	End user's participation (representation) in the VM workshops	3.48	0.660	0.436
5	All participants	Discipline and attitude of the participants	3.47	0.566	0.321
6	Process	Background information collected	3.43	0.498	0.248
7	All participants	Decision-making authority granted to each participant by their respective organization	3.39	0.596	0.355
8	All participants	Team mix of the participants	3.33	0.541	0.292
9	All participants	Input from the relevant governmental departments and local authorities (e.g.: local planning)	3.31	0.594	0.353
10	Facilitator	Years of experience of the facilitator in VM workshop facilitation	3.30	0.590	0.348

## **5.6 Summary of the Chapter**

This chapter presents and discusses the factors that may affect the performance of the VM workshop. The potential factors identified from previous research are used as the basis for the identification of the CSFs from the perspective of VM practices in Malaysia. Through several statistical analyses, ten CSFs have been identified and

discussed with reference to other relevant works. Those CSFs were then classified into five relevant themes for easy reference. The CSFs identified in a thin chapter will be part of the performance management framework for VM studies in construction. The interrelationship among the components will be discussed in the following chapters.

This research revealed ten CSFs for VM workshops implementation in Malaysia. Client-related success factors include providing clear objectives, supporting, and participating in the implementation of the workshops. Participants-related CFSs include end-user participation, discipline and attitude, the authority to make decisions, and input from relevant governmental departments. The other two factors are background information collected and experience of the facilitator.

Uniquely, this research revealed that participation of the end users (ranked number four) during the workshop was one of the crucial factors for success. The presence of these stakeholders was vital because they provide good input regarding user requirements, and it was more practical from the operational perspectives of a particular project. This factor was not captured in previous relevant studies.

The CSFs identified by this research can benefit future applications of VM within the Malaysian construction industry and that of other countries that share a similar culture. Carefully considering the CSFs during the initial stages of planning VM workshops for the project will enhance the performance of the workshops and improve the chances of successfully completing the project.

## **CHAPTER 6: KEY PERFORMANCE INDICATORS (KPIs) FOR VALUE MANAGEMENT IMPLEMENTATION**

### **6.1 Introduction**

Previous chapters explored the relevant literature on performance of the VM workshop. One of the common approaches to measuring the workshop's performance is using the key performance indicators (KPIs) approach. Hence, this chapter outlines the process of identification of the potential performance indicators from the literature review, followed by statistical analyses conducted in order to rank those potential indicators according to their relative level of importance. In the end, this chapter will thoroughly explain the KPIs identified for measuring the VM workshops for the case of public project implementation in Malaysia.

### **6.2 Identification of Potential Key Performance Indicators**

One of the objectives of this research is to determine the KPIs to measure the performance of VM workshops in the Malaysian construction industry. The KPIs should be manageable in number of indicators that can shed light on the level of efficiency and effectiveness of both process and outputs of the VM workshops. In this research, the conventional approach was adopted as recommended by Lu et al. (2008).

The first step was to discover a comprehensive range of success factors by conducting a thorough literature review. It was followed by a questionnaire survey of experienced practitioners in the Malaysian construction industry to determine their level of agreement with each of the success factors. Finally, as suggested by Yu et al. (2006), the data collected from the survey was statistically analysed to determine the KPIs.

According to Chau et al. (1999), the last step is particularly effective when factors were subjective in nature and when hard performance data were not available.

In order to identify the best approach to achieving the aim of this research, a review of recently published papers was conducted on those of a similar nature in identifying the research trends in a particular area. These included, among others, Xue et al. (2012) on information technology applications in architecture, engineering, and construction projects, Hong et al. (2012) on partnering in construction, Yuan and Shen (2011) on waste management, Tang et al. (2010) and Ke et al. (2009) on public-private partnership, Xue et al. (2010) on collaborative working in construction, Holt (2010) on contractors' selection, and Lin and Shen (2007) on value management in construction.

The desktop search was carried out using the search engines to retrieve the published papers. Both Scopus and Science Citation Index Expanded were used because some of the journals were not indexed by each other. By assuming that author(s) may be keen to publish their papers in a first-tier journal based on the quality of the journals (Bröchner and Bjork 2008), the search results were further refined by making reference to the journal ranking list recommended by Chau (1997) in the area of construction engineering and management and the institutional journals listed to determine the journals to be incorporated. The authors used a similar approach to those previously adopted by Bröchner and Björk (2008) for construction management related journals and McKercher et al. (2006) for tourism and hospitality related journals.

Since this research was based on the findings of Shen and Liu (2007), the previous potential indicators were revisited and cross-checked with recent references. They

have determined factors that have an influence on the performance of VM studies based on the nature of VM studies, the overall process of the construction project, and also the basic principles found in performance measurement.

It was hypothesised that the successful implementation of the VM workshops will have positive effects toward the successful implementation of the construction projects. In order to prove the hypothesis, the performance of the VM workshops needs to be measured and evaluated to identify the significant contribution from the outputs of the workshops towards the construction project implementation. In a later stage, the client needs to measure the performance of the construction project (for different KPIs, see Chan and Chan (2004) and Masurier and Warren (2006) as an example), and identify the significant contributions of the VM workshops into the construction projects.

A thorough literature review was carried out using keywords such as performance indicators, performance metric, performance measures, and performance item to ensure a broad coverage of the potential indicators. However, it was discovered that the identification of KPIs by Lin et al. (2011) (Table 6.1) presents extensive coverage of potential indicators for this research. Screening was conducted to remove any duplication of indicators from those 47 potential indicators. Some indicators were combined and rephrase to suit the local context that resulted in 28 potential performance indicators in this research. In total, eleven indicators were related to the process during the workshop (*process-related*) (Table 6.2) and seventeen indicators were related to the outputs of the workshop (*output-related*) (Table 6.3).

**Table 6.1 List of the potential indicators by Lin et al. (2011)**

<b>Indicator</b>
Satisfaction of the time when the VM workshop will be conducted
Satisfaction of venue
Disciplines of participants
Authority of key stakeholder participants
Years of professional experience of participants
VM knowledge of participants
Years of experience of facilitator
Numbers of VM workshop facilitated
Qualification of the facilitator
Client's support
Client's participation
Clear objectives of the workshop
Relevant department's support
Time spent on preparation before workshop
Background information collected
Number of pre-workshop meetings held
Number of site visit
Number of related documents analysed
Duration of each phase
Time keeping of each phase
Satisfaction of the techniques used in each phase
Interaction among participants in each phase
Client's objectives clarified
Project givens/assumptions clarified
Primary function identified
Total number of ideas

Average number of ideas generated by each participant
Equal contribution of participant
Efficiency of idea generation
Duration to complete the report
Quality of the report
Percentage of action plan carried out
Proposed change on design project investment
Proposed change on life cycle cost
Return of investment of VM study
Proposed change on design schedule
Proposed change on construction schedule
Reducing the difficulty of construction
Improving the project quality
Improving the project appearance
Identifying and clarifying the client's requirements
Accelerating the decision-making
Improving communication and understanding among stakeholders
Deliberating the alternative
Client's satisfactions
Participants' satisfaction
Facilitator's satisfaction

**Table 6.2 List of the potential process-related performance indicators**

<b>Code</b>	<b>Indicator</b>
<b>P1</b>	Duration of each phase of VM workshops
<b>P2</b>	Time controls for each phase of VM workshops
<b>P3</b>	Satisfaction of the techniques used in each phase
<b>P4</b>	Interaction between the workshop team members
<b>P5</b>	Clarification of the client's objective(s)
<b>P6</b>	Clarification of the end user's objective(s)
<b>P7</b>	Clarification of the project given/assumptions
<b>P8</b>	Clarification of the primary functions
<b>P9</b>	Total numbers of ideas generated
<b>P10</b>	Efficiency rate of idea generated (total ideas/hour)
<b>P11</b>	No. of ideas to be implemented

**Table 6.3 List of the potential output-related performance indicators**

<b>Code</b>	<b>Indicator</b>
<b>O1</b>	Duration taken to complete the workshop report
<b>O2</b>	Quality and coverage of the workshop report
<b>O3</b>	Percentage of action plan carried out
<b>O4</b>	Identification and clarification of the client's requirements
<b>O5</b>	Identification and clarification of the end user's requirements
<b>O6</b>	Identification of the option/alternatives
<b>O7</b>	Minimisation of the project cost
<b>O8</b>	Optimisation of project planning and scheduling
<b>O9</b>	Return on investment of VM study (proposed saving/cost of VM workshop)
<b>O10</b>	Improvement to the overall quality/performance/appearance
<b>O11</b>	Improvement to the buildability/constructability aspect
<b>O12</b>	Acceleration of the decision-making process
<b>O13</b>	Improvement of the communication among stakeholders
<b>O14</b>	Satisfaction of the client
<b>O15</b>	Satisfaction of the end user
<b>O16</b>	Satisfaction of the facilitator
<b>O17</b>	Satisfaction of the participants

### 6.3 Quantitative Analysis on Potential Key Performance Indicators

As previously described in Chapter 4 of this thesis, the questionnaire was developed, piloted, and distributed to the construction professionals within the Malaysian construction industry. Stratified sampling was adopted to reach a particular group of respondents that have been previously exposed to VM. Out of 503 surveys distributed, 195 valid responds were received and divided into four different clusters based on two fundamental variables: formal VM training and participation in VM workshop.

Statistical analyses were executed by optimising the functions provided by *Statistical Package for Social Sciences* (SPSS 20.0). Basic screening tests such as the reliability test and *Cronbach's Alpha* test were conducted to determine the consistency of the collected data. It was then followed by the *descriptive analyses* (frequency, mean, and standard deviation) to provide the summaries of the sample. These analyses provide initial descriptions of the collected data and gave direction for further detail and extensive statistical analysis as required. It was then supported by *Kendall's concordance* test to measure the consistency of agreement between the respondents within the particular cluster (Chan et al., 2011).

With the assumption that the respondents can be categorised into different clusters based on their VM knowledge and experience, *Mann-Whitney U* tests were conducted to examine whether statistically significant differences existed among the different clusters. This test is appropriate for data that is not classified as a normal distribution and measured by using an ordinal scale of measurement (Love et al. 2004). To investigate further, the correlation between groups of respondents (Parl, 2009; Kog and Loh, 2012), *Spearman's rank correlation* was employed. It was followed by the Exploratory Factor Analysis (EFA) to determine the underlying themes from the big

number of potential indicators. Finally, *scale-ranking* analysis was conducted in order to rank the performance indicators based on the mean value of the collected samples.

A normality test was carried out to determine whether the data fitted a normal distribution curve. The result revealed that the data collected through this survey was not modelled by a normal distribution (sigma value of Shapiro-Wilk < 0.05) (Chen and Chen, 2007). Reliability refers to the extent to which a scale produces consistent results if the measurement is repeated a number of times. The result of 0.912 suggests that the data collected for the performance indicators are reliable.

### **6.3.1 Descriptive Analysis and Kendall's Concordance Test**

Descriptive analysis of all collected data was carried out to provide an overall picture of the responses. The mean, standard deviation, and ranking of indicators in each cluster and combined clusters are presented in Table 6.4 and 6.5. In the event that more than one indicator shares the same mean value, the mean value with the lowest standard deviation overrides the others for a higher ranking among other indicators (Field, 2005)

To explore further level of agreement within each cluster, Kendall's concordance test was carried out. The W values of  $\geq 0.05$  suggest that we can reject the null hypothesis that the respondents' set of rankings is independent of each other within the same cluster (Chan et al. 2011). Hence, it can be concluded that there is a strong consensus among the respondents in each cluster. The consensus level indicates that respondents with the same background of formal training and workshop experience have a mutual agreement in ranking the indicators.

**Table 6.4 Result of the descriptive analysis for process-related indicators in different clusters of respondents**

No.	Performance Indicator	Cluster A			Cluster B			Cluster C			Cluster D			All Clusters		
		Mean	SD	Rank	Mean	SD	Rank									
PI1	Duration of each phase of VM workshops	3.14	0.669	8	2.94	0.645	11	2.92	0.572	11	2.79	0.563	11	3.00	0.634	9
PI2	Time controls for each phase of VM workshops	3.27	0.627	6	2.98	0.678	9	3.28	0.542	7	2.89	0.562	8	3.09	0.632	7
PI3	Satisfaction of the techniques used in each phase	3.21	0.600	7	3.02	0.547	6	3.32	0.476	6	3.07	0.462	6	3.13	0.540	6
PI4	Interaction between the workshop team members	3.52	0.535	2	3.31	0.583	5	3.60	0.500	3	3.29	0.563	1	3.41	0.562	3
PI5	Clarification of the client's objective(s)	3.59	0.557	1	3.37	0.662	2	3.64	0.569	1	3.27	0.522	3	3.45	0.593	1
PI6	Clarification of the end user's objective(s)	3.51	0.564	3	3.37	0.528	1	3.56	0.583	4	3.29	0.494	2	3.42	0.544	2
PI7	Clarification of the project given/assumptions	3.29	0.580	5	3.37	0.528	3	3.40	0.645	5	3.11	0.454	5	3.27	0.550	5
PI8	Clarification of the primary functions	3.43	0.530	4	3.35	0.483	4	3.60	0.500	2	3.21	0.414	4	3.37	0.494	4
PI9	Total numbers of ideas generated	3.03	0.621	9	2.98	0.547	8	3.24	0.663	8	2.89	0.528	7	3.01	0.588	8
PI10	Efficiency rate of idea generated (total ideas/hour)	2.86	0.692	11	2.96	0.599	10	3.16	0.800	9	2.86	0.616	9	2.92	0.665	11
PI11	No. of ideas to be implemented	3.02	0.635	10	2.98	0.583	7	3.00	0.577	10	2.82	0.575	10	2.95	0.598	10
	Number of sample (n)	63			51			25			56			195		
	Kendall's Coefficient of Concordance (W)	0.176			0.137			0.139			0.146			0.139		
	Actual calculated value of Chi-square	110.734			69.871			34.691			820.32			270.425		
	Degree of freedom (df)	10			10			10			10			10		

**Table 6.5 Result of the descriptive analysis for output-related indicators in different clusters of respondents**

No.	Performance Indicator	Cluster A			Cluster B			Cluster C			Cluster D			All Clusters		
		Mean	SD	Rank	Mean	SD	Rank									
OI1	Duration taken to complete the workshop report	2.92	0.630	17	2.94	0.645	16	3.16	0.473	16	2.82	0.606	17	2.89	0.607	17
OI2	Quality and coverage of the workshop report	3.22	0.634	12	3.18	0.654	8	3.20	0.500	15	3.16	0.496	5	3.19	0.583	11
OI3	Percentage of action plan carried out	3.21	0.572	13	3.02	0.648	15	3.20	0.500	14	3.04	0.380	14	3.11	0.541	13
OI4	Identification and clarification of the client's requirements	3.43	0.588	1	3.29	0.610	3	3.56	0.583	4	3.14	0.401	9	3.33	0.561	1
OI5	Identification and clarification of the end user's requirements	3.35	0.572	3	3.39	0.493	1	3.60	0.577	3	3.14	0.483	8	3.33	0.544	2
OI6	Identification of the option/alternatives	3.27	0.574	6	3.16	0.579	9	3.40	0.577	9	3.09	0.514	12	3.21	0.564	10
OI7	Minimisation of the project cost	3.03	0.740	16	2.82	0.817	17	3.60	0.500	2	3.13	0.634	10	3.08	0.739	14
OI8	Optimisation of project planning and scheduling	3.22	0.522	11	3.29	0.576	2	3.44	0.507	8	3.27	0.447	1	3.28	0.515	5
OI9	Return on investment of VM study (proposed saving/cost of VM workshop)	3.24	0.615	10	3.12	0.653	10	3.44	0.583	7	3.14	0.520	7	3.21	0.600	9
OI10	Improvement to the overall quality/performance/appearance	3.27	0.601	8	3.24	0.586	5	3.52	0.510	5	3.23	0.467	3	3.28	0.554	4
OI11	Improvement to the buildability/constructability aspect	3.27	0.574	7	3.10	0.608	12	3.60	0.500	1	3.23	0.539	2	3.26	0.580	6
OI12	Acceleration of the decision-making process	3.25	0.595	9	3.29	0.610	4	3.24	0.663	12	3.09	0.581	11	3.22	0.605	8
OI13	Improvement of the communication among stakeholders	3.30	0.528	5	3.12	0.553	11	3.20	0.707	13	3.05	0.483	13	3.17	0.553	12
OI14	Satisfaction of the client	3.40	0.636	2	3.18	0.623	7	3.44	0.583	6	3.16	0.458	6	3.28	0.588	3
OI15	Satisfaction of the end user	3.30	0.663	4	3.22	0.610	6	3.28	0.678	10	3.18	0.431	4	3.24	0.591	7
OI16	Satisfaction of the facilitator	3.11	0.675	15	3.04	0.528	13	3.12	0.726	17	2.93	0.420	16	3.04	0.582	16
OI17	Satisfaction of the participants	3.16	0.677	14	3.02	0.510	14	3.24	0.597	11	2.98	0.447	15	3.08	0.568	15
	Number of sample (n)	63			51			25			56			195		
	Kendall's Coefficient of Concordance (W)	0.062			0.087			0.143			0.068			0.056		
	Actual calculated value of Chi-square	62.155			71.142			57.263			60.521			173.816		
	Degree of freedom (df)	16			16			16			16			16		

### 6.3.2 Mann-Whitney U Test

The differences in agreement on each performance indicator by different clusters were further explored using the Mann-Whitney U test (Yuan et al. 2009) (Table 6.6). Pairwise comparison tests were carried out on each of two clusters (Yu et al. 2008), based on the following hypothesis where  $\alpha = 0.05$  level of significance.

*Null hypothesis: No difference exists between the two clusters, so they have the same mean ( $H_0: 1 = 2$ )*

*Alternative hypothesis: A difference exists between the two clusters: in particular, they have different means ( $H_1: 1 \neq 2$ )*

**Table 6.6 Schedule of pairwise comparison of Mann-Whitney U test**

	A	B	C	D
A		Test 1	Test 2	Test 3
B			Test 4	Test 5
C				Test 6
D				

The results of the tests were interpreted by the  $p$ -value in which null hypothesis will be rejected if the  $p$ -value is less than 0.05. It is found that there were statistical differences between four clusters. Having said that, cluster A has been treated as the most reliable cluster to this survey as they have received formal VM training and have participated in VM workshops.

Table 6.7 presents the result of the test and reveals that there is no major statistically significant difference between cluster A and B. Hence, Test 1 was accepted and one

hundred and fourteen respondents from clusters A and B were treated as one category of a valid sample to represent the population for further analysis. Cluster C was initially considered to be included (with only two indicators having  $\alpha < 0.05$  (OI7: minimisation of the project cost and OI11: improvement to the buildability/constructability aspect). However, by looking into the practicality of experience compared to the theoretical knowledge of the respondents, cluster A was prioritized, and cluster C was excluded.

**Table 6.7 The Mann-Whitney U test result for potential indicators**

Indicators	Asymp. Sig. (2-tailed) of Pair wise comparison		
	Test 1	Test 2	Test 3
	A and B	A and C	A and D
PI1	0.104	0.983	0.010*
PI 2	0.025*	0.962	0.001*
PI 3	0.090	0.477	0.142
PI 4	0.051	0.574	0.022*
PI 5	0.070	0.628	0.001*
PI 6	0.152	0.648	0.017*
PI 7	0.466	0.357	0.050
PI 8	0.385	0.176	0.013*
PI 9	0.640	0.159	0.272
PI 10	0.421	0.089	0.840
PI 11	0.757	0.910	0.089
OI 1	0.837	0.934	0.221
OI 2	0.768	0.765	0.455
OI 3	0.149	0.903	0.047*
OI 4	0.235	0.314	0.001*

OI 5	0.797	0.052	0.029*
OI 6	0.326	0.333	0.067
OI 7	0.144	0.001*	0.541
OI 8	0.440	0.086	0.697
OI 9	0.287	0.157	0.253
OI 10	0.780	0.084	0.565
OI 11	0.145	0.015*	0.674
OI 12	0.702	0.983	0.135
OI 13	0.082	0.616	0.009*
OI 14	0.056	0.844	0.011*
OI 15	0.412	0.894	0.131
OI 16	0.407	0.971	0.048*
OI 17	0.143	0.678	0.052

### 6.3.3 Spearman's Correlation Test and Scale Ranking Analysis

Since there are two clusters selected for detailed analysis, the *Spearman's rank correlation* test was carried out to test the correlation on ranking between these two clusters. According to Chan et al. (2011), this correlation test can help in identifying the consistency of the ranking between two clusters. The positive coefficient value ( $p \geq 0.05$ ) of 0.815 suggest that the null hypothesis can be rejected as indicated in Table 6.8. Hence, it can be concluded that there is a significant correlation between cluster A and B in ranking the indicators.

*Null hypothesis: No significant correlation between the two clusters ( $H_0: A \neq B$ )*

*Alternative hypothesis: A significant correlation exists between the two clusters ( $H_1: A = B$ )*

**Table 6.8 The Spearman’s rank correlation test result between clusters A and B**

<b>Process-related indicators</b>	<b>Cluster A</b>	<b>Cluster B</b>
Cluster A	1.00	0.815*
Cluster B	0.815*	1.00
<b>Output-related indicators</b>	<b>Cluster A</b>	<b>Cluster B</b>
Cluster A	1.00	0.700*
Cluster B	0.700*	1.00

#### **6.4 Exploratory Factor Analysis**

The initial analysis was conducted to ensure the data were suitable or not for EFA analysis. The Kaiser-Meyer-Olkin (KMO) index of sampling adequacy for factor analysis was explored to ensure the sufficiency of covariance in the scale items to warrant factor analysis. The Bartlett’s test for sphericity was also applied to ensure that the correlation matrix was not an identity matrix.

A KMO index for process-related indicators was 0.741 respectively, which is above the cut-off point suggested by Field (2009). The individual process-related indicators KMO’s values vary from .655 to .875 and is above the minimally accepted limit of .50. The initial analysis found that the Bartlett’s test for sphericity was sufficiently large ( $X^2(55) = 547.764, p < .001$ ) indicating that the correlation matrices for process-related indicators were not identity matrices (Field, 2009; Hair et. al, 2010).

The same situation occurred when initial analysis of EFA was conducted toward output-related indicators. A KMO index was 0.809, while almost all KMO values for individual output-related indicators for this variable were  $> .665$  (range: .665 to .912), which is above the acceptable limit of .50 (Field, 2009). Bartlett’s test for sphericity for this analysis was sufficiently large ( $X^2(136) = 1206.753, p < .001$ ) indicating that

the correlation matrices for output-related indicators were not identity matrices (Field, 2009; Hair et. al, 2010).

Since, the initial analysis for both categories of performance indicators was appropriate to conduct EFA analysis, the numbers of indicators to be extracted for each variable were accessed through parallel analysis where the eigenvalues from factor analysis were compared with eigenvalues from the Monte Carlo simulation. The number of factors was retained if the eigenvalues from factor analysis exceeded the simulated eigenvalues (Watkins, 2006). A result from parallel analysis in Table 6.9 indicates that three constructs exist for both process-related and output-related indicators.

#### **6.4.1 Process-related Indicators**

After rotation, the process-related indicators were constrained to a three-factor solution (Table 6.10). All the 11 indicators exceeded the minimum cut-off load (load  $>0.55$ ), which explained 67.93% of the variance. The communalities value for each item also exceeded the cut-off point 0.50.

The factors extracted from this analysis were named: clarifications (Construct 1), efficiency (Construct 2), and logistic (Construct 3). The constructs that were extracted from this analysis were at an acceptable level reliability due to the lowest Cronbach's alpha being greater than 0.70 (Construct 3 = 0.713), which exceeds the minimum cut of point suggested by Nunnally and Bernstein (1994) indicating a satisfactory result.

**Table 6.9 Result of parallel analysis**

<b>Variable</b>	<b>Component Number</b>	<b>Actual eigenvalue from factor analysis</b>	<b>Criterion value from parallel analysis</b>	<b>Decision</b>
<b>Process-related indicators</b>	1	<b>3.920</b>	1.531	<b>Accept</b>
	2	<b>2.295</b>	1.377	<b>Accept</b>
	3	<b>1.258</b>	1.249	<b>Accept</b>
	4	0.775	<b>1.149</b>	Reject
<b>Output-related indicators</b>	1	<b>7.342</b>	1.742	<b>Accept</b>
	2	<b>1.550</b>	1.523	<b>Accept</b>
	3	<b>1.500</b>	1.448	<b>Accept</b>
	4	1.209	<b>1.354</b>	Reject

#### **6.4.1.1 Clarification (Construct 1)**

The first construct consisted of indicators related to the clarifications of both clients and the end users with the remaining participants of the VM workshop through communication between client and end users of the project. By definition, client refers to a party that provides the funding and manages the execution of the project. In that sense, the clients will not always be the user of the constructed project. Hence, the end users are the party that will be using the constructed facilities during the operational phase.

Three main indicators with regard to the workshop are the objectives of the client and end users for the project, the primary function of the project, and what are the assumptions that have been made about the project until the date of the workshop being carried out. The clarifications within the context of the VM workshop were achieved through interaction and communication among the participants from various stakeholders.

#### **6.4.1.2 Efficiency (Construct 2)**

The second construct consisted of indicators related to the efficiency levels specifically during the creativity phase of the workshop. According to the VM job plan, creativity is one of the phases that are very crucial and critical in applying the VM methodology. During the creativity phase, idea generation was carried out to allow the participants to toss around ideas on how to conduct the project and to address the objective of the VM workshop. The brainstorming technique is one of the common techniques used. Hence, there are three major indicators found to be relevant in measuring the efficiency level of the VM workshop.

First is the total numbers of ideas generated during the creativity phase. Since the time allocated creativity phase may vary, the efficiency rate of the idea generated measured by identifying the total of ideas generated per hour. Finally, the idea to be implemented that represent the level of buying ideas by the team members on the proposed ideas. The total ideas to be implemented can be identified during the development phase of the workshop where the accepted ideas will be developed in detail with the estimated value implication in the project.

#### **6.4.1.3 Logistic (Construct 3)**

The third construct consisted of indicators related to the logistic of the workshop. The workshop program was usually prepared during the pre-workshop stage. Usually, the program is prepared by the VM facilitator whom responsible for convincing the client that the rundown will be able to be completed within the timeframe and achieve the agreed workshops' objectives. The facilitator is also responsible for identifying the suitable technique in conducting various workshop processes. Therefore, it is crucial to managing the time in every phase of the workshop since every phase has its process to be accomplished.

**Table 6.10: Result of EFA of process-related indicators**

<b>Item</b>	<b>Construct 1</b>	<b>Construct 2</b>	<b>Construct 3</b>	<b>Communalities</b>
Clarification of the End User's objective(s)	<b>.823</b>	-.087	.147	.706
Clarification of the primary functions	<b>.808</b>	.190	-.126	.704
Clarification of the client's objective(s)	<b>.799</b>	-.204	.320	.783
Clarification of the project's given/assumptions	<b>.784</b>	.256	-.018	.680
Interaction between the workshop team members	<b>.666</b>	.029	.340	.559
No. of ideas to be implemented	.138	<b>.810</b>	.006	.675
Efficiency rate of idea generated (total ideas/hour)	-.046	<b>.797</b>	.341	.755
Total numbers of ideas generated	.033	<b>.782</b>	.239	.670
Time controls for each phase of VM workshops	.169	.139	<b>.857</b>	.783
Duration of each phase of VM workshops	-.042	.234	<b>.745</b>	.611
Satisfaction of the techniques used in each phase	.394	.179	<b>.600</b>	.547
Eigenvalue	3.920	2.295	1.258	
% Variance Explained (67.93%)	35.63	20.86	11.44	
Cronbach's Alpha Statistic	.850	.781	.713	
KMO Measure of Sampling Adequacy Statistic		0.741		
Bartlett's Test of Sphericity		$\chi^2 (55) = 547.764^{**}$		

Note: \* The EFA analysis was based on Principal Component extraction method with Varimax rotation method. \*\* p<.001.

### **6.4.2 Output-related Indicators**

The output-related indicators also being constrained to a three-factor structure solution was also done for the output-related indicators (Table 6.11). The variable explained 63.58% of the variance with two indicators removed for having low factor loading (Optimization of project planning and scheduling = 0.432: Improvement of the communication among stakeholders= 0.412). The communalities value for each item exceeds the minimum cut-off point of 0.50 except one indicator (Duration taken to complete the workshop report = 0.474).

However, this item remains in the analysis due to having a high factor loading (0.649). The constructs that were extracted from this analysis were named as satisfactions (Construct 1), identifications (Construct 2), and improvements (Construct 3). The construct that was extracted from this analysis was at an acceptable level reliability if the Cronbach's Alpha values exceed 0.70 (Nunnally and Bernstein, 1994). All three constructs, Construct 1, Construct 2, and Construct 3 were very reliable with the value of 0.837, 0.846, and 0.804 respectively.

#### **6.4.2.1 Satisfactions (Construct 1)**

The first construct consisted of indicators related to satisfaction regarding workshop implementation. The focus on satisfaction measured for different categories of team members consisting of the client, end users, facilitators, and other participants. Workshop outputs focused on the acceleration of decision-making and finally optimization of the project cost.

#### **6.4.2.2 Identifications (Construct 2)**

The second construct consisted of indicators related to the tangible outputs of the VM workshop. Indicators within this construct can be quantified quantitatively. Among

others, the indicators include the clarification of the requirement for the client and the end users as well as the number of options and alternatives to improve the value of the project through idea generation during the creativity phase.

As a result of the workshop, an action plan should be prepared to indicate the necessary actions to be taken during the post-workshop stage and the party responsible for overlooking and monitoring progress as per the decision made during the workshop. Finally, the workshop report could indicate efficiency and effectiveness through the breadth and depth of coverage of the report as well as the duration taken to prepare a report.

#### **6.4.2.3 Improvements (Construct 3)**

The third construct consisted of indicators related to the intangible outputs of the VM workshop. Indicators within this construct are not able to be quantified quantitatively. Hence, its measurement is more subjective. As the VM was initiated to improve the project's value, it is expected that improvement from the various aspects of the project could be achieved as a result of value improvement identified during the workshop.

First impact is to the physical project and the second impact is to the project team. The improvements in the quality, buildability, and optimization of the overall project planning are expected. Meanwhile, improvement in the project team's communication aspect is a particular concern. Among others, the indicators include the clarification of the requirement for the client and the end users as well as the number of options and alternatives to improve the value of the project through idea generation during the creativity phase.

**Table 6.11: Result of EFA of output-related indicators**

<b>Item</b>	<b>Construct 1</b>	<b>Construct 2</b>	<b>Construct 3</b>	<b>Communalities</b>
Satisfaction of the participants	<b>.768</b>	.284	.157	.695
Satisfaction of the client	<b>.715</b>	.356	.193	.675
Satisfaction of the facilitator	<b>.706</b>	.283	.003	.578
Satisfaction of the End User	<b>.703</b>	.330	.230	.655
Minimization of project cost	<b>.628</b>	-.276	.321	.574
Acceleration of the decision-making process	<b>.606</b>	.237	.329	.531
Identification and clarification of the end user's requirements	.359	<b>.750</b>	.015	.692
Quality and coverage of the workshop report	.153	<b>.700</b>	.441	.708
Identification and clarification of the client's requirements	.359	<b>.686</b>	-.085	.606
Duration taken to complete the workshop report	.085	<b>.649</b>	.212	.474
Identification of the options/alternatives	.156	<b>.610</b>	.441	.591
Percentage of action plan carried out	.177	<b>.607</b>	.455	.606
Improvement to the buildability/constructability aspect	.329	.541	<b>.858</b>	.809
Improvement the overall quality/performance/appearance	.224	.378	<b>.826</b>	.757
Optimization of project planning and scheduling	.362	.462	<b>.826</b>	.439
Improvement of the communication among stakeholders	.264	.295	<b>.826</b>	.521
Return on Investment of VM study (proposed saving/cost of VM workshop)	.095	.169	<b>.600</b>	.583
Eigenvalue	6.541	1.531	1.464	
% Variance Explained (63.58%)	43.61	10.21	9.76	
Cronbach's Alpha Statistic	.837	.846	.804	

KMO Measure of Sampling Adequacy Statistic	0.786
Bartlett's Test of Sphericity	$X^2(105) = 1053.568^{**}$

Note: \* The EFA analysis was based on Principal Component extraction method with Varimax rotation method. \*\*  $p < .001$ .

## **6.5 Identification of the Key Performance Indicators**

In order to rank the indicators from the selected samples, scale ranking analysis was carried out. The total frequencies, mean, and standard deviation of each factor were generated by SPSS. The performance indicators were then ranked according to their mean score values (Lu et al. 2008; Yu et al. 2008; Li et al. 2011).

Fifteen performance indicators were identified based on the overall mean value in order to present a manageable number of indicators. Performance indicators with means of 3.20 and above were considered to be KPIs and amongst these, there are five process-related indicators and ten output-performance indicators.

### **6.5.1 Identification of Process-related Key Performance Indicators**

Process-related indicators refer to the indicators that are correlated with the performance throughout the VM workshop process. These are most likely observed during the pre-workshop and workshop stage.

The mean values for process-related indicators range from 3.49 to 2.90. Ten out of eleven indicators score a minimum value of 3.00 and above (Table 6.12). The result indicates that the respondents agreed that those indicators are relevant to measuring the workshop processes with several indicators achieving mean values towards 3.50. The indicators *efficiency rate of the ideas generated* scored a minimum mean value of 2.90. The interpretation is that the total number of generated ideas is not so important, however. The focus is on more useful ideas that can improve the value of the project.

**Table 6.12: Mean score for process-related indicators**

<b>Rank</b>	<b>Construct</b>	<b><i>Process-related indicators</i></b>	<b>Mean</b>
1	Clarification	Clarification of the client's objective(s)	3.49
2	Clarification	Clarification of the end user's objective(s)	3.45
3	Clarification	Interaction between the workshop team members	3.43
4	Clarification	Clarification of the primary functions	3.39
5	Clarification	Clarification of the project givens/assumptions	3.32
6	Logistic	Time control for each phase of VM workshop	3.14
7	Logistic	Satisfaction of the techniques used in each phase	3.13
8	Logistic	Duration of each phase of VM workshop	3.05
9	Efficiency	Total numbers of ideas generated	3.01
10	Efficiency	No. of ideas to be implemented	3.00
11	Efficiency	Efficiency rate of idea generated (total ideas/hour)	2.90

Clarification of both client and end user's objectives is among the top ranked KPI-Ps as depicted in Table 6.13. These suggest that the objectives should be identified prior to the workshop in ensuring the direction of the workshop is clear. As the workshop involves various stakeholders of the project, the VM facilitators should ensure and encourage the participants to interact and discuss. Active participation is the only way for the workshop to move forward to clarify the primary functions and all assumptions made prior to the workshop. However, it is also important to avoid domination by a particular participant, especially the client representative in the workshop. The spirit of VM is always open, and all participants should remove their

caps and work together under the spirit of project well-being to achieve the workshop objectives.

**Table 6.13: Identification of key process-related indicators**

<b>Rank</b>	<b>Construct</b>	<i>Process-related indicators</i>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Variance</b>
1	Clarification	Clarification of the client’s objective(s)	3.49	0.613	0.376
2	Clarification	Clarification of the end user’s objective(s)	3.45	0.550	0.303
3	Clarification	Interaction between the workshop team members	3.43	0.564	0.318
4	Clarification	Clarification of the primary functions	3.39	0.509	0.259
5	Clarification	Clarification of the project givens/assumptions	3.32	0.556	0.310

The findings of process-related indicators suggested that the main focus of the indicators is directed toward the project itself. Both client and the end users should identify their respective objectives prior the workshop implementation. The identification of the project’s objectives will provide a clear picture of the overall project in order for the participants to take into consideration and set their priorities throughout the workshop process. The primary functions shall be scrutinised, and all assumptions shall be clarified along the way.

### **6.5.2 Identification of Output-related Key Performance Indicators**

Output-related indicators refer to the indicators that are correlated with the outputs produced. It is likely to be observed during the post-workshop stage.

The mean values for output-related indicators are ranging from 3.37 to 2.94. Fifteen out of seventeen indicators scored a mean value of 3.00 and above (Table 6.14). However, the overall mean of the indicators are slightly low in the direction of 3.00, indicating that the respondents tend to agree with the inclusion of all the indicators in

measuring the workshop outputs. *Minimisation of project cost* and *Duration taken to complete the workshop report* achieved mean values of 2.94 and 2.93 respectively. As VM methodology focuses on value improvement, cost saving would be a bonus if possible to attain through VM. In certain circumstances, the workshop report should be available as soon as possible in order for the client to make decisions on the recommendations from the workshop. Delay in decision-making may affect the smooth running of the project development.

**Table 6.14: Mean score for output-related indicators**

<b>Rank</b>	<b>Construct</b>	<b><i>Output-related indicators</i></b>	<b>Mean</b>
1	Identifications	Identification and clarification of the end user's requirements	3.37
2	Identifications	Identification and clarification of the client's requirements	3.37
3	Satisfaction	Satisfaction of the client	3.30
4	Satisfaction	Acceleration of the decision-making process	3.27
5	Satisfaction	Satisfaction of the end user	3.26
6	Improvements	Optimisation of project planning and scheduling	3.25
7	Improvements	Improvement to the overall quality/performance/appearance	3.25
8	Improvements	Improvement of the communication among stakeholders	3.22
9	Identifications	Identification of the option/alternatives	3.22
10	Identifications	Quality and coverage of the workshop report	3.20
11	Improvements	Return on investment of VM study	3.19
11	Improvements	Improvement to the buildability/constructability aspect	3.19
13	Identifications	Percentage of action plan carried out	3.13
14	Satisfaction	Satisfaction of the participants	3.10
15	Satisfaction	Satisfaction of the facilitator	3.08

16	Satisfaction	Minimisation of the project cost	2.94
17	Identifications	Duration taken to complete the workshop report	2.93

Again both client and end user's requirements should be identified and clarified at the end of the workshop as depicted in Table 6.15. This is in relation to the clarification of both these stakeholder's objectives during the process of VM workshop. Hence, their mutual satisfaction can indicate the performance of the overall workshop. Moreover, the client mostly will bear the cost of the project, including the cost of organising the workshop.

**Table 6.15: Identification of key output-related indicators**

<b>Rank</b>	<b>Construct</b>	<b><i>Output-related indicators</i></b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Variance</b>
1	Identifications	Identification and clarification of the end user's requirements	3.37	0.537	0.288
2	Identifications	Identification and clarification of the client's requirements	3.37	0.599	0.359
3	Satisfaction	Satisfaction of the client	3.30	0.637	0.406
4	Satisfaction	Acceleration of the decision-making process	3.27	0.599	0.359
5	Satisfaction	Satisfaction of the end user	3.26	0.639	0.408
6	Improvements	Optimisation of project planning and scheduling	3.25	0.545	0.298
7	Improvements	Improvement to the overall quality/performance/appearance	3.25	0.592	0.351
8	Improvements	Improvement of the communication among stakeholders	3.22	0.545	0.297
9	Identifications	Identification of the option/alternatives	3.22	0.576	0.332
10	Identifications	Quality and coverage of the workshop report	3.20	0.641	0.410

As the workshop involved almost all major stakeholders of the project, it should bring in a better communication and decision-making process among them. The feeling of self-belonging with the project certainly will benefit the project. Since VM methodology aims for better value, the workshop outputs may be translated in the form of good optimisation of the project planning and scheduling, improvement to the quality/performance/appearance. All these indicators are important as it will reflect the performance of the construction project as whole during both the construction and occupation stage. Today's clients not only demand on-time completion within the budget and at the acceptable level of quality, but also look for better value in a holistic perspective for their investment.

A good quality report will significantly help the client to decide on all recommendations from the workshop. In certain conditions, the decision-makers are probably not part of the workshop participants. Hence, the report should be able to provide necessary and critical information to ease the decision-making process. Apart from that, the report can be used as a reference to monitor the action plan implementation during the post-workshop stage.

With the increasing number of applications of VM within the Malaysian construction industry, the identification of the KPIs is highly relevant for monitoring purposes. They are important, particularly for public projects since the applications of VM incur additional cost in terms of resources. Compared to conventional practice before VM was introduced, more manpower is involved during the VM workshop and hence the cost to organise a workshop. Apparently, KPIs are also synonymous with the 2009 government transformation slogan "People First, Performance Now" to ensure that public benefits are measured and demonstrated.

## **6.6 Summary of the chapter**

This chapter revealed 15 KPIs as the tool and yardstick to measure the performance of future VM workshops. KPIs also provide the relevant stakeholders with the measures to be given more attention in assuring effective and efficient VM workshops. The KPIs identified and presented in this chapter will be part of the performance management framework to be developed in managing the performance of the VM workshop in contributing positive effects on the project performance.

## CHAPTER 7: CASE STUDIES OF VALUE MANAGEMENT APPLICATIONS FOR PUBLIC PROJECTS IN MALAYSIA

### 7.1 Introduction

The first three chapters provide critical information that motivated this research. They were followed by a presentation of the research methodology adopted for attaining the research objectives. Chapters five and six presented the CSFs and KPIs identified through a literature review and a survey, along with a series of statistical analyses. This chapter will present the findings of five case studies in measuring and evaluating the VM applications for public projects in Malaysia.

### 7.2 Public Projects' Implementation

The Malaysian government made a specific budgetary allocation for annual expenditure. Typically, the budget consisted of an allocation for operational expenditures and development expenditures. Table 7.1 shows that there has been a steady increase in annual government expenditures from 2011 to 2014. The DE allocation was mainly used to build public infrastructures and facilities.

**Table 7.1 Annual Government's expenditures**

<b>Year</b>	<b>Total budget (bil/MYR)</b>	<b>Operational Expenditures (bil/MYR)</b>	<b>Development Expenditures (bil/MYR)</b>
<b>2011</b>	212.0	162.8 [76.8%]	49.2 [23.2%]
<b>2012</b>	232.8	181.6 [78.0%]	51.2 [22.0%]
<b>2013</b>	251.6	201.9 [80.2%]	49.7 [19.8%]
<b>2014</b>	264.2	217.7 [82.4%]	46.5 [17.6%]

In managing the allocations, the EPU of the Prime Minister's Department is responsible for managing the country's socio-economic development in a strategic and sustainable manner according to the followings objectives:

1. Comprehensive planning through the formulation of effective policy
2. Development programs through an outcome-based approach
3. Maximize the usage of finance resources through effective distribution of budgetary allocations
4. Strengthen human capital towards elevating efficiency and professionalism
5. Establish organizational capacity for effective delivery of services

25 ministries formed under the cabinet are each responsible for a specific area of the national growth and development along different economic sectors. At the same time, they collectively ensure the wellbeing of the citizenry. Among others, the Ministry of Education and Ministry of Health deal heavily with the provision of public facilities. When these ministries require facilities and infrastructure in fulfilling their responsibilities, a specific allocation can be applied to the EPU. The application by the ministries will be processed, reviewed, and when approved, the ministries will receive that allocation to enable them to proceed with implementation of the required project.

In implementing public projects in Malaysia, there were various stakeholders involved. They directly and indirectly ensure smooth functioning and successful implementation of public projects. Among others, the stakeholders involved are the Ministry of Finance, Economic Planning Unit, clients (Ministries/Departments/Agencies/Statutory Bodies), end users, implementation agencies (Public Works Department / Department of Irrigation and Drainage), local

authorities, service providers (electricity, water, sewerage, telecommunication), and consultants (town planner, architect, landscape architect, civil and structural engineer, mechanical and electrical engineer, land surveyor, quantity surveyor, building surveyor).

### **7.3 Selection of the Projects for Case Studies**

Public project implementation was carried out through the years. At a particular point, various projects were at different stages of project implementation. During the second stage of data collection of this research, it was found that the majority of the workshops conducted were Value Analysis (VA) workshops. Details on the VM workshop stages and its objectives were previously described in Chapter 2. After series of discussions with both the VM Section of the EPU and the VM and Partnering Unit of the PWD, case studies were focused on VA implementation based on the availability of the workshops during the data collection process.

### **7.4 Projects' Profiles**

During the period of data collection, five projects were identified and selected for the detailed studies based on the category of projects and other considerations. The project profiles are as follows.

#### **7.4.1 Educational Building (P1)**

This project was previously proposed in 2007 to accommodate 2,400 students and scheduled to offer diploma courses from four academic departments. The project was put on hold due to the high estimated cost at that time. Recently, the project received the green light to proceed but with a new, reduced scope.

As part of the VA exercise, the Schedule of Area (SOA) workshop was carried out in February 2013. As a result, the total GFA was estimated at 33,790.77 square meters. The major reduction was a reduction of the students' accommodation capacity from 1,200 students to 600, the sports complex was excluded, and a compact development approach was adopted to avoid major costs associated with earthworks. Earthworks were identified as contributing a huge amount of cost due to the nature of the site (hilly and requiring terracing). Apart from that, the size of the academic department was reduced to one department that will only offer two diploma programs. P1 workshop's profile is presented in Table 7.2 and the photos in Figure 7.1.

**Table 7.2 Summary of P1 workshop's profiles**

<b>Item</b>	<b>Description</b>
Procurement method	Design and Build (with outline proposal)
Tendering method	Open tender
Stage of project	Concept design
Allocation	MYR 150 million
Capacity	1,200 students
Date	21 October 2013 – 25 October 2013
Venue	Ministry of Education, Putrajaya
Total Participants	47 participants
Participants' Demographic	<ul style="list-style-type: none"> <li>▪ Clients</li> <li>▪ End users</li> <li>▪ Technical departments</li> <li>▪ Service providers</li> <li>▪ Facilitators</li> </ul>



**Figure 7.1 Workshop for project P1**

#### **7.4.2 Commercial Building (P2)**

This project involves the redevelopment of a traditional commercial complex that was built in the early 1990's. The complex houses 277 small entrepreneurs, selling various products such as accessories, kitchen wares, traditional medicines, handicrafts, gifts, etc. It is one of the major tourist attractions locally and serves as a local tourism product. The building also has been undergoing a major renovation back in 1995 with the allocation of MYR 6.5 million.

The objective of the project is to redevelop the commercial building to increase the comfort level for both entrepreneurs and visitors. In addition, the building maintenance cost is very high due to the current building condition that is very old, resulting in a significant burden for the building owner. Major issues for consideration in its redevelopment include the following:

- To provides additional parking lots
- To increase the size of the shop lot
- To improve the natural lighting and natural ventilation

- To improve the shop layout

The redevelopment should maintain the uniqueness of its business features that include traditional Malay and Islamic architectural features. This project has its constraint on the issue of the temporary relocation of the existing entrepreneurs while the complex undergoes redevelopment. P2 workshop's profile is presented in Table 7.3 and the photos in Figure 7.2.

**Table 7.3 Summary of P2 workshop's profiles**

<b>Item</b>	<b>Description</b>
Procurement method	Conventional
Tendering method	Open tender
Stage of project	Concept design
Allocation	MYR 55.85 million
Date	28 October 2013 – 01 November 2013
Venue	Economic Planning Unit, Putrajaya
Total Participants	43 participants <ul style="list-style-type: none"> <li>▪ Clients</li> <li>▪ End users</li> </ul>
Participants'	<ul style="list-style-type: none"> <li>▪ Technical departments</li> <li>▪ Consultants</li> </ul>
Demographic	<ul style="list-style-type: none"> <li>▪ Local authority</li> <li>▪ Service providers</li> <li>▪ Facilitators</li> </ul>



**Figure 7.2 Workshop for project P2**

### **7.4.3 Healthcare Building (P3)**

The proposed hospital serves as a district hospital with a total area of 20.7 hectares. Currently, there are three other hospitals located within a 30km radius with a total capacity of 1,745 beds. Within the district, there are six health clinics, 22 local clinics, 12 private health clinics, two private dental clinics and one 1Malaysia clinic. P3 workshop's profile is presented in Table 7.4 and the photos in Figure 7.3.

The main objectives of the proposed hospital are:

- To provide adequate, effective and efficient secondary level medical care for the population of the district
- To provide adequate, effective, and efficient visiting specialist follow-up clinics
- To provide comfortable and well-equipped medical wards for the benefit of the patients
- To reduce the total number of outpatient referrals to the nearest hospital

- To reduce the total number of outpatient attendances for specialist care in the nearest specialist hospital

The original scope includes a one block hospital with 76 patient beds, staff quarters, and ancillary buildings.

**Table 7.4 Summary of P3 workshop’s profiles**

<b>Item</b>	<b>Description</b>
Procurement method	Conventional
Tendering method	Open tender
Stage of project	Concept design
Allocation	MYR 120 million
Date	18 November 2013 – 22 November 2013
Venue	National Cancer Institute, Putrajaya
Total Participants	50 participants
Participants’	<ul style="list-style-type: none"> <li>▪ Clients</li> <li>▪ End users</li> <li>▪ Technical departments</li> </ul>
Demographic	<ul style="list-style-type: none"> <li>▪ Consultants</li> <li>▪ Local authority</li> <li>▪ Service providers</li> <li>▪ Facilitators</li> </ul>



**Figure 7.3 Workshop for project P3**

The proposed hospitals will offer out-patient services (emergency services with OSCC, visiting specialist clinics, and dialysis services), in-patient services (general medicine, general surgery with Orthopaedics, Obstetrics and Gynaecology, General Paediatrics, imaging services, operation theatre, delivery suites, pathology, and mortuary), medical support services (pharmacy and medical store, medical record & information technology, rehabilitation, and medical social services) and non-medical support services (catering, transport, privatized support services, linen, waste disposal, maintenance and engineering, cleaning and housekeeping and security). In addition, there will be a dedicated area for a conference room, library, quality assurance room, patient education unit, administrative offices, revenue collection and admission, and telephone system.

The development of the district hospital aims to achieve the following outcomes:

- The improvement of the facilities for conducive, safe and high-quality services to the patients, customers and staff

- The 149,900 people of that district will have access to systematic and efficient health facilities

- A 30% reduction in total patients referrals to other hospitals

The workshop managed to identify the following constraints to the project:

- Land acquisition for the upgrading of the main road

- Land topography requires filling works (earthworks)

- Source of electrical supply located quite distance from the site and involves higher contribution costs to the utility provider (TNB)

- Alternative route for water discharge to the nearest river (1.5km from the site, with the uncertainty of the PWD road reserve along the way)

- Future plan of the highway project across the proposed site

- Low water pressure in the development area requires booster pumps

- Additional filtering devices to control and ensure that the water supply meets necessary quality standards for hospital operations

The workshop acknowledges the following “project’s must” list:

- Comply with the Health Technical Memorandum standard

- Comply with the requirement of the local authorities and statutory bodies

- Use of construction materials that require fewer maintenance works

- Comply with the safety, infection, comfort, and green technology standard

- Comply with the floor area norms for both clinical and non-clinical requirements

- The sewerage treatment plant must cater to the current population equivalent

- Apply the Industrialized Building System into construction methods

- Completion within 36 months

- Parking lot numbers to meet the requirement of the local authority

- Provide a water supply that meets the national water quality index
- Take into consideration the future expansion of the floor area, utilities and support services
- Provide safe entrance and exit roads

The original Preliminary Detail Abstract prepared by the consultant was excluded the provision for staff quarters and vehicles. Hence, the model cost established at the beginning of the workshop includes those scopes to fit in the budget of MYR 120 Million.

#### **7.4.4 Sport & Recreational Building (P4)**

Velodrome is an arena for track cycling sport. In recent years, there is a huge development program for track cycling sports, with the achievement at the international level (e.g., Asian Games, Commonwealth Games, Olympic Games, and World Championships). Currently, there are two open velodromes in Malaysia that were built in 1980's as follows:

- Cheras Velodrome (Concrete track, 333.3m)
- Ipoh Velodrome (Timber, 250m)

However, both velodromes were not certified by Union Cyclist International (UCI), an international body that regulates and oversees the cycling sport. Hence, the Prime Minister has announced the allocation of MYR 80 mil for the construction of a covered velodrome. The proposed velodrome will be the first velodrome that meets the specifications of UCI for hosting its championships.

The main objectives of the national velodrome project are:

- To provide a world class, covered velodrome that meets the specifications of UCI and Malaysia National Cyclist Federation
- To provide training facilities for world class athletes

- To host one international cycling event and four national cycling events annually

The original scope of the project includes the cycling track (with infield and access to the infield), grandstands, technical and supporting rooms, cyclist rooms, and an administrative office. The development of the national velodrome aims to achieve the following outputs:

- Covered velodrome that meets the UCI specifications for category one and MNCF requirements
- Training centre that provides facilities for national athletes
- Venue to host international and national championships

The workshop managed to identify the following givens to the project:

- Development cost approved for MYR 80 Million
- Budget speech 2013 from the Treasury
- To meet the UCI standard for category one

The workshop managed to identify the following constraints to the project:

- The total land area of 4.021 hectares is too small to build the velodrome
- Limited land area for the provision of parking facilities
- The site topography
- The allocated budget should be spent by 31 December 2015

The development of the national velodrome aims to achieve the following outcomes:

- To train more cycling athletes at the international level
- To win a medal in Olympic Games 2020
- To host the cycling championship at the international level

The representatives from PWD informed the workshop that the estimate was prepared based on the SOA and the other features of the velodrome as indicated in the concept drawing. P4 workshop's profile is presented in Table 7.5 and the photos in Figure 7.4.

**Table 7.5 Summary of P4 workshop's profiles**

<b>Item</b>	<b>Description</b>
Procurement method	Design & Build
Tendering method	Open tender (Pre-qualification)
Stage of project	Concept design
Allocation	MYR 80 million
Date	25 November 2013 – 28 November 2013
Venue	Empress Hotel, Sepang, Selangor
Total Participants	47 participants
Participants'	<ul style="list-style-type: none"> <li>▪ Clients</li> <li>▪ End users</li> <li>▪ Technical departments</li> </ul>
Demographic	<ul style="list-style-type: none"> <li>▪ Local authority</li> <li>▪ Service providers</li> <li>▪ Facilitators</li> </ul>



**Figure 7.4 Workshop for project P4**

#### **7.4.5 Industrial Building (P5)**

The entire dedicated industrial hub consists of 134 acres of land. Phase I of the project has been developed with a total cost of MYR 22.4 million that provide 58 units on the premises.

Due to increasing demand among manufacturers, the current facilities of phase I was unable to keep up with the demand. Hence, the current proposal of phase II development covers the total land area of 20.81 acres. Based on the market survey conducted, phase II will provide an additional 89 units of various size of premises to a potential 131 entrepreneurs.

The main objectives of the phase II development is to promote the hub as the centre for production and manufacturing, distribution and marketing of halal products by providing the following:

- To provide facilities that meet the specifications for Halal and Good Manufacturing Practices

- To provide the infrastructure facilities
- To provide training, guidance and financial support

The original scopes as registered are 91 units of premises consisting of: terrace (46 units: 22' x 80'), attached (32 units: 50, x 87'), and single (13 units: 70' x 126')

The outcome of the proposed phase is to increase the numbers of premises for the entrepreneurs to a minimum of 70 units by the year 2018. P5 workshop's profile is presented in Table 7.6 and the photos in Figure 7.5.

**Table 7.6 Summary of P5 workshop's profiles**

<b>Item</b>	<b>Description</b>
Procurement method	Conventional
Tendering method	Open tender
Stage of project	Detail design
Allocation	MYR 42.95 million
Date	21 October 2013 – 25 October 2013
Venue	Bendahara Hotel, Malacca
Total Participants	31 participants
Participants'	<ul style="list-style-type: none"> <li>▪ Clients</li> <li>▪ End users</li> <li>▪ Technical departments</li> </ul>
Demographic	<ul style="list-style-type: none"> <li>▪ Consultants</li> <li>▪ Local authority</li> <li>▪ Service providers</li> <li>▪ Facilitators</li> </ul>



**Figure 7.5 Workshop for project P5**

The workshop acknowledges the following “project’s must” list:

- Water supply for current development able to cater the demand from phase II. However, future development may need to include a water tank.
- Planning Permission approved on 27 September 2013 with total charge for plan submission and drainage of MYR 112,000.00.
- Compliance with the Uniform Building by Law.
- Contribution fees of MYR 200,000 to the power supply provider
- Construction of a sewerage pipe and connection to the existing sewerage treatment plant. Total fees and contribution are MYR 27,920.00
- Compliance with the halal standard requirements
- Contribution fee of MYR 18,200.00 to the PWD
- Contribution fee of MYR 70,150.00 for utilities detection mapping

There was no constraint to the project since most of the preparation work has been carried out. Planning permission was approved by the local authority and feedback was received from relevant technical departments, which the latest design has taken it into account.

The team had another workshop on 30 September 2013 – 2 October 2013. However, it was called off due to the lack of background information provided by the client and the consultants. Hence, it was observed that during this workshop, most of the information was available, which helps the workshop run smoothly.

## **7.5 Quantitative and Qualitative Data Collection and Analysis**

During the case studies, questionnaire surveys were distributed to all participants to measure the workshop's performance based on the identified KPIs. Each KPI was designed to provide some guide for the participants to rank the workshop's performance. Apart from that, the respondents also asked to provide feedback on the overall performance of the workshop.

### **7.5.1 Methods of Data Collection**

#### **7.5.1.1 Observation**

The researcher observed all five VM workshops selected as case studies in this research. The observer was present during the entire duration of the workshops. The observer, being an independent participant, was only authorized to observe, but not to take part in the workshop process. During the observation, the whole process was a matter of attention, but specifically focused on the CSFs and KPIs identified during the first stage of data collection. An observation form was developed to assist the observation process and later turned into an observation report.

### **7.5.1.2 Questionnaire Survey**

At the end of each workshop, participants were requested to fill in the survey. However, in ensuring the reliability of the survey, only those who participated in the whole duration of the workshop were invited to response to the survey. Hence, the numbers of valid responds were relatively smaller than the total number of participants of the workshop. The representatives from the local authority and the service providers were given exemption to leave the workshop after the *information* phase, leading to a smaller number of participants involved for the whole duration of the workshop.

### **7.5.1.3 Semi-structured Interview**

During this stage, a total of 20 semi-structured interviews were carried out with representatives from various stakeholders of the projects that participated in the VM workshops. To obtain a wider coverage and different perspectives on the workshop performance, interviewees were selected from different categories of stakeholders. For each case study, four interviewees were approached. In all cases, the interviewees were the client organization and the VM workshop facilitators. In some of the cases, interviewees were among the other stakeholders to a project such as the end users, government agencies, local authorities, or project's consultants.

The interview process began with a formal invitation to the potential interviewees. Once they agreed to participate, the interview questions were sent ahead of the interview session to allow them necessary time for preparation. The interviewees were also required to sign a consent form for their participation. A digital audio recorder was used during the sessions. Apart from that, notes were taken when the interviewer observed any sign from the interviewees' body language that closely related to the

questions asked. After completing the session, the transcription process began and draft transcripts were to the interviewees for their review and confirmation. The interviewer sought further clarifications when it was deemed to be necessary. To protect the privacy of the interviewees, they were made anonymous in this research, which does not affect the intended knowledge transfer and sharing in relation to the focus of the research.

### **7.5.2 Method of Data Analysis**

Quantitative data collected through the survey were analysed using the SPSS software. While the qualitative data from the semi-structured interviews and observation reports were analysed using the NVivo 10 software.

## **7.6 Summary of Observations**

Based on the observations carried out in five VM workshops, the major findings are discussed from three major areas as follows: gross floor area model, the cost model, and efficiency level.

### **7.6.1 Gross Floor Area Model**

Gross floor area (GFA) refers to the total built area of a particular building/structure. According to the RICS, GFA is derived by calculating the total spaces provided. For the public project implementation, the client with the support of the end users will first identify and provide the Schedule of Accommodation (SOA). The SOA will detail the area required for every space of the project's components. The SOA will serve as the basis for the designer to prepare the layout design to fulfil the areas

required as stated in the SOA. During the initial stage, GFA usually serves as the basis for a rough estimate cost of the project.

The designers may refer to the design team from the PWD or the appointed consultants, depending on the type of procurement adopted. GFA proposed by the designers prior to workshop implementation will be the basis of discourse during the workshop. In all workshops, the GFA was revisited and scrutinized based on the requirements of the client and end users. However, this will be screened through after the identification of the functions of the project during the *function analysis* phase of the workshop. Finally, a revised GFA will be outputs of the workshop. Table 7.7 presents a comparison between the proposed GFA and the revised GFA for all workshops.

There was a significant reduction of the GFA for project P4 at 66.3%. The other projects, P2, P1, and P3 have a reduction of GFA at 35.9%, 27.4%, and 14.7% respectively while the GFA for P5 remained at 27,056m<sup>2</sup>. Significant reduction of 19,900m<sup>2</sup> of floor area for P4 was achieved through consolidation of the SOA developed by the architect. The workshop was informed that the SOA was developed based on the need statements provided by the client. It was supported by the visual experiences during the technical visit to similar types of building in other countries (e.g., Guangzhou and Hong Kong).

One of the ideas generated during the *creativity phase* of the P4's workshop was to revisit the SOA based on the function of each room identified during the *function analysis phase*. A dedicated group was formed by the facilitators to look critically into this matter. The group consisted of representatives from the client, end user, and the designers from PWD. Further clarification by the end user's representative provided

valid justification for the workshop to review the SOA. As a result, the workshop managed to come up with a revised SOA. It is still providing the basic functions of the proposed building with necessary secondary function to ensure the functionality of the building.

It was the same case observed for projects P1, P2, and P3. The SOA was revisited based on the agreed project's functions identified during the *function analysis*. For instance, the number of meeting rooms provided for P1 was reduced, and the sharing facilities concepts was encouraged as the meeting rooms were not going to be used at all times. Arrangements between the potential users are possible through prior coordination and a booking system. P3 adopted the same approach, where the staff facilities will be shared by two medical wards.

Meanwhile, the detailed designs for P5 were completed prior to the workshop. In addition, the building plans were approved by the local authority with minor changes and required being taken into consideration in the revised building plans and detailed design. Hence, there were no changes in terms of the GFA of the proposed project.

**Table 7.7 Comparison between the proposed GFA and the revised GFA as per workshop's outputs**

<b>Variable</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>	<b>P5</b>
<b>Proposed GFA</b>	37,420.14 m <sup>2</sup>	23,804.00 m <sup>2</sup>	19,725.00 m <sup>2</sup>	30,000.00 m <sup>2</sup>	27,056.00 m <sup>2</sup>
<b>Revised GFA</b>	27,179.79 m <sup>2</sup>	15,254.08 m <sup>2</sup>	16,822.00 m <sup>2</sup>	10,100.00 m <sup>2</sup>	27,056.00 m <sup>2</sup>
<b>Differences</b>	(10,240.35 m <sup>2</sup> )	(8,549.92 m <sup>2</sup> )	(2,903.00 m <sup>2</sup> )	(19,900.00 m <sup>2</sup> )	(0.00 m <sup>2</sup> )
<b>Percentage of differences</b>	(27.4%)	(35.9%)	(14.7%)	(66.3%)	0.0%

**Table 7.8 Comparison between the cost model and the final cost model as per workshop's outputs**

<b>Variable</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>	<b>P5</b>
<b>Cost model (in MYR)</b>	301,391,500.00	63,005,462.00	150,921,660.00	157,522,000.00	46,673,495.81
<b>Final cost (in MYR)</b>	148,478,000.00	52,980,797.00	154,213,000.00	78,166,445.00	42,881,156.81
<b>Differences (in MYR)</b>	(152,913,500.00)	(10,024,655.00)	3,291,340.00	(79,355,555.00)	(3,792,339.00)
<b>Percentage of differences</b>	(50.7%)	(15.9%)	2.2%	(50.4%)	(8.1%)

### **7.6.2 Cost Model**

Cost is an essential element in any development project. It is the main concern of the client, who provides the funding for the project. It is also the responsibility of the project team to ensure that the development will be completed according to the allocated budget. A cost estimate can be prepared using several methods, depending on the stage of the development and availability of the design information to come up with a realistic cost estimate. Cost per floor area is commonly used based on the historical data of a similar nature of projects. However, this method requires adjustment based on the time frame of the historical data. As the main implementing agency for public projects in Malaysia, PWD published a reference book for the cost per square meter of buildings based on the various categories and types of common public-use buildings.

In the Commonwealth countries like Malaysia, quantity surveyor (QS) is one of the professionals in the built environment discipline that is responsible for preparing the cost estimate. In a project where the Government appointed private consultants, the consultants' QS were required to prepare the cost estimate. Otherwise, the QS from PWD were required to prepare such an estimate as one of the critical information requirements for the implementation of the VM workshop. Table 7.8 presents a comparison between the cost model and the final estimated cost as per VA workshop's outputs.

Significant reductions were found in the cost estimate for both projects P1 and P4. They were 50.7% and 50.4% respectively. While projects P2 and P5 recorded an acceptable reduction of 15.9% and 8.1%. In contrast to the other projects, only P3 showed an increased cost estimate after the VM workshop.

Based on observations during the workshops, the significant reduction of cost estimated for P1 was due to the major changes in the overall concept design, going from an initial scattered design to a subsequent compact design. The new compact design primarily focused on one single complex for the academic building, with several support buildings. As a result, the team managed to escape from the major cost for the infrastructure works such as earthworks, electrical supply, and water supply. It is important to note that the site condition and topography for P1 required excessive earthworks to achieve the proposed platform level.

On the other hand, the significant reduction of the cost estimate for P4 was due to the revised SOA. As mentioned before, the cost estimate was prepared based on the floor area and the historical cost data. Hence, the reduction of SOA contributed to a significant cost reduction.

In contrast to the others, the overall estimate for P3 showed an increase after the workshop. During the *information* phase, the EPU required that the original scope of the project should be included and taken into consideration during the workshop. It was strongly supported by the end user. However, the participants were informed that the cost model excluded the staff quarters as agreed by the client prior to the workshop. The mechanical & electrical consultant also advised that additional scope for the quarters may not only affect the GFA, but also the associated cost of mechanical & electrical works and infrastructure works. After deliberation during the *analysis* phase, it was agreed that the new project scope will incorporate the quarters. As a consequence, the final cost model at the end of the workshop found to be higher than the original cost model at 2.2%.

### 7.6.3 Efficiency Model

One of the critical phases in the VM job plan is the *creativity* phase. The *creativity* phase provides room for all participants, with the facilitation of the facilitator to creatively think about how to achieve the functions of the project with a maximum value to the client. These case studies employed the brainstorming technique during the *creativity* phase. Brainstorming is a well-known creative thinking technique that can help a team to generate as many ideas as possible during the allocated time.

However, not all ideas will be accepted for implementation into the project. It is important for the facilitators to ensure that the participants were participating and contribute logical and practical ideas. Table 7.9 presents the comparison of the efficiency level during the *creativity* phase for five different workshops. The different variables are described as follows:

#### i) **Total generated ideas**

Total number of ideas generated during the *creativity* phase where all participants were encouraged to contribute their ideas without any judgment from the other participants.

#### ii) **Total evaluated ideas**

Total number of ideas agreed by all participants and evaluated during the *evaluation* phase of the workshop.

#### iii) **Total implemented ideas**

Total number of ideas that were agreed to for implementation of the project and had its cost implication added to the estimated cost.

The VM job plan doesn't specify the exact duration for every phase of the workshop. However, it can be seen from the table that 540 minutes were spent on average during

the *creativity* phase of all workshops, except for P5 since it was the second workshop of the project. The facilitators decided to move on to the following phase after realizing that the idea generation was stagnant at 22 ideas.

For comparison purposes within these case studies, the total ideas were divided by the total time spent during *creativity* phase. This comparison, however, disregards the number of participants involved in each workshop as the numbers vary between workshops. P2 was efficient in idea generation when the participants spent less time (5.3 minutes per idea generated) as well as per ideas evaluated (7.8 minutes). P5 seem to be less efficient probably due to the smallest number of participants involved in the workshop. The participants spent the most time at 8.2 minutes per idea generated.

For the total ideas for implementation, P1 managed to achieve the best performance at 12.4 minutes per idea. It followed by P2 (17.8 minutes/idea), P5 (25.7 minutes/idea), and P3 (27.5 minutes/idea). P4 spent the most time at 36.2 minutes per idea. On the other hand, percentage of idea for implementation can be interpreted as representing the quality of the ideas. It shows the level of valuing the ideas by the workshop participants. As the brainstorming technique allows the participants to throw out any ideas to the group, some may not be practical for implementation or within the project's parameters. On that remark, P1 achieved the highest buying rate of ideas at 54.9%. About more than half of the generated ideas were good and practical. The least was for P4 where only 18.8% of generated ideas were accepted for implementation into the project.

**Table 7.9 Efficiency levels of *creativity* phase for five different workshops.**

<b>Variable</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>	<b>P5</b>
Total generated ideas	82	107	87	69	22
Total evaluated ideas	45	73	44	34	14
Total implemented ideas	45	32	20	13	7
Total time of creativity phase	560 min	570 min	550 min	470 min	180 min
<hr/>					
<b><i>Efficiency rate</i></b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>	<b>P5</b>
Total generated ideas	6.8 min/idea	5.3 min/idea	6.3 min/idea	6.8 min/idea	8.2 min/idea
Total evaluated ideas	12.4 min/idea	7.8 min/idea	12.5 min/idea	13.8 min/idea	12.9 min/idea
Total implemented ideas	12.4 min/idea	17.8 min/idea	27.5 min/idea	36.2 min/idea	25.7 min/idea
<hr/>					
Percentage of implemented ideas	54.9%	29.9%	23.0%	18.8%	31.8%

## 7.7 Quantitative Data on Key Performance Indicators

The KPIs were used to measure the performance of the workshops. A questionnaire survey was distributed and collected at the end of each workshop. The composition of the respondents is as per outlined in Table 7.10.

**Table 7.10 Composition of respondents from five workshops**

Variable	P1	P2	P3	P4	P5	Total
Total participants	47	43	50	47	31	218
Total distributed	25	35	32	31	20	143
Total responds	17	23	26	21	16	103
Rate of return (%)	68%	66%	81%	68%	80%	72%

### 7.7.1 Process-related Key Performance Indicators

Process-related KPIs were described in Chapter 6 as the indicators that highlight the achievement of the workshop's processes. Table 7.11 presents the mean scores for all five workshops for five key process-related indicators.

**Table 7.11 KPI-P scores for all workshops**

	P1	P2	P3	P4	P5	Average
KPI-P1	3.88	3.91	3.88	4.33	4.00	4.00
KPI-P2	3.88	3.30	3.45	4.57	3.63	3.77
KPI-P3	3.65	4.00	3.73	3.95	4.31	3.93
KPI-P4	3.71	3.70	4.15	4.81	3.81	4.04
KPI-P5	3.94	3.70	3.73	4.29	3.88	3.91

### 7.7.2 Output-related Key Performance Indicators

Output-related KPIs were described in Chapter 6 as the indicators that indicate the achievement of the workshop outputs. Table 7.12 presents the mean scores for all five

workshops for nine key output-related indicators. Note that KPI-O10 were excluded due to the lack of availability of the related information during the survey.

**Table 7.12 KPI-O scores for all workshops**

	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>	<b>P5</b>	<b>Average</b>
<b>KPI-O1</b>	3.94	3.78	3.81	4.33	3.94	3.96
<b>KPI-O2</b>	3.82	3.87	3.88	4.33	4.25	4.03
<b>KPI-O3</b>	3.71	4.04	3.77	3.67	3.63	3.76
<b>KPI-O4</b>	3.82	3.65	3.42	3.86	3.13	3.58
<b>KPI-O5</b>	3.82	3.87	4.08	4.24	3.88	3.98
<b>KPI-O6</b>	4.00	3.91	3.54	4.29	4.00	3.95
<b>KPI-O7</b>	4.24	4.22	3.62	4.52	4.69	4.26
<b>KPI-O8</b>	3.71	3.96	3.92	4.10	4.13	3.96
<b>KPI-O9</b>	3.94	4.17	3.38	4.57	3.88	3.99

Both tables 7.11 and 7.12 present the individual score of each indicator for all five workshops with their respective average scores. The following sub-chapter focuses on evaluating the overall performance of each workshop.

### **7.7.3 Performance Evaluation of Value Management Implementation**

The individual scores of each KPI in each project presented in Table 7.11 and 7.12 are unable to evaluate the overall performance of the workshops. Hence, a systematic evaluation method is required. In the following subchapter, evaluation into all workshops will be carried out through a systematic and scientific approach, Fuzzy Synthetic Evaluation (FSE).

FSE provides a synthetic evaluation of an object relative to the objective in a fuzzy decision environment that involves numbers of indicators, multi-levels, and weighting factors given to specific indicators (Nassar and Abourizk, 2014). Previous research by

Xu et al. (2010) and Mu et al. (2014) on risk management also adopted FSE when dealing with multi-criteria decision-making. Three basic elements are required to run the FSE: a family of the basic indicator,  $F = \{F_1, F_2, \dots, F_m\}$ , a set of alternatives,  $E = \{e_1, e_2, \dots, e_n\}$ , and an evaluation matrix of  $R=(r_{ij})_{m \times n}$  for every object  $u \in U$ . In the fuzzy environment,  $r_{ij}$  is the degree to which alternative  $e_j$  satisfies the criterion  $f_j$ . It is presented by the fuzzy membership function of alternative  $e_j$  with respect to the criterion  $f_j$ .

### 7.7.3.1 Identification of the Mean Scores

The mean score of each KPI was identified based on the summation of individual scores of each KPI divided by the number of respondents. The calculation of the score was computed by the following formula:

$$= \frac{\sum_{i=1}^s s_i f_i}{\sum_{i=1}^s f_i}$$

where:

$s_i$  represents the weight assigned to each response,  $s_i = 1, 2, 3,$  and  $4$  for  $i = 1, 2, 3,$  and  $4$  respectively;

$f_i$  represents the frequency of each response; and

$i$  represents response ratings of  $1, 2, 3, 4$  or  $5$  corresponding to strongly disagree, disagree, neutral, agree, strongly agree.

Mean score for each KPIs was analysed based on the data collected during the first stage of this research work, which involved 114 respondents.

### 7.7.3.2 Identification of the Appropriate Weighting for Each KPI

The weighted criteria were developed based on the mean scores identified in the previous step. The calculation of the weightage of each KPI was computed using the following formula:

$$X = (X_1, X_2, \dots, X_m)$$
$$X_j(M_1, \dots, M_m) = \frac{M_j}{\sum_{j=1}^m M_j}$$

where:

$X_j$  represents the weightage of a particular KPI;

$M_j$  represents the mean score of a particular KPI; and

$\sum M_j$  represents the summation of mean scores of all KPIs.

The same process was repeated to identify the appropriate weightage for each construct.

### 7.7.3.3 Identification of the Membership Function for Each KPI

Suppose that the indicator in fuzzy performance evaluation is  $f = \{f_1, f_2, \dots, f_n\}$ ; and the ratings of performance level defined as  $E = \{1, 2, 3, 4, 5\}$  where it represents very poor, poor, average, good, and very good. For each of the KPIs, the membership function can be formed based on the data collected from the performance survey and presented in Table 7.13.

### 7.7.3.4 Developing the Fuzzy Synthetic Evaluation Model

Finally, an FSE model was established to enable the systematic evaluation of the overall performance of the workshops. The model includes three levels of membership function: level three refers to each of the KPIs; level two refers to each construct (clarifications, satisfactions, identifications, and improvements); and level

one refers to the overall workshop performance, which is presented as a single metric for each workshop using the equation below:

$$PL = \sum_{k=1}^5 (X * R_k) * L$$

where:

X represents the weightage of each construct;

R represents the level 1 membership function of each KPI construct;

$R_k$  represents the rating of each KPI, and

L represents the rating used to evaluate each of the KPIs, where 1 = very poor, 2 = poor, 3 = average, 4 = good, and 5 = very good.

Based on the membership function level one identified for each workshop that is presented in Table 7.14 – 7.18, the overall performance of each workshop was calculated and presented in Table 7.19. Empirically, it can be summarized that the overall performance of VM workshops implementation for five public projects in this case studies can be regarded as average good with the overall score between 3.74 and 4.29. To support this claim, qualitative data were collected from various stakeholders involved in the workshops. The findings of the semi-structured interviews are presented in the following sub-chapter.

**Table 7.13 Mean scores and weightage of KPIs**

<b>Construct</b>	<b>Indicator</b>	<b>Description</b>	<b>Mean value for each KPI</b>	<b>Total Mean value for each construct</b>	<b>Weightage for each KPI</b>	<b>Weightage for each construct</b>
<b>Clarifications</b>	<b>KPI-P1</b>	Clarification of the client's objective(s)	<b>3.49</b>	17.08	0.204	<b>0.367</b>
	<b>KPI-P2</b>	Clarification of the end user's objective(s)	<b>3.45</b>		0.202	
	<b>KPI-P3</b>	Interaction between the workshop team members	<b>3.43</b>		0.201	
	<b>KPI-P4</b>	Clarification of the primary functions	<b>3.39</b>		0.198	
	<b>KPI-P5</b>	Clarification of the project givens/assumptions	<b>3.32</b>		0.194	
<b>Identifications</b>	<b>KPI-O1</b>	Identification and clarification of the end user's requirements	<b>3.37</b>	9.96	0.338	<b>0.214</b>
	<b>KPI-O2</b>	Identification and clarification of the client's requirements	<b>3.37</b>		0.338	
	<b>KPI-O9</b>	Identification of the options/alternatives	<b>3.22</b>		0.323	
<b>Improvements</b>	<b>KPI-O6</b>	Improvement to the overall quality/performance/appearance	<b>3.25</b>	9.72	0.334	<b>0.208</b>
	<b>KPI-O7</b>	Optimisation of project's planning and scheduling	<b>3.25</b>		0.334	
	<b>KPI-O8</b>	Improvement of the communication among stakeholders	<b>3.22</b>		0.331	
<b>Satisfactions</b>	<b>KPI-O3</b>	Satisfaction of the client	<b>3.30</b>	9.83	0.336	<b>0.211</b>
	<b>KPI-O4</b>	Acceleration of the decision-making process	<b>3.27</b>		0.333	
	<b>KPI-O5</b>	Satisfaction of the end users	<b>3.26</b>		0.332	
<b>Total</b>				<b>46.59</b>		<b>1.00</b>

*\*KPIO-10 was excluded from the evaluation due to unavailability of the score as the report were not completed during the survey were conducted*

**Table 7.14 Identification of membership functions for P1's workshop**

<b>Construct</b>	<b>Indicator</b>	<b>Weightage of KPI</b>	<b>Membership function of level 3</b>	<b>Membership function of level 2</b>	<b>Weightage of construct</b>	<b>Membership function of level 1</b>
<b>Clarifications</b>	<b>KPI-P1</b>	<b>0.204</b>	(0.00, 0.06, 0.24, 0.46, 0.24)	(0.00, 0.04, 0.29, 0.49, 0.18)	<b>0.367</b>	(0.00, 0.03, 0.24, 0.57, 0.16)
	<b>KPI-P2</b>	<b>0.202</b>	(0.00, 0.06, 0.18, 0.58, 0.18)			
	<b>KPI-P3</b>	<b>0.201</b>	(0.00, 0.00, 0.47, 0.41, 0.12)			
	<b>KPI-P4</b>	<b>0.198</b>	(0.00, 0.06, 0.29, 0.53, 0.12)			
	<b>KPI-P5</b>	<b>0.194</b>	(0.00, 0.00, 0.29, 0.47, 0.24)			
<b>Identifications</b>	<b>KPI-O1</b>	<b>0.338</b>	(0.00, 0.00, 0.12, 0.82, 0.06)	(0.02, 0.02, 0.20, 0.65, 0.12)	<b>0.214</b>	
	<b>KPI-O2</b>	<b>0.338</b>	(0.00, 0.06, 0.18, 0.64, 0.12)			
	<b>KPI-O9</b>	<b>0.323</b>	(0.06, 0.00, 0.29, 0.47, 0.18)			
<b>Improvements</b>	<b>KPI-O6</b>	<b>0.334</b>	(0.00, 0.00, 0.35, 0.47, 0.18)	(0.00, 0.02, 0.24, 0.58, 0.16)	<b>0.208</b>	
	<b>KPI-O7</b>	<b>0.334</b>	(0.00, 0.06, 0.24, 0.52, 0.18)			
	<b>KPI-O8</b>	<b>0.331</b>	(0.00, 0.00, 0.12, 0.76, 0.12)			
<b>Satisfactions</b>	<b>KPI-O3</b>	<b>0.336</b>	(0.00, 0.00, 0.06, 0.65, 0.29)	(0.00, 0.02, 0.18, 0.63, 0.18)	<b>0.211</b>	
	<b>KPI-O4</b>	<b>0.333</b>	(0.00, 0.06, 0.29, 0.53, 0.12)			
	<b>KPI-O5</b>	<b>0.332</b>	(0.00, 0.00, 0.18, 0.70, 0.12)			

**Table 7.15 Identification of membership functions for P2's workshop**

<b>Construct</b>	<b>Indicator</b>	<b>Weightage of KPI</b>	<b>Membership function of level 3</b>	<b>Membership function of level 2</b>	<b>Weightage of construct</b>	<b>Membership function of level 1</b>
<b>Clarifications</b>	<b>KPI-P1</b>	<b>0.204</b>	(0.00, 0.00, 0.26, 0.57, 0.17)	(0.02, 0.05, 0.31, 0.44, 0.18)	<b>0.367</b>	(0.01, 0.04, 0.26, 0.47, 0.22)
	<b>KPI-P2</b>	<b>0.202</b>	(0.04, 0.09, 0.44, 0.29, 0.04)			
	<b>KPI-P3</b>	<b>0.201</b>	(0.00, 0.04, 0.26, 0.35, 0.35)			
	<b>KPI-P4</b>	<b>0.198</b>	(0.00, 0.04, 0.35, 0.48, 0.13)			
	<b>KPI-P5</b>	<b>0.194</b>	(0.04, 0.09, 0.22, 0.43, 0.22)			
<b>Identifications</b>	<b>KPI-O1</b>	<b>0.338</b>	(0.00, 0.09, 0.26, 0.43, 0.22)	(0.00, 0.07, 0.21, 0.48, 0.25)	<b>0.214</b>	
	<b>KPI-O2</b>	<b>0.338</b>	(0.00, 0.04, 0.26, 0.48, 0.22)			
	<b>KPI-O9</b>	<b>0.323</b>	(0.00, 0.09, 0.09, 0.52, 0.30)			
<b>Improvements</b>	<b>KPI-O6</b>	<b>0.334</b>	(0.00, 0.04, 0.44, 0.35, 0.17)	(0.00, 0.01, 0.36, 0.42, 0.20)	<b>0.208</b>	
	<b>KPI-O7</b>	<b>0.334</b>	(0.00, 0.00, 0.30, 0.53, 0.17)			
	<b>KPI-O8</b>	<b>0.331</b>	(0.00, 0.00, 0.35, 0.39, 0.26)			
<b>Satisfactions</b>	<b>KPI-O3</b>	<b>0.336</b>	(0.00, 0.00, 0.09, 0.61, 0.30)	(0.00, 0.03, 0.12, 0.57, 0.29)	<b>0.211</b>	
	<b>KPI-O4</b>	<b>0.333</b>	(0.00, 0.09, 0.13, 0.52, 0.26)			
	<b>KPI-O5</b>	<b>0.332</b>	(0.00, 0.00, 0.13, 0.57, 0.30)			

**Table 7.16 Identification of membership functions for P3's workshop**

<b>Construct</b>	<b>Indicator</b>	<b>Weightage of KPI</b>	<b>Membership function of level 3</b>	<b>Membership function of level 2</b>	<b>Weightage of construct</b>	<b>Membership function of level 1</b>
<b>Clarifications</b>	<b>KPI-P1</b>	<b>0.204</b>	(0.00, 0.00, 0.19, 0.73, 0.08)	(0.00, 0.01, 0.30, 0.58, 0.11)	<b>0.367</b>	(0.00, 0.01, 0.34, 0.56, 0.09)
	<b>KPI-P2</b>	<b>0.202</b>	(0.00, 0.04, 0.46, 0.50, 0.00)			
	<b>KPI-P3</b>	<b>0.201</b>	(0.00, 0.00, 0.35, 0.57, 0.08)			
	<b>KPI-P4</b>	<b>0.198</b>	(0.00, 0.00, 0.12, 0.61, 0.27)			
	<b>KPI-P5</b>	<b>0.194</b>	(0.00, 0.00, 0.38, 0.50, 0.12)			
<b>Identifications</b>	<b>KPI-O1</b>	<b>0.338</b>	(0.00, 0.00, 0.23, 0.73, 0.04)	(0.00, 0.00, 0.29, 0.59, 0.12)	<b>0.214</b>	
	<b>KPI-O2</b>	<b>0.338</b>	(0.00, 0.00, 0.23, 0.65, 0.12)			
	<b>KPI-O9</b>	<b>0.323</b>	(0.00, 0.00, 0.42, 0.39, 0.19)			
<b>Improvements</b>	<b>KPI-O6</b>	<b>0.334</b>	(0.00, 0.04, 0.50, 0.46, 0.00)	(0.00, 0.01, 0.36, 0.56, 0.06)	<b>0.208</b>	
	<b>KPI-O7</b>	<b>0.334</b>	(0.00, 0.00, 0.12, 0.69, 0.19)			
	<b>KPI-O8</b>	<b>0.331</b>	(0.00, 0.00, 0.46, 0.54, 0.00)			
<b>Satisfactions</b>	<b>KPI-O3</b>	<b>0.336</b>	(0.00, 0.00, 0.46, 0.54, 0.00)	(0.00, 0.00, 0.45, 0.49, 0.06)	<b>0.211</b>	
	<b>KPI-O4</b>	<b>0.333</b>	(0.00, 0.00, 0.23, 0.62, 0.15)			
	<b>KPI-O5</b>	<b>0.332</b>	(0.00, 0.00, 0.65, 0.31, 0.04)			

**Table 7.17 Identification of membership functions for P4's workshop**

<b>Construct</b>	<b>Indicator</b>	<b>Weightage of KPI</b>	<b>Membership function of level 3</b>	<b>Membership function of level 2</b>	<b>Weightage of construct</b>	<b>Membership function of level 1</b>
<b>Clarifications</b>	<b>KPI-P1</b>	<b>0.204</b>	(0.00, 0.00, 0.00, 0.67, 0.33)	(0.00, 0.00, 0.08, 0.46, 0.47)	<b>0.367</b>	(0.00, 0.00, 0.11, 0.49, 0.40)
	<b>KPI-P2</b>	<b>0.202</b>	(0.00, 0.00, 0.00, 0.43, 0.57)			
	<b>KPI-P3</b>	<b>0.201</b>	(0.00, 0.00, 0.29, 0.47, 0.24)			
	<b>KPI-P4</b>	<b>0.198</b>	(0.00, 0.00, 0.00, 0.19, 0.81)			
	<b>KPI-P5</b>	<b>0.194</b>	(0.00, 0.00, 0.10, 0.52, 0.38)			
<b>Identifications</b>	<b>KPI-O1</b>	<b>0.338</b>	(0.00, 0.00, 0.10, 0.47, 0.43)	(0.00, 0.00, 0.19, 0.50, 0.31)	<b>0.214</b>	
	<b>KPI-O2</b>	<b>0.338</b>	(0.00, 0.00, 0.10, 0.47, 0.43)			
	<b>KPI-O9</b>	<b>0.323</b>	(0.00, 0.00, 0.38, 0.57, 0.05)			
<b>Improvements</b>	<b>KPI-O6</b>	<b>0.334</b>	(0.00, 0.00, 0.29, 0.57, 0.14)	(0.00, 0.00, 0.13, 0.54, 0.33)	<b>0.208</b>	
	<b>KPI-O7</b>	<b>0.334</b>	(0.00, 0.00, 0.10, 0.57, 0.33)			
	<b>KPI-O8</b>	<b>0.331</b>	(0.00, 0.00, 0.00, 0.48, 0.52)			
<b>Satisfactions</b>	<b>KPI-O3</b>	<b>0.336</b>	(0.00, 0.00, 0.00, 0.48, 0.52)	(0.00, 0.00, 0.06, 0.48, 0.46)	<b>0.211</b>	
	<b>KPI-O4</b>	<b>0.333</b>	(0.00, 0.00, 0.19, 0.52, 0.29)			
	<b>KPI-O5</b>	<b>0.332</b>	(0.00, 0.00, 0.00, 0.43, 0.57)			

**Table 7.18 Identification of membership functions for P5's workshop**

<b>Construct</b>	<b>Indicator</b>	<b>Weightage of KPI</b>	<b>Membership function of level 3</b>	<b>Membership function of level 2</b>	<b>Weightage of construct</b>	<b>Membership function of level 1</b>
<b>Clarifications</b>	<b>KPI-P1</b>	<b>0.204</b>	(0.00, 0.00, 0.31, 0.38, 0.31)	(0.00, 0.00, 0.29, 0.50, 0.21)	<b>0.367</b>	(0.00, 0.01, 0.24, 0.56, 0.19)
	<b>KPI-P2</b>	<b>0.202</b>	(0.00, 0.00, 0.56, 0.25, 0.19)			
	<b>KPI-P3</b>	<b>0.201</b>	(0.00, 0.00, 0.00, 0.39, 0.31)			
	<b>KPI-P4</b>	<b>0.198</b>	(0.00, 0.00, 0.25, 0.69, 0.06)			
	<b>KPI-P5</b>	<b>0.194</b>	(0.00, 0.00, 0.31, 0.50, 0.19)			
<b>Identifications</b>	<b>KPI-O1</b>	<b>0.338</b>	(0.00, 0.00, 0.19, 0.68, 0.13)	(0.00, 0.00, 0.21, 0.65, 0.15)	<b>0.214</b>	
	<b>KPI-O2</b>	<b>0.338</b>	(0.00, 0.00, 0.00, 0.75, 0.25)			
	<b>KPI-O9</b>	<b>0.323</b>	(0.00, 0.00, 0.44, 0.50, 0.06)			
<b>Improvements</b>	<b>KPI-O6</b>	<b>0.334</b>	(0.00, 0.13, 0.63, 0.24, 0.00)	(0.00, 0.04, 0.31, 0.58, 0.06)	<b>0.208</b>	
	<b>KPI-O7</b>	<b>0.334</b>	(0.00, 0.00, 0.25, 0.62, 0.13)			
	<b>KPI-O8</b>	<b>0.331</b>	(0.00, 0.00, 0.06, 0.88, 0.06)			
<b>Satisfactions</b>	<b>KPI-O3</b>	<b>0.336</b>	(0.00, 0.00, 0.00, 0.31, 0.69)	(0.00, 0.00, 0.10, 0.56, 0.37)	<b>0.211</b>	
	<b>KPI-O4</b>	<b>0.333</b>	(0.00, 0.00, 0.06, 0.75, 0.19)			
	<b>KPI-O5</b>	<b>0.332</b>	(0.00, 0.00, 0.25, 0.62, 0.13)			

**Table 7.19 Overall performance scores**

<b>Project</b>	<b>Category of building</b>	<b>Membership function of level 1</b>	<b>Score</b>	<b>Rank</b>
<b>P1</b>	Academic	(0.00, 0.03, 0.24, 0.57, 0.16)	3.86	3
<b>P2</b>	Commercial	(0.01, 0.04, 0.26, 0.47, 0.22)	3.86	3
<b>P3</b>	Healthcare	(0.00, 0.01, 0.34, 0.56, 0.09)	3.74	5
<b>P4</b>	Sports and Recreational	(0.00, 0.00, 0.11, 0.49, 0.40)	4.29	1
<b>P5</b>	Industrial	(0.00, 0.01, 0.24, 0.56, 0.19)	3.94	2

## 7.8 Qualitative Findings on Workshops' Performance

### 7.8.1 Profiles of the Interviewees

In ensuring that the respondents from the interviews are not biased, four participants from different categories of stakeholders were approached and invited for the interviews. Views from four different perspectives based on the organization they represent provided some check and balance on the overall findings. It may also enlighten the reasons behind any related findings.

Factors such as active participation in the workshop and credibility to represent their organization were considered during the selection of the interviewees. Background information of the interviewees is detailed in the following tables (Table 7.20 – 7.24):

**Table 7.20 Profiles of the interviewees for P1**

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4
Code	P1-A	P1-B	P1-C	P1-D
<b>Category of Stakeholder</b>	Client	End-user	Implementing Agency	Lead facilitator
<b>Position</b>	Under Secretary (M44)	Head of Department (DH 54)	Principle Asst. Director (J48)	Deputy Director (J54)
<b>Academic</b>	Diploma, Bachelor	Diploma, Bachelor, Master	Diploma, Bachelor	Diploma, Bachelor, Master
<b>Experience</b>	< 5 years	< 5 years	> 20 years	> 20 years
<b>Previous workshop(s)</b>	< 5 workshops	< 5 workshops	> 20 workshops	> 20 workshops

**Table 7.21 Profiles of the interviewees for P2**

	<b>Interviewee 1</b>	<b>Interviewee 2</b>	<b>Interviewee 3</b>	<b>Interviewee 4</b>
<b>Code</b>	P2-A	P2-B	P2-C	P2-D
<b>Category of Stakeholder</b>	Client	Implementing Agency	Consultant	Facilitator
<b>Position</b>	Principle Asst. Director (M48)	Principle Asst. Director (J48)	Managing Director	Deputy Director (J54)
<b>Academic</b>	Diploma, Bachelor	Diploma, Bachelor	Bachelor, Master, PhD	Diploma, Bachelor
<b>Experience</b>	5 - 10 years	16 - 20 years	> 20 years	> 20 years
<b>Previous workshop(s)</b>	< 5 workshops	< 5 workshops	< 5 workshops	> 20 workshops

**Table 7.22 Profiles of the interviewees for P3**

	<b>Interviewee 1</b>	<b>Interviewee 2</b>	<b>Interviewee 3</b>	<b>Interviewee 4</b>
<b>Code</b>	P3-A	P3-B	P3-C	P3-D
<b>Category of Stakeholder</b>	Client	Implementing Agency	Consultant	Facilitator
<b>Position</b>	Senior Principal Asst. Director (UD54)	Asst. Director (J41)	Design Architect	Principle Asst. Director (J52)
<b>Academic</b>	Bachelor, Master	Diploma, Bachelor	Bachelor	Diploma, Bachelor
<b>Experience</b>	5 - 10 years	5 - 10 years	5 - 10 years	16 - 20 years
<b>Previous workshop(s)</b>	< 5 workshops	< 5 workshops	< 5 workshops	> 20 workshops

**Table 7.23 Profiles of the interviewees for P4**

	<b>Interviewee 1</b>	<b>Interviewee 2</b>	<b>Interviewee 3</b>	<b>Interviewee 4</b>
<b>Code</b>	P4-A	P4-B	P4-C	P4-D
<b>Category of Stakeholder</b>	Client	Implementing Agency	Implementing Agency	Lead facilitator
<b>Position</b>	Principle Asst. Secretary (M48)	Principle Asst. Director (J48)	Principle Asst. Director (J52)	Deputy Director (J54)
<b>Academic</b>	Diploma, Bachelor	Diploma, Bachelor, Master,	Bachelor, Master, PhD	Diploma, Bachelor, Master
<b>Experience</b>	< 5 years	> 20 years	16 - 20 years	> 20 years
<b>Previous workshop(s)</b>	< 5 workshops	< 5 workshops	< 5 workshops	> 20 workshops

**Table 7.24 Profiles of the interviewees for P5**

	<b>Interviewee 1</b>	<b>Interviewee 2</b>	<b>Interviewee 3</b>	<b>Interviewee 4</b>
<b>Code</b>	P5-A	P5-B	P5-C	P5-D
<b>Category of Stakeholder</b>	Client	Client	Consultant	Facilitator
<b>Position</b>	Business Manager	Electrical Engineer	Quantity Surveyor	Assist. Director (J44)
<b>Academic</b>	Bachelor, Master	Diploma, Bachelor	Diploma, Bachelor, Master	Diploma, Bachelor
<b>Experience</b>	5 - 10 years	11 - 15 years	11 - 15 years	5 - 10 years
<b>Previous workshop(s)</b>	< 5 workshops	< 5 workshops	< 5 workshops	> 20 workshops

Overall, 100% of the respondents possessed a minimum qualification of an undergraduate degree, of which a significant number possessed a postgraduate degree (45% with Master's degree and 15% with Ph.D. degree). In term of industrial experience in the construction industry, 15% had less than five years, 30% had between 5-10years, 10% had 11-15 years, 15% had 16-20 years, and another 30% had more than 20 years of experience working in the industry.

As VM has recently been introduced into the public project implementation process, it is also important to identify respondent's experience in any VM workshops. As predicted, the interviewees fall into only two categories. All the facilitators have experience participating in more than 20 workshops while the other entities have participated in less than five workshops, except one of them who used to be the facilitators in EPU. The scenario has clearly shown the considerably low level of applications of VM within a Malaysian context.

### **7.8.2 Interviewees Feedback on the Workshops' Performance**

#### **i) Educational Building (P1)**

P1's workshop tied with P2's workshop at 3.86. KPI-P3 for P1 achieved the minimum mean at 3.65. The score is in line with the opinion of the interviewees that the room layout affected interaction among the participants. Moreover, one of the groups was moved to an adjacent room in order to provide more space for group discussions during the *creativity* phase.

It is very likely that these problems had an impact on outputs' indicator KPI-O8 that had a score of 3.71. It is claimed that the workshop should enable participants to interact and thereby improve communications (Shen and Liu, 2003; Lin and Shen, 2007), but a lack of interaction during this workshop hindered the process. Indicator

KPI-O3 also scored 3.71, which suggests that the participants were of the view that the client was not satisfied with the outputs as there was a deviation in the hostel capacity. Although the workshop acknowledged the potential problem of students' not being able to find accommodation in the surrounding area because it had not yet been developed, the capacity of the student hostel was still reduced in order to minimize the construction cost.

According to interviewee P1-C and P1-D, the organizer has been informed that the workshop requires a bigger room that can cater to the whole team. In addition, the room needed to be able to cater to group discussion when the participants were being split into smaller groups during the latter part of the workshop. However, due to the unavailability of a suitable room, P1-A admitted that the workshop was conducted in a meeting room with formal meeting table layout. As a consequence, one of the groups was required to move to another room during the group discussion.

P1-D added that the venue could play a vital role and give impact to the progress and outputs of the workshop. The best arrangement requested by the facilitators was one big room that could accommodate the separation of the participants into three or four smaller group. Each group requires a computer, overhead projector, notice board, and stationaries when it is deemed necessary for group discussion.

The weaknesses and problems during the workshop process have impact on the outputs indicator (KPIO-8) at 3.71. The participants believed that the workshop should have enabled them to improve communication more, provided that they have communicated well throughout the workshop.

In term of outputs, it seems that the client was satisfied with the overall implementation of the workshop. However, there were things related to the outputs

that slightly deviate from the original intention. According to P1-A, the hostel capacity was reduced in order to meet the approved budget. Even though the client foresees a potential problem regarding students' accommodation, these are among others things that need to be sacrificed to ensure that this project can proceed.

As the client representative, P1-A expressed her gratitude for successful completion of the workshop. She believed that the workshop helped the client to achieve the target of operating this campus by 2016. The establishment of the action plan provided some guidance through several key milestones for implementation and monitoring. However, she wishes that the participants were more prepared with the information to ease the group discussion and decision-making. The discussion for the whole workshop was mainly based on the master plan provided by the architect with minimal input and creativity thrown into the proposal. She felt that her experience in this VM workshop provides a good experience in organizing future VM workshops, in particular to improve the logistic aspect of the workshop.

From the perspective of end users, P1-B expressed his gratitude with the introduction of VM into the public projects. He has learned a lot from this experience where VM has opened his mind to look from a different perspective when it comes to project development in the future. He added further that VM provided a new way of thinking to find the best alternative in gaining maximum benefit by maximizing the function of the facilities provided in the project. The approach was very effective compared to the conventional approach whereby the stakeholders attended a series of meetings and had less focus. The way the VM workshops are conducted according to the VM job plan enables better control and saves a lot of time.

He believed that engagement with the end users enables the project team to understand the end user's requirement to ensure that the project fits its purpose. With the overall aim to optimize the value, the end user's input is important to ensure that the building will function well during the operation stage. For instance, input on the different rooms' layout is critical as the design team may not be able to interpret the needs statement very well from an operational perspective.

VM has enabled the project team to get to know each other better. Relationship building and networking is important as they will be working together as a team during the course of the project implementation, which could last for years. Apart from the formal discussion during the workshop process, the participants interacted with each other during the tea break and during meals as well. The social interactions as such allowed the participants to get to know each other better.

On the other hand, P1-B found that the workshop's lack of visual information hindered them to make a better decision. He believed that visual information such as the drawings or sketches enables the group to understand and decide better together. As the end users, he can contribute input to ensure the effectiveness of the design and layout that is suitable for the operational of the facilities. The involvement of the end users is the beauty that VM offers compared to the conventional approach. In the conventional approach, the end users were not given many opportunities to express their concerns and contributed their ideas for the betterment of the project.

P1-C's main concern, on the other hand, was about the facilitation provided by the VM facilitator, especially regarding handling strong characters that were present in the workshop. The communication problems due to the dominant participant during the workshop implementation tarnished the overall workshop environment.

P1-C also observed that the participants among the design team did not contribute to the maximum. Some of them may think that they have done their job by throwing one or two ideas and decided just to sit back and relax. Perhaps this problem is closely related to the facilitation provided by the facilitators. She thinks that the facilitators should have managed the workshop better, in particular in dealing with strong characters that appeared during the workshop. Hence, the facilitators should come well equipped with the required competency skills. Through random conversation, it was discovered that some facilitators have never been to any formal VM training, and a majority of the facilitators were not equipped with soft skills training. By having the required skills, the facilitators will be able to attract and engage the participants better. Without these skills, it appears that the facilitators acted like a dictator. That created a not so harmonic environment, and the participants did not enjoy participating in the process.

Another aspect of her concern was in the *function analysis* phase. The fact that the workshop was driven by the objective to reduce the cost below MYR 150 mil resulted in a minimum of innovative ideas for improving the project's value. It is interesting to do something when you don't know the cost. However, the present approach is where the team is responsible for ensuring that the estimated cost as the outputs of the VM workshop is lower or equivalent to the approved budget.

In deliberating her feedback toward the performance of the workshop, P1-D was happy with the overall implementation and the outputs of the workshop. In particular, she believed that VM will help this project move forward despite implementation being prolonged since 2008. The development of an action plan that has been agreed

by all participants formed as part of the workshop report as a proof of commitment by all stakeholders in ensuring that the project will be completed as scheduled.

However, there are several matters of her concern in relation to this workshop that could have been improved for better performance in future workshops. First and foremost, just like other interviewees, P1-D was disappointed with the venue of the workshop. She wishes that the venue would be a bigger room where the team can be stationed in one place for the team discussion or presentation as well as for a small group discussion. She elaborated further that by having more than one room, there are possibilities where the participants will skip out in the process as if they went to the other room.

The facilitators also needed to handle a strong character among the participants. Obviously during this workshop, one of the participants was dominating the discussion to safeguard the proposed master plan and the overall concept design. According to P1-D, when dealing with such a character, what is the most important thing is not to go against them. A more diplomatic approach is required that engages all participants to think of the best option or solution for the project.

It was also disappointing to P1-D when the participants were not provided with details and information about the design and costing, even though, the project was first initiated in 2008. Moreover, the participants should also be able to respond immediately during the workshop into any queries from the other participants. The example of having information on hand P1-D referred to, for example, included the revised master plan and design as well as the cost implication of any options that is being considered.

In terms of interaction among the participants, P1-D observed that only a maximum of 50% of the participants actively participated during the workshop. Participation and interaction among the participants are crucial to ensure that the information is being shared, and the risk of having too many assumptions is reduced. VM by definition also emphasized a multidisciplinary approach where experts from various discipline are working together and complementing each other when necessary.

## **ii) Commercial Building (P2)**

P2's workshop tied with P1's workshop at 3.86. In particular for P2's workshop, the end-user related indicators achieved the lowest scores (KPI-P2 at 3.30, KPI-O1 at 3.78, and KPI-O5 at 3.87), although the end users did participate in the workshop. The interviewees expressed the view that the workshop was not able to clarify the end user's requirements, and hence were unable to translate the requirements into outputs. The survey also revealed that the end users had inadequate knowledge and experience of the technical aspects of construction and building operations, as well as knowing very little about public project implementation and procedures.

As the individual that is responsible for project execution, P2-B expressed his disappointment with the end users and the consultants. He was disappointed that the end users were not trying to understand the constraints faced by the project team. Meanwhile, the consultants were not able to present critical information to support the decision-making process. Furthermore, some of the consultants were not represented by credentialed representatives. P2-B was supported by P2-D by responding that the participants of the workshop should be aware and prepare adequately prior attending to the workshop in order to contribute constructively. They should equip themselves with information regarding site condition, design requirements as well as the local

authority requirements to speed up the discussion and the decision-making process during the workshop. On a serious note, P2-C also agreed that that the consultants were not ready to embark in VM. However, it seems that P2-C had the wrong perception towards VM as she argued that what has been done during the workshop was merely a cost cutting exercise.

In overall, P2-A agreed that VM is a good management tool to ensure effective project implementation. What she liked the most was that the workshop enabled the project team to deliberate all constraints, uncertainties, and problems that were construed to be a risk to the project. The action plan is good in the sense that it summarizes the necessary and critical action to be taken by all relevant stakeholders. Having said that, she believed that the action plan needs to be backing with close monitoring on the ground.

With regards to the end users participation in this workshop, P2-A thought that they needed to be informed well on how decisions during the VM workshop would give impact on the progress of the project. Despite having the briefing session at the beginning of the workshop, it seems that it was not effective especially for the end users who were not equipped with technical knowledge and regarding public project implementation procedures. P2-A added that the end users were still requesting changes after the completion of the workshop despite that being impossible since everything was already agreed to all by participants during the workshop.

P2-A was also concerned that the participants who have no technical knowledge were having difficulties in understanding various technical terms. Perhaps the facilitators need to put more attention to this group of participants in the future to ensure that this particular group of participants will not lose interest in participating and contributing.

The participation of all participants is crucial as to safeguard that all assumptions are made at the early stage of the workshop. Often, matters related to the site condition and requirements by the local authority need to be confirmed by the relevant representatives who participated in the workshop.

In relation to the facilitation, P2-A thought that the facilitators should improve their facilitation skills. During these few years of VM implementation in Malaysia, the facilitators probably need to put extra effort in engaging the participants and managing the whole workshop as the majority of the other participants have no previous experience in VM. Close monitoring is important to avoid misconceptions and mistakes in performing any of the activities during the workshop.

Though the workshop achieved its objective, P2-B was not totally happy with the approach on how the SOA of this project was prepared and finally computed as the estimated cost. The SOA for this project was developed simply by multiplying the number of units with the area per unit with allocation for common areas, services and ventilation. However, he concurred that the final design and construction may not be able to meet exactly what was planned.

P2-B's view was that the participants representing various stakeholders should always be present during the workshop process to help the workshop to make any decision. All stakeholders must also be committed to electing appropriate representatives equipped with both technical knowledge and experience and taken preferably from among the senior management team that can make a decision without seeking further approval from their respective management. Without any expert's opinions and the inability to advise will delay the decision-making process that is crucial during the workshop. In terms of the facilitation, P2-B regrets that the facilitators didn't show

their openness in facilitating the workshop by trying to make a decision on behalf of the other participants. Probably it has something to do with how they conveyed that message. It involves soft skills to handle such situations and requires practice and experience. He hoped that in time, the facilitators will gain more experience and improve their facilitation skills.

P2-D, as one of the facilitators in the workshop, believes that the workshop has fulfilled the objectives and met most of the requirements of both the client and the end users. He was pleased to see the commitment showed by the top management of the client organization that actively participated throughout the workshop. This is not the usual case in other workshops. The remaining requirements that were not addressed in this project was justified and accepted by the participants. The workshop provided a better platform for all stakeholders, especially the end users to express their views and concerns about the project.

The development of the action plan as part of the workshop's report has taken into consideration all possible risks and identified a specific duration and date for each task to be completed. One of the important milestones identified in the action plan was relocation matters. As this project involved the relocation of the existing traders, a temporary relocation is required while the construction work takes place. The workshop identified that this matter was not properly taken care at that point and may jeopardise the overall planning of the project. First and foremost, the relevant stakeholders have to identify a temporary relocation place with the agreement by all traders, with associated cost related to the relocation. The workshop managed to bring up this issue and enlighten all participants that this is a big issue that requires attention and assistance.

P2-D was also not happy with the participation and commitment of some of the participants. It was clear that they were not prepared for the workshop. Some of their assumptions were unreliable and without any supporting documents to justify their positions. The reliability of the assumptions is crucial because, by the end of the workshop, it is expected that all the assumptions made before the workshop are facts and correct information about the project. Therefore, P2-D stressed the importance of a pre-workshop meeting and a checklist to check the readiness of the information prior to the workshop implementation.

**iv) Healthcare Building (P3)**

P3's workshop had one of the lowest scores of 3.74. The fact that the project's estimated cost was higher than the cost produced by one of the workshop's outputs had a significant impact on the overall performance score. It was observed that the participants struggled to identify the best options for reducing cost while maintaining the functions of the hospital. The end users appeared to be very disappointed with the tremendous reduction of the project's scope. To add to the negativity, commitment from the client's top management during the workshop was minimal. There were times when the workshop was not able to proceed because none of the clients' representatives were willing to make a decision. Based on feedback from the interviewees, the client representatives had either not been delegated the necessary power to make decisions or they were avoiding the risk of making decisions.

According to P3-A, effort went into making the workshop a reality. However, it was sad that after spending five days in the workshop, the final estimated cost was not accepted by the EPU. During the workshop process, the participants were struggling to come up with the best options and alternatives in optimizing the cost yet maintain

the function of the hospital. The end users were very disappointed with the tremendous reduction on the project's scope.

From the perspective of the facilitator, P3-D was disappointed with the negative attitude of the end users' representative. It seems to him that the end users were rigid and were not trying to understand the constraints and aspirations of the workshop. He believed that every stakeholder wanted to make sure that this project will proceed this time around. He also slammed the participants for being too much depending on the facilitators for going through the process instead of being more active contributors. However, P3-B and P3-C disagreed with P3-D. To them, as VM is relatively new to the industry in Malaysia, the participants required more facilitation and guidance in performing all activities during the workshop. The facilitators should have played active roles to stimulate a positive environment throughout the workshop.

Other than that, the commitment from the top management of the client organization was very minimal during the workshop. At the time, the workshop was not able to proceed due to waiting for the decision taker forms the client organization. Their representatives were either not delegated the power to make decisions or else they did not want to take the risk of making a decision.

As a client, P3-A considered VM important for highlighting what the client and the end users will get as the final product of the project. She believed that the way VM philosophy was built is very good and well supported with the issuance of the guideline for practices in public project implementation. Based on her experience in previous workshops, the workshop's reports are very useful in the later stage of the project. With all the detailing and appendices, the project team can always make a

cross reference to the decision made during the workshop. It will be useful to the other stakeholders to have a copy of the report as well.

However, she admitted that the client did not provide optimum support during this workshop because they were missing decision makers from top management. The decision maker being present is important when dealing with the end users who may want to request everything to be incorporated in this project without realizing that there is a cost limitation. However, the end users are not to be blamed as the workshop provides the room for them to participate and to give their opinions.

After being involved in two VM workshops, P3-A realized and felt that they have to conduct the VM workshop to determine the estimated cost, rather than the current practice where the VM is conducted after the estimated cost is determined. She believed that the current practice is not purely a cost cutting exercise. What has been done during the workshop is a creative approach to putting the functions together. For instance, the previous workshop leads the design team to creatively design the staff facilities to be shared instead of being provided in each and every medical ward. However, the hospital's components are not tolerable to ensure its functionality. She believed that the workshop can explore how those components can be integrated or reduced without risking the effective operation of the hospital.

P3-B also has previous experience in the VM workshops. From his experience, VM enables the project team to follow through the overall project planning and scheduling. In term of the issue of participation in the VM workshop, he regrets that the representatives from several governmental departments and the local authority were unable to participate. Even though the project team has visited the site, there are matters that arise during the discussion that requires feedback and decision from those

agencies. Perhaps, the representative could have advised the workshop of other options to deal with the problems.

P3-B also observed that there was a lack of participation by the client representative. There were quite a number of client representatives who attended the workshop. However, they were among the lower and middle management team that was either afraid to make a decision or not delegated with the power to do so. It is well understood that if the top management were not able to commit to the whole workshop's duration, it is crucial for them to make themselves available from time to time to provide some direction, opinion, suggestion or to make a necessary decision to enable the workshop to proceed further. At the same time, the end users seemed to be very ambitious in requesting more than is required for that hospital to be functioning as a district hospital. They should have been made aware of the project's givens and constraints that were discussed during the information phase to tally with the allocation approved for this project.

In term of the facilitation, P3-B was looking forward to a better environment provided by the facilitators. What he experienced during the workshop was disappointing when some the facilitators step in the beginning, giving instructions, but later not keeping in touch with the participants. The facilitators will drop by in the end and expecting the group to progress and achieve the workshop objectives. At the time, it appears that the quantity surveyor from the implementing agency and the consultants were taking the lead by monitoring the cost implications of suggestions so as to check if revisions to estimated cost remained lower than the approved budget. P3-B also agreed that the facilitators require more facilitation skills in how to lead and facilitate a workshop to

achieve its objectives. It is more like a join-effort rather than the sole responsibility of the participants to accomplish the objectives.

Overall, P3-B believes that both the client and the end users were not happy with the workshop's outputs. The project was not being able to move to the next stage because the estimated cost after the workshop still exceeded the allocated budget. The end users certainly were not happy as there were plenty of the components and items that they requested that were not considered a priority for the district hospital at this time due to the tight budget.

For the sake of improvement, P3-B hopes that the client would be stricter in enforcing the participation by the stakeholders of the project. In particular where the project involved private consultants, the principle should have attended the workshop to speed up the decision-making process due to their experience and capacity in doing so.

Representing the private consultant in the workshop, P3-C expressed his disappointment in terms of how the workshop progressed, particularly during the *information* phase. However, things were gradually getting better later in the third day until the completion of the workshop. He can see that the team has put effort toward realizing this workshop and this project. He argued that most of the matters discussed during the *information* phase should have been firmed and agreed to prior to the workshop implementation. It was disappointing when the funder, the clients, and the end users were in disagreement to some of the facts and information presented. He agreed that some of the information is crucial in providing guidance for decision-making during the workshop process. However, he felt that too much time was spent on arguments that deviated from the focus of the workshop in achieving its objectives.

It was disappointing that there was a lack of commitment to the workshop from the top management of the client organization in providing direction and necessary decision-making capacity. It's true that there were representatives from the client organization, but the question is, were they able to commit themselves and be present at all times. What happened during the workshop was none of the client representatives were able to make a decision right away. So the workshop was stuck due to the absent of the decision makers.

He also observed that most of the consultant's' representatives were reluctant to speak up and go against the client when it came to big matters with huge implications for the project. They were reluctant to speak due to the nature of the relationship where the consultants were appointed by the client. So, the consultants would like to maintain a good relationship with the client for the sake of future business opportunities. It seems to him that the consultants, as the workshop participants were given opportunity and freedom to speak up, but somehow did not.

P3-C also suggested that the facilitators should have recorded the whole workshop. The recording will enable them to assess the overall workshop process as well as how the participants and the facilitators themselves performed. The facilitators may have conducted a series of workshops, but probably no one informed them what was going right and what going wrong with their facilitation and workshop implementation. They probably have not received any feedback or comments as there was no feedback form distributed to the participants at the end of the workshop.

From a technical perspective, P3-C concurred that this workshop was conducted at the very initial stage of the project development. As such, there were plenty of matters that were given weighted assumptions. For instance, the master plan of the project

was not yet finalised and the approach taken at that time was to minimise the building footprint in order to directly reduce the cost for earthworks. Later, this will affect the cost for infrastructure and ancillary works. So some of the information was based on the speculation and assumptions that could have changed in a minute and impact the overall project cost.

In summary, P3-C regrets to admit that he believed that the workshop for this project has gone a bit too far up to the extent of revising medical equipment to reduce the cost. What is important for the client is to revisit the objective of building this hospital and determining the required function as the district hospital in order for the project team to identify the necessary scope of the project within the allocated budget. From the perspective of the consultants, they understand the client's need and requirements, but again the big hassle is the cost. The consultants have prepared the proposal based on the needs statements, and the estimated cost was exceeding the allocated budget.

In the future workshops, P3-C hoped to see improvement in terms of facilitation skill among the facilitators. In addition, they should also make themselves prepared with basic information about the project to avoid unnecessary discussion and possible argument during the *information* phase that otherwise wasted the time allocated for other phases of the workshop. The client, with the help from the facilitators, should have assessed the readiness level of each project before proceeding into organizing the VM workshop. The workshop should have found the best options on how to fill the templates, especially those that can be prepared ahead of the workshop.

P3-D as the facilitator was satisfied with the outputs of the workshop, even though, the objectives were not totally achieved. To him, the workshop managed to enlighten the client that the estimated cost of MYR 120 mil is no longer reliable for the 76-bed

hospital to be fully functioning. There is an urgent need for the client to review their estimate before applying the budget from the government for the upcoming development plans.

Even though the project needs to go through another round of the workshop, the outputs from this workshop has significantly acted as an eye opener to all participants. The workshop managed to identify a more accurate estimate for the contribution fees to the service providers. Surprisingly, the difference was significant: an additional 50% over the original estimated cost. Without having the workshop, certainly this project would have experienced serious problems during construction and completion. Through the discussion of the preliminary concept design by the architect, the workshop managed to gather critical feedback form the client and the end users on the design of the roof. According to the client, they were facing problems with the roof maintenance work to the existing hospitals, where there were no access points provided to the root top for the contractors to carry out maintenance works. The implication would be higher maintenance costs are required for the hospital's operational cost. Such interaction during the workshop managed to prevent the same mistake repeating itself.

There were also certain aspects of weaknesses of the workshop. At the beginning of the workshop, P3-D reminded the participants that they need to think creatively and innovatively to have this project go through with the allocated budget. It was disappointing when the decision makers were not present most of the time when the workshop was carried out. Not only the client as the project owner, some other representatives from the service providers were also not present to confirm those assumptions made for the project and unable to advise the workshop on the best way

forward. Despite having some proof of letter of communication, for example on the issues of the access road to the hospital, it was a one-way communication which did not enable the group to discuss possible alternatives to the project.

It was also found that the proposed design was not prepared in accordance with the EPU guidelines. The guidelines provide information on the allowable floor area based on the function of the space and the entitlement of the end users. For example, the provision of the guidelines is that any meeting room with capacities less than 25 persons is not entitled to an audio conference system. However, the consultant incorporated such facilities into the design. This is an example of how the project team can be more responsible and follow through with the guidelines so that the workshop is not required to revisit such matters again. All stakeholders should go back to the basic question and ask themselves whether it is something they need, or they want.

In conclusion, despite not achieving the workshop objectives, P3-D was happy that the workshop managed to highlight the issue of cost to the client. It is clear that there is a need to revise their cost estimate with the current market prices of construction material and labours. He further added that it is no longer possible to use the estimated cost prepared in 2007 for a project in 2013, in which the construction may begin in the next two years or so.

#### **vi) Sport & Recreational Building (P4)**

P4's workshop ranked at the top with an overall score of 4.28. All interviewees supported the observation that the overall workshop processes went smoothly and without major issues. Yet, KPI-O3 obtained the lowest score at 3.67. Perhaps most of the participants thought that the architect's impression of the velodrome is impossible

to achieve after changes were made during the workshop. Having said that, the changes made to the proposal managed to retain the functions of the velodrome as well as adhere to the requirements.

The interviews revealed that the client had a negative perception of VM by assuming that it is just another red-tape exercise that may cause a delay to the project. Later, the client realized that VM is very useful for optimizing the project's value. The workshop also managed to bring major stakeholders together for face-to-face discussions rather than via phone calls, emails, and letters.

From the interviews, it was clear that the client's intention was to have the velodrome comply with the requirements of the UCI. P4-A added that at the ministry, the objectives for having this velodrome is very clear, namely Malaysia becoming an international destination for and contributor to this sport. However, P4-B wishes that the client should have done something extraordinary to mark this velodrome as another national landmark. It was so disappointing to her when the reduction of cost throughout the workshop was not given back to enhance some of the elements and components of the project. For instance, allocation for the seating bench could have been increased to provide more comfortable seats for the spectators.

This workshop was the first ever VM application for the project under this ministry. According to P4-A, the ministry was a bit reluctant to undergo VM due to the perception that VM will be another red-tape exercise that may cause a delay in the overall project planning. Eventually, the perception turned very positive, and ministry representatives realized that VM is important and useful to maximize the value from the allocation provided for this project. He also believed that there would be more

improvement if the participants were given more time and received support from all stakeholders of the project.

Having said that, the workshop managed to bring all major stakeholders to get involved through discussion and exchange of ideas among participants with various backgrounds and expertise. Without VM, he believed that it is not easy even for the PWD representatives to meet each other physically due to the dispersed location of their offices. So the workshop provided a platform for the stakeholders to have face-to-face discussions rather than rely just on communication through phone calls, emails and letters.

However, the participants were informed at the beginning of the workshop that the main task was to improve the value and to reduce the cost to be below the total allocation approved. Hence, the focus of the discussion during the workshop was tailored towards cutting any unnecessary costs. Apart from that, the workshop also tried to look into the possibility of increasing the efficiency of the design, layout, and the equipment to be installed in the velodrome. P4-A realized that the workshop involved by the implementers, mainly among those who managed the project at the operational level without the presence of the decision makers from the top management of the client organization. The top management will certainly have the final say on the project's matter.

Due to the budget constraint, the client accepted the fact that the final product later on will not be lavish and fancy, but still meet the function to achieve the project's objectives. Most importantly, the requirements of UCI have been given priority and do not ensure that the velodrome meets the requirement of classification to host international championships.

In the future workshops, P4-A is looking forward to getting more involvement and participation from the right representatives from all stakeholders. The best representatives would be among those who involved totally with the project and able to make decisions on behalf of their organization.

This workshop was not the first involvement of P4-B in a VM workshop. She has been involved in several other workshops in the past. She believes that the success of VM depends on the whole team getting involved in the workshop. P4-B observed that the client was a bit lost during first two days. However, with strong support from the facilitators and other experienced participants, the workshop ran smoothly until the end. She also observed that everyone was given the opportunity and freedom to speak and contribute to the workshop's objectives. It is simply a matter whether the participants want to grab and make use of the opportunity to do so. But, in general, the interactions were good, and this enabled the workshop to attain its objectives.

She has the view that VM expedited the process compared to the traditional project management approach, especially during the pre-construction stage. The traditional approach is where the stakeholders tend to work in silos and at the risk of misinterpretation. Moreover, communications via emails or telephone are not as effective as face-to-face discussion.

P4-C also welcomes the introduction of VM into public projects in Malaysia. However, it seems that there are problems in terms of how VM is implemented. For instance in this workshop, P4-C was disappointed when the workshop turned the original proposal into something totally different, despite maintaining the main basic functions. On the other hands, she agreed that VM is beneficial as a tool to control the problems of overdesign on both architectural and structural elements.

In terms of the participation, P4-C was glad that the end users' representatives were actively participating in the discussion. They were well experienced and had clear understanding of the requirements of the velodrome. Hence, their input during the workshop process were useful to enable the other stakeholders to make any recommendations, suggestions, and ultimately to make any decision. Since one of the objectives was to reduce the estimated cost, the final outputs of the workshop does help P3-C in revising the estimated cost for a formal cost estimate for the submission.

However, P3-C was a bit disappointed with the client representatives as they seemed trying to not minimize the impact of the original proposal. It was frustrating because the proposed design was an outcome of a design competition and series of design consultations among the design team. She also agrees that the facilitators require necessary skills to run the VM workshop. What is important in VM facilitation is to facilitate the process to avoid misrepresentation of VM as cost cutting exercise. She also thinks that the facilitators have dominated the discussion by directing the discussion towards reducing the cost to the maximum.

Having said that, P3-C believed that every stakeholder have their weaknesses in this workshop. Firstly, the client seemed to not take this project and VM seriously. Secondly, PWD as the implementing agency was not equipped with the right information on the project. Moreover, it was disappointing when certain units did not send appropriate representatives to participate in the workshop.

To P4-D, the beauty of VM is when the workshop managed to bring all stakeholders in the same forum. He believes that prior to the workshop, some of the stakeholders may not be so sure of certain things. As the lead facilitator, he admitted that this was among the better workshops that he has ever facilitated. He also received feedback

from quite a number of participants highlighting that this workshop has provided them with a better understanding of VM methodology as well as better understanding of the project. The workshop also managed to make the client and design team realize that with such an amount of money allocated for this project, they have achieved the maximum in line with the objective to marry the project's scope with the project's cost.

In summary, P4-D was happy that the client appreciates the efforts by all participants throughout the workshop where the team managed to give the project proper perspective, sizing, and direction. During the information phase, the workshop enables the EPU as well as the other stakeholders to query on the project's objectives. The clarification is important because it does happen that the other stakeholders have a different understanding on the project. The possible risk would be the projects were designed and constructed but in the end not functioning or not addressing the objectives and KPIs of the ministry. With the cooperation and participation by all stakeholders, the VM workshop managed to streamline the objectives of the project, as well as meet the requirements of both the client and the end users.

One of the major achievements of this workshop was highlighting major issues related to the parking facilities and the status of the adjacent land to the proposed site. These are the major issues that require an immediate action by the client to enable the project to proceed to the next stage, upon receiving approval from the EPU. The action plan clearly indicated key milestones for the attention and action by relevant stakeholders.

Having said that, P4-D had some reservation since the outputs of the workshop was translated into the VM report, which is subject to buy in from key stakeholders.

Typically, VM reports are jointly signed by the EPU, the client, the end users, and the implementing agency. Hence, as far as the workshop outputs itself are concerned, he believes that the workshop managed to attain its objectives to marry the scope and the cost.

However, there were a few things that perhaps need improvement in the future to improve the efficiency and effectiveness of the workshop's processes and outputs. Firstly, time management is crucial. He wishes that all participants would be more responsible for attending the workshop according to the timetable. There were also situations where some of the participants needed to skip the workshop to attend another meeting or other obligation. As a group decision approach, sometimes the workshop was unable to proceed when there were not enough participants to make a quorum. It is even worse when the participant missed the discussion of certain processes and forced the whole team to reverse and discuss it again to enable decision-making. This delayed the whole process and was very frustrating to those who committed themselves throughout the workshop. As to the facilitators, he was also concerned that failure to control the time in a certain phase may force the workshop to speed up the following phase that may risk of leaving out something important.

#### **v) Industrial Building (P5)**

P5's workshop ranked second with a score of 3.94. This was the second workshop of the project and as such ran quite smoothly because the participants had a better understanding of the project and the workshop processes. However, KPI-P2 achieved the lowest score of 3.77. The end users were not represented at the workshop so that interaction between them and the other stakeholders did not occur. Instead, the

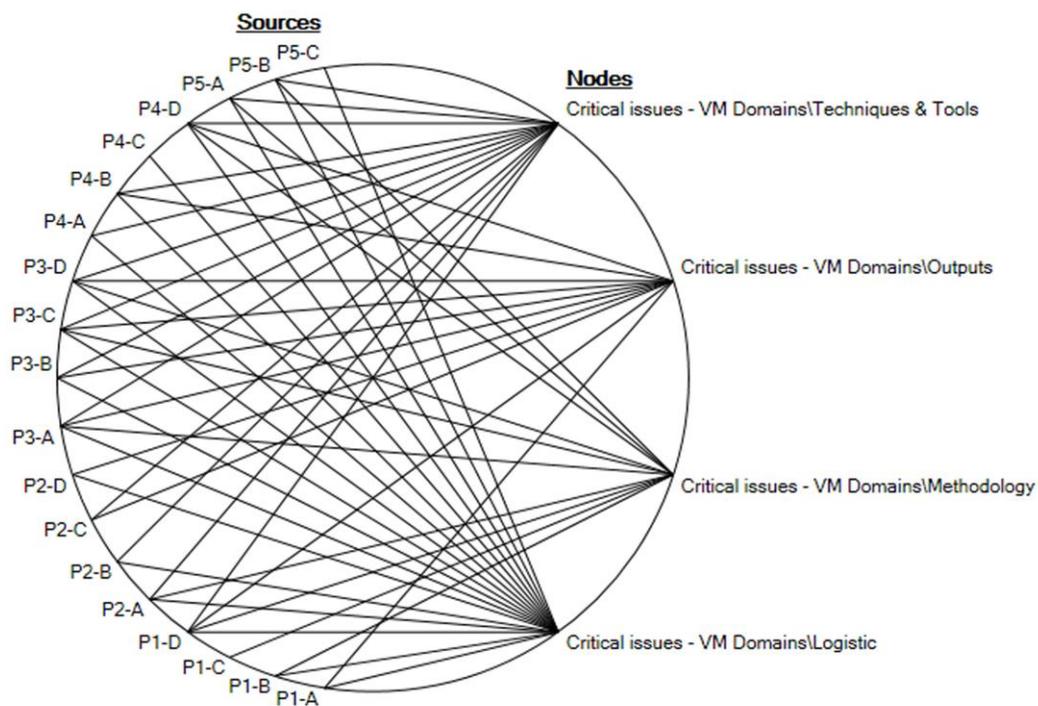
workshop was informed that the client had conducted a market survey to identify the end-user's requirements. On the other hand, KPI-O4 scored even lower at 3.13. This very low score possibly suggests that the participants believed that the outputs of the workshop have a minimum impact on the project since the local authority had already approved the building plan.

P5-B admits that there were weaknesses in the client organisation where the unit that was responsible for project development did not complete enough preparation and thorough study before proceeding with the proposal. She also wishes that the local authority could be more tolerable in enforcing some of the requirements that are not relevant to this project. The approach to handling the workshop could have also been improved in the future. She received complaints from some of the participants among the consultants that they were not engaged at some point that made them feel that their participation was not important. P5-C had the same thought as P5-B. It was observed that the facilitator was not engaging and nor provided continuous support throughout the workshop.

P5-C also admits that one of the key factors to the smooth running and success of the workshop in the readiness of the participants with the necessary information. Taking herself as an example, P5-C ensured that she had all the project information. She brought all the relevant reference materials and supporting documents with her in case it is needed for the workshop. This is based on her previous experience in a VM workshop for another project.

## 7.9 Critical Issues – Value Management Domain

One of the objectives of this research is to identify the critical issues in implementing the workshops within the practice of VM in Malaysia. Part E of the interview questionnaire for stakeholders' representatives tried to solicit the issues encountered during the workshop implementation from the perspective of the VM domain. Figure 7.6 conceptualizes various issues discussed by the interviewees. Apart from the interviews, the discussion is supported by the observations conducted as a means to check and balance between different views of interviewees. The findings of the interviews are explained as follows:



**Figure 7.6 Critical issues on VM domains**

### 7.9.1 Value Management Methodology

The uniqueness of VM over other management tools is the implementation of the workshop processes according to a specific job plan. Job plans provide guidance for the progress of the workshop from one phase to the next. Each phase has its intended

objectives, techniques and tools to achieve the objective and a specific outputs that acts as an input for the following phase. Similarly, practices in Malaysia follow the typical VM job plan of six phases.

Realizing that VM is relatively new in Malaysia, knowledge plays important roles in ensuring the smooth running and success of the workshop. The majority of the interviewees agreed that the participants lacked VM knowledge. In most cases, more than 80% of the participants of each workshop had no previous experience. Hence, clear explanation of the VM job plan, different workshop phases, roles and responsibilities of the participants and the facilitators is crucial. It was observed that the workshop has allocated a time slot for briefing on VM implementation by the facilitator's representative. However, not all participants managed to grasp the input given within that short period. On top of that, the style of presentation and the content may cause the participants to listen and learn something from the presentation.

As the workshop progressed, there was no clear demarcation between the six phases of the workshop. The interviewees agreed that the participants may get lost as they were not aware of the current phase that they were in. In particular, the *function analysis* phase required clear understanding on the technique and also the project's objective and functions. Moreover, the development of the FAST diagram is not an easy task. All participants should work hand in hand with strong support from the facilitators to construct and understand the FAST well in order to ease the process in the following phases.

Other stakeholders held the opinion that the facilitators needed to ensure the correct approach in facilitating and executing the workshop. Facilitating any workshop requires some generic skills to enable the facilitators to function well in executing

their roles. The facilitators must ensure that the facilitation of the workshop is complying with the VM methodology. Care must also be given to ensure that every participant was actively participating by engaging them throughout the workshop.

### **7.9.2 Workshop Tools and Techniques**

There were different techniques and tools to be used at a particular phase of the workshop. Therefore, it is crucial for the facilitators to identify a suitable technique based upon the available information to ease the decision-making process. The traditional brainstorming technique adopted in all five workshops was demanding, and an important role of the facilitator is to guide group discussion and keep it geared toward achieving the workshop's objectives. However, this did not happen all the times in all five workshops. There were times that the facilitators were not monitoring the progress of the discussion. As a result, the participants experienced difficulties and to some extent lost their interest to participate. One of the important roles of the facilitators is to engage the participants in the discussion.

The facilitation team from EPU developed the standard templates to assist the different activities at different phases of the workshop. Among others, the templates include the “project must”, “project constraints”, “can we”, “value implication”, and action plan. All templates were developed using MS PowerPoint, which requires repetitive works from one template to another. These processes were time consuming given the fact that there was an overall time limitation for each workshop. P4 also experienced serious problems when the files were unintentionally deleted, which caused major problems in the group as they lost the work that they just completed.

The available technique to be used is not exclusively for the VM workshop. Hence, there should have been a proper explanation on how that particular technique will be

used during the workshop. As brainstorming promotes the quantity rather than the quality, a problem has occurred when participants simply throw out any idea and view without critically thinking about how it can be practical to the project. As a result, unintelligent arguments among participants have prolonged the process during the workshop. Hence, the facilitators should have experience and necessary skill to control such situations and direct the discussion back on track to achieve the workshop objectives.

Detailed examination into the templates found that they seemed to be complicated for the participants seeing it for the first time. The facilitators should have assisted the participants in working with those templates. Although the existing templates were a result of a series of improvements from the first time VM was employed, the current templates are still time-consuming to work with. Some interviewees (P1-B, P2-B, P4-A, P4-D) suggested for the automation of the templates. Perhaps, an online system or support system may increase the user-friendliness of the templates and simplify the current process that in overall will improve the efficiency and effectiveness of the process and outputs of the workshop.

### **7.9.3 Workshop's Outputs**

The workshop's outputs were the results based on various input from all stakeholders. The outputs were included in the reports for record keeping and future references. Among others, the reports summarized the outputs in terms of the total estimated cost, total GFA, scope of the project, all generated, evaluated and implemented ideas and the action plan for the project team. On top of that, participant details were attached in case further clarifications are required in the future.

The feedback gained from interviewees revealed that the workshop's outputs reduced the project's quality and resulted in the project losing its aesthetic value (P3-A, P3-C, P4-B, and P4-C). Some even argued that the workshop was merely a cost cutting exercise (P4-C). However, it is the client to play an active role to ensure that what has been agreed to during the workshop is something that they look forward to as outputs of the project. Perhaps the client value system needs to be given serious consideration and provide some ideas to all participants on the perceived value of the project from the client's perspective. On the other hand, it is worth noting that some workshops managed to bring significant value to the proposed project by identifying the missing scope and components for the project to achieve its objectives.

After going through all phases with the input from various stakeholders, there were assumptions that were not clarified due to several reasons. Primarily, it was due to lack of information and the absence of relevant stakeholder representatives to enlighten the workshop and decide on that matter. All assumptions remain as assumptions and imposed risk to the project team. Some interviewees suggested that all the sketches and visual outputs should be incorporated into the VM workshop's report (P1-A, P1-C, P1-D). To them, the visual outputs may ease the understanding later during the post-workshop stage and future reference.

In relation to project cost, P3 experienced the situation whereby the final estimated cost after the workshop exceeded the budget allocation. Despite having revisited the project objectives and scope, identifying the project objectives and outcomes, and deliberating the option and alternatives, there was an increase estimated cost that exceeded the budget allocated. It was disappointing to the whole team as that report is not worth it to justify that an additional allocation be required for that project. In

contrast, in the event where the final estimated cost is lesser from the allocated budget, the surplus should have been returned to the project so that an additional value can be added to the project components and items. It is at the facilitators' discretion to decide on this matter whether the excess budget can be utilized on the project or else it will be considered as a 'saving' to the government. The 'saving' would then be able to be used to initiate other projects.

#### **7.9.4 Logistic of the Workshop**

There are various aspects of the logistics of the VA workshop. Literature reviews revealed that these aspects are important, though it has no direct relation to the outputs of the workshop. It was suggested that the workshop environment should provide a conducive environment that can support the workshop processes. The venue also should be equipped with the support facilities such as the public address system, computers, internet access, printer, overhead projector, whiteboard, stationaries, etc.

The geographical location of the venue will determine if the participants were to stay overnight or just attend the workshop during office hours. If the participants were to provide accommodation within the workshop venue, they should be able to reach the venue on time in every session. Where else if it is not? There will be a risk of delay due to unpredictable traffic conditions and so on when the participants travel to the workshop venue. The delayed arriving of the participants may force the workshop to delay and in ensuring enough quorums to enable the workshop to proceed.

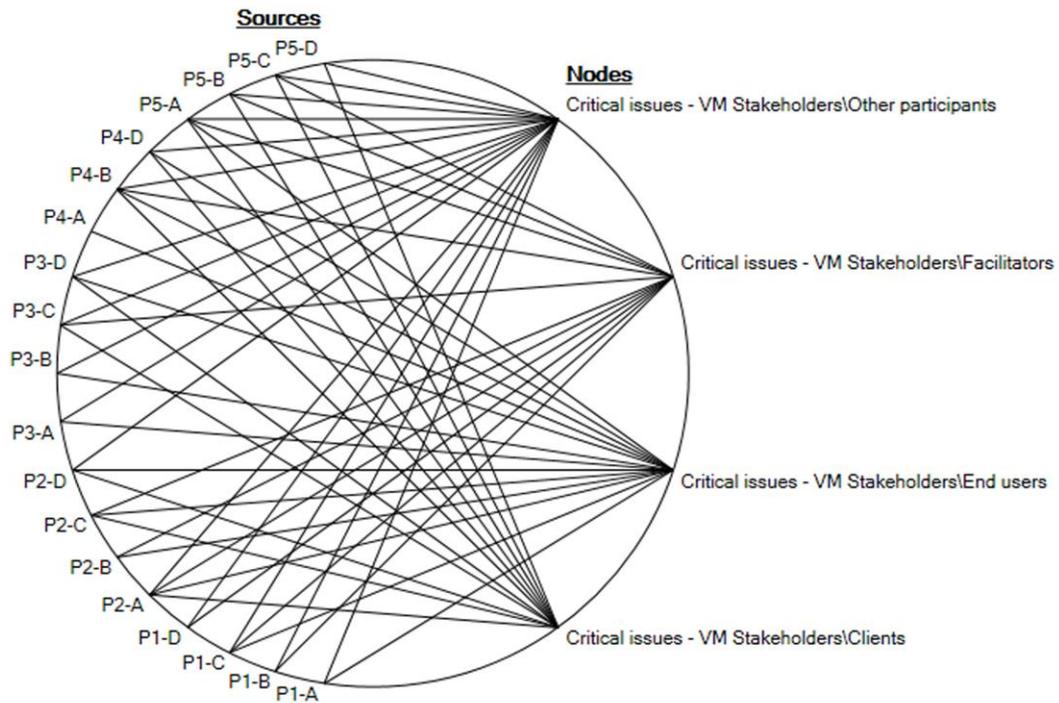
There is always a strong debate on the total duration of the workshop. However, it is argued that a 40-hour session should be reasonable and enough for the workshop to be completed, provided that all participants equipped themselves with the necessary information on the project. To achieve that, care must be given in time management

and control of each phase of the workshop. The evening session could be utilized as well when necessary. However, some interviewees disagreed and claimed that it was too much and felt tired after spending the whole day in the workshop. The evening session may not be as effective as the daytime session.

In terms of the way the workshop was being conducted, the facilitators needed to design the workshop carefully to ensure that the scope of the study is balanced among the groups. There were cases such as in P2 and P4, where certain groups needed to look into the bigger scope of the project. For example, the architectural groups usually needed to cover both master planning and the architecture aspect of the project. Uneven workload has put more burden and pressure for the group to work on, especially when it comes to a bigger scale of the project. Some interviewees were also concerned with the VM intervention during the project cycle (P1-B, P1-C, P3-B, P3-C, P4-C, and P4-D). Sometimes it was too early, where the information was limited, and sometimes it was a bit late where the design and drawings were already approved by the relevant authorities.

### **7.10 Critical Issues – Value Management Stakeholders**

Figure 7.7 conceptualizes the critical issues in relation to the various groups of stakeholders, supported by observations. The findings of the analysis of the interviews are discussed as follows:



**Figure 7.7 Critical issues on VM stakeholders**

### 7.10.1 Client

From the perspective of public project implementation in Malaysia, the client organizations are mainly the ministries established under the parliamentary cabinet. All ministries are allocated funds to be used for physical projects implementation and are responsible for managing the project to achieve the intended outcomes. In most of the workshops, the representatives from the client organizations were personnel from the development and technical divisions who were responsible for managing the projects' development.

On top of that, there were also representatives from the agencies in P2 and P5 that specifically were responsible for the proposed project. Most of the representatives were from the middle management level and were responsible at the operational level.

Based on the demographic of the representatives among the client, they should have been in the best position to represent the client's organisations.

The client as the owner of the project is expected to have the utmost knowledge about the project. However, there were cases where the projects were proposed by the agencies under the relevant ministries. At this juncture, it is critical to ensure the readiness level of the information prior to the implementation of the workshop. Ample time should be allocated in between the *pre-workshop* stage to the *workshop* stage.

It was observed that the workshops lacked participation of and commitment by the representatives. Some were present all the time during the workshop process but did not contribute much. This probably was due to other factors such as lack of power delegated from their top management as well as the lack of facilitation from the facilitators. It is also important to ensure that the credentials of the assigned representatives participating in the workshop are sufficient to the task. Some others were absent in between the workshop process due to other work related commitments.

Another critical issue is related to the decision-making authority granted to the representative to represent their decision maker from their organization. It is important for all stakeholders to ensure that their representatives were given ample power to decide and that representatives must also take that responsibility on behalf of their organisation. For example, the client representatives for P3 were present during the workshop. However, they were reluctant to make a decision to help the workshop to proceed smoothly. Most of the time, the workshop had to wait for another client representative at a higher ranking to decide. This has caused serious delay as that particular representative only came in between when requested to.

### **7.10.2 End Users**

It is essential that the completed projects meet the users' expectation and satisfaction. Liu and Walker (1998) consider satisfaction as an attribute of success. Torbica and Stroh (2001) believe that if end users are satisfied, the project can be considered being successfully completed in the long run.

During the workshops conducted for these case studies, the academic staffs involved in the teaching and learning activities, as well as some of them who were involved in the curriculum development, participated in P1's workshop. P2's workshop involved the representatives of the traders that are currently operating businesses on the premises. For P3, the workshop was participated by several clinical staffs: the doctors, matron, and staff nurse, while P4 workshop participated by the representative from the federation overseeing the athletes' training and development. Only P5 was not represented by any representative from the end users. Based on the demographic of the representatives from the end users, it was clear that they were the right individuals to represent the end users.

There were also issues on inaccuracy of the information. For instance, the end users from P1 were unable to justify the population details to support their justification for the proposed project. Meanwhile, the end users from P2 were unable to provide the accurate number of traders that will be affected by the project. They also haven't finalized the temporary location for the relocation of the traders during the redevelopment work.

From the perspective of technical knowledge of construction works, most of the end users have no technical background on construction works. They were having problems to grasp the discussion and give their input. For example, the end users in

P2's workshop were not aware of the public project implementation process and procedures.

### **7.10.3 Other Participants**

The other participants were mainly among the stakeholders to the project, such as the implementing agencies, local authorities, service providers, and private consultants.

The representatives from PWD, local authorities, and service providers were invited by the client to participate as they were part of the project team. In addition, the private consultants were invited for P3 and P5 workshops as they have been appointed as the design team to the projects. Most of the representatives were among the middle management level that involves at the operational level, with small numbers of junior members representing their organization. Based on the demographic of the representatives among the client, they should have been at their best position to represent their organizations.

The same problem of lack of information existed among this group of participants. They came into the workshop with the least preparation and the required information that is crucial to support the discussion and justify an argument. There was also a lack of participation and commitment among them. On the other hand, several interviewees claimed that they were not sure about their roles during the workshop process. Perhaps the briefing during the first day was not able to attract them and there was a lack of facilitation throughout the workshop processes.

When specifically addressing this group of stakeholders, they were governed by specific rules and regulations and also empowered by law to impose guidelines and requirements. However, a problem occurs when the guidelines frequently change or the representatives were not following the guidelines thoroughly. The project team

was also facing problems when dealing with different desk officers at different stages of the construction project that may have lasted for several years. In most cases, it was not easy to get their representative to cooperate to agree even when they realized the constraints that the team has faced for the project to be implemented.

On a separate note, several interviewees also suggested the involvement of a third party during the workshop to provide unbiased opinions. They can be selected among the industry players that have the relevant experience with a project of a similar nature.

#### **7.10.4 Facilitator**

Since the rebranding of the Cost and Standardization section of EPU into VM section, VM Section was responsible for overseeing the workshop implementation. This section has strong technical professionals of 30 officers representing various disciplines related to the construction projects.

For each workshop, the numbers of facilitators depended upon the scale and nature of the project. In most cases, 6-8 facilitators will be elected and headed by one of the senior personnel as the lead facilitator. In ensuring balanced facilitation during the workshop, the facilitators consisted of various disciplines: architects, civil and structural engineers, mechanical and electrical engineers, and quantity surveyors. The facilitators were appointed by a designated group based on their discipline.

It was observed and agreed by most of the interviewees that the workshops lacked time management, especially during the first three days. As a result, everything was conducted in a hurried fashion towards the end of five days' workshop.

Three major areas were determined from the aspect of the competency of the facilitators: VM knowledge, technical knowledge, and facilitation skills. It is

important for the facilitators to equip themselves with the theoretical knowledge on VM serve as the basis of their roles to facilitate the workshop. Another aspect is the technical knowledge of a specific discipline and type of building. For example, P4 involved the construction of a velodrome that will be the first of its kind in Southeast Asia. Hence, there was no other example that they could look at. Basic information through reading may help the facilitators to understand the project better so that they can provide necessary facilitation during the workshop.

On top of that, there is a strong need for the facilitators to enhance their soft skills in facilitating the workshop. The skills include observing, listening, communication, negotiation, time management, attending and questioning. Some individuals may be gifted talent as such while the rest may require special training to learn and practice.

### **7.11 Summary of the Chapter**

This chapter discusses the findings of triangulated data collection methods into five VM workshops of real-life public projects in Malaysia. The establishment of the FSE model enables the performance evaluation with a single score to be carried out into each workshop. The discussion of the level of performance of each workshop was supported by the observation reports and the semi-structured interviews with twenty participants representing various stakeholders involved in the projects. Furthermore, critical issues in implementing the workshops were identified and discussed from two main perspectives: VM domain and the stakeholders with relevant recommendations and suggestions for improvement.

## **CHAPTER 8: PERFORMANCE MANAGEMENT FRAMEWORK FOR VALUE MANAGEMENT IMPLEMENTATION IN THE CONSTRUCTION INDUSTRY**

### **8.1 Introduction**

This chapter will focus on the development of the models and framework for establishing the performance management framework for VM implementation in the construction industry. The need for such frameworks will be discussed to justify the development. The variables of the framework are also discussed and supported by the validation of the proposed framework.

### **8.2 Performance Measurement Model**

The performance measurement model is proposed to provide assistance for VM stakeholders in measuring the performance of VM implementation. The KPIs identified in Chapter 6 were used as the basis for developing this model using the Structural Equation Modelling (SEM) approach. SEM is a series of statistical approaches that allow examination of complex relationships between one or more independent variables and one or more dependent variables in order to validate causal relationships.

According to Wong and Cheung (2005), SEM is able to produce a more accurate representation of the overall interrelationships by explicitly taking into account the measurement errors in the variables. In addition, SEM also takes into account the errors in measurement that occur when a large number of variables are involved (Molenaar et al., 2000).

The use of SEM for research in the field of construction management and engineering was pioneered by Sarkar et al. in 1998 when they explored the effects of relational bonding of global construction firms. Moleenar et al. (2000) supplemented this ground-breaking research by exploring the effects of construction disputes between clients and contractors. Recent analysis by Xiong et al. (2015) found that 84 journal papers were published in 31 leading construction management and engineering journals using SEM as the primary statistical approach in exploring the interrelationships among variables.

Within this research in particular, SEM was used to model the interrelationship between the KPIs and performance of the VM implementation. With the available software to run the SEM, analysing and testing a particular framework was fast, efficient, and user-friendly. The SEM analysis in this research was conducted using SPSS Analysis of Moment Structures (AMOS) version 22.0. Other software available to conduct SEM analysis included LISREL, EQS, SEPATH, and PROC CALIS. The advantage of AMOS, compared to the other software in its class, lies in its graphics representation of the model. AMOS allows the user to specify, estimate, assess and present a model in a causal path diagram to show the hypothesized relationship among constructs of interest.

The variables of the performance measurement model in this research were identified as follows:

i) Measured variables

15 KPIs consisting of five process-related KPIs and ten output-related KPIs (Table 8.1).

ii) First-order latent variables

Four latent variables deduced from exploratory factor analysis (EFA) that represent the observed variables: clarifications, identifications, improvements, and satisfactions.

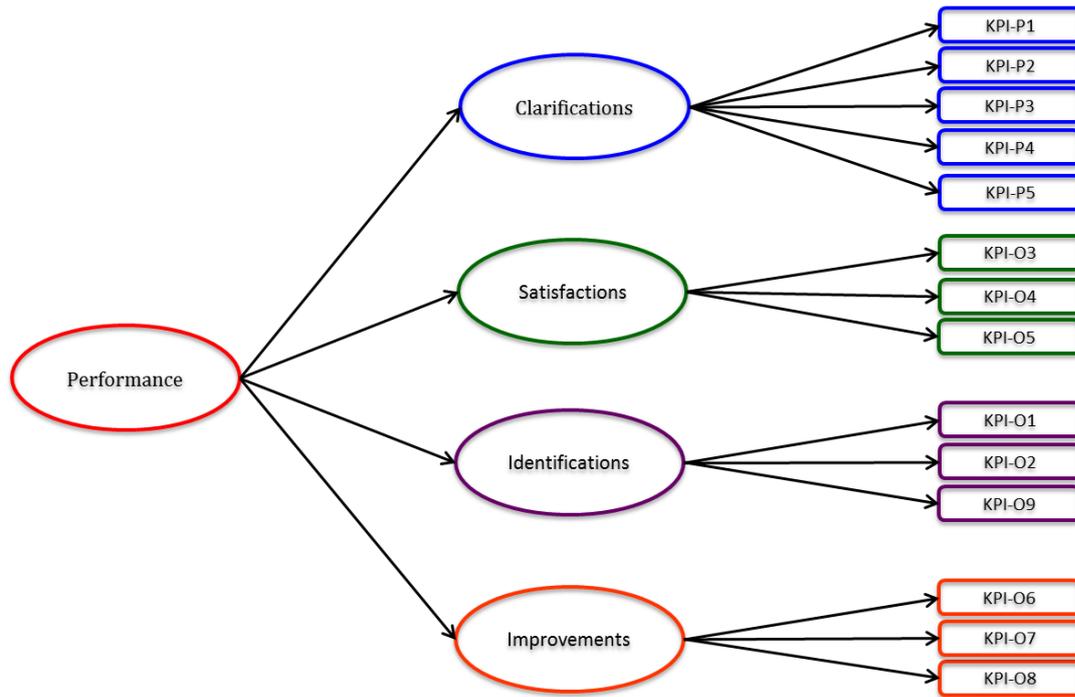
iii) Second-order latent variables

Performance of VM implementation

**Table 8.1 Constructs and variables for SEM analysis**

<b>Latent variable</b>	<b>Observed variables</b>	<b>Description</b>
Clarifications	KPI-P1	Clarification of the client's objective(s)
	KPI-P2	Clarification of the end user's objective(s)
	KPI-P3	Interaction between the workshop team members
	KPI-P4	Clarification of the primary functions
	KPI-P5	Clarification of the project givens/assumptions
Satisfactions	KPI-O3	Satisfaction of the client
	KPI-O4	Satisfaction of the of the end user
	KPI-O5	Acceleration of the decision-making process
Identifications	KPI-O1	Identification and clarification of the end user's requirements
	KPI-O2	Identification and clarification of the client's requirements
	KPI-O9	Identification of the option/alternatives
Improvements	KPI-O6	Optimisation of project planning and scheduling
	KPI-O7	Improvement to the overall quality/performance/appearance
	KPI-O8	Improvement of the communication among stakeholders

The hypothetical model was developed as presented in Figure 8.1, and four hypotheses (Table 8.2) were deduced from the hypothetical model to examine the interrelationships between the measured variables, first-order latent variables, and second-order latent variable.



**Figure 8.1 The hypothetical model of causal relationship of VM performance**

**Table 8.2 List of hypothesis based on the hypothetical model**

Hypothesis	Description
H1	The clarifications-related indicators will positively contribute towards a better performance of VM
H2	The satisfactions-related indicators will positively contribute towards a better performance of VM
H3	The Identifications-related indicators will positively contribute towards a better performance of VM
H4	The improvements-related indicators will positively contribute towards a better performance of VM

### **8.2.1 Development of the Measurement Model**

The hypothetical model was then redeveloped in the AMOS software to enable detailed analysis and to finalise the performance measurement model. As depicted in Figure 8.2, measured variables were represented by rectangles, the latent variables by ellipses, measurement errors using circles and a line with an arrow to indicate the direction of the effects. The lines should originate at the causal variable and point to the variable that is caused. The absence of a line indicates there is no causal relationship between the variables.

Unfortunately, the model was not able to achieve the model's fit during the initial analysis based on the measurement model in Figure 8.3. Therefore, modification of the measurement model was conducted. The modification of the model is necessary to improve the model's fit when the original proposed model does not fit. Modification to the model can be suggested by the residuals obtained in the original run as well as by special statistics called modification indices. These indices point specifically to paths whose addition to the model would result in the biggest improvement in the overall chi-square value. However, these modifications need also to make sense theoretically to interpret the resulting model as the modifications may result in a final model that is contradicted by the theory. The same case is true if modifications were made by adding or dropping paths.

As for the model developed in this research, dropping paths were the best options. Paths that had a very low standardized coefficient value were removed (Sarker et al., 1998). Paths that have been removed were clarified and justified in the following subchapter.

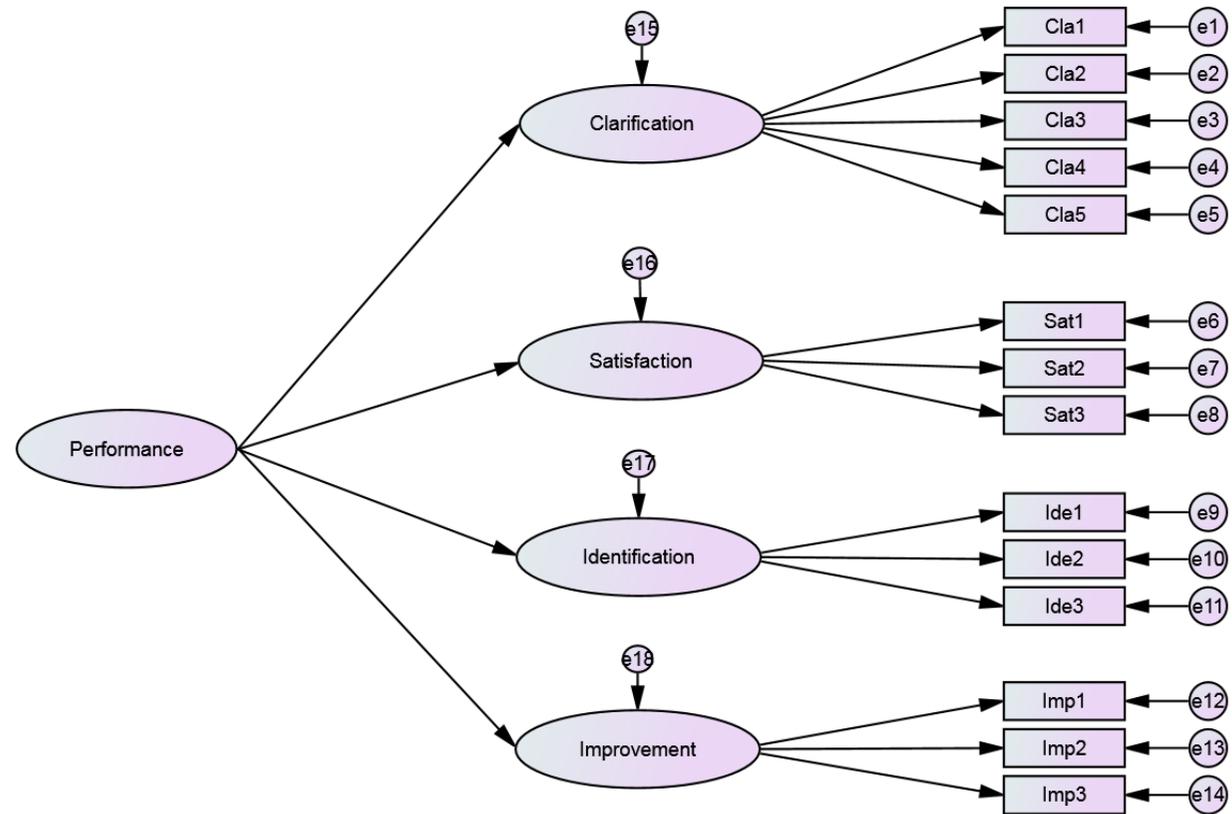


Figure 8.2 The measurement model developed using AMOS

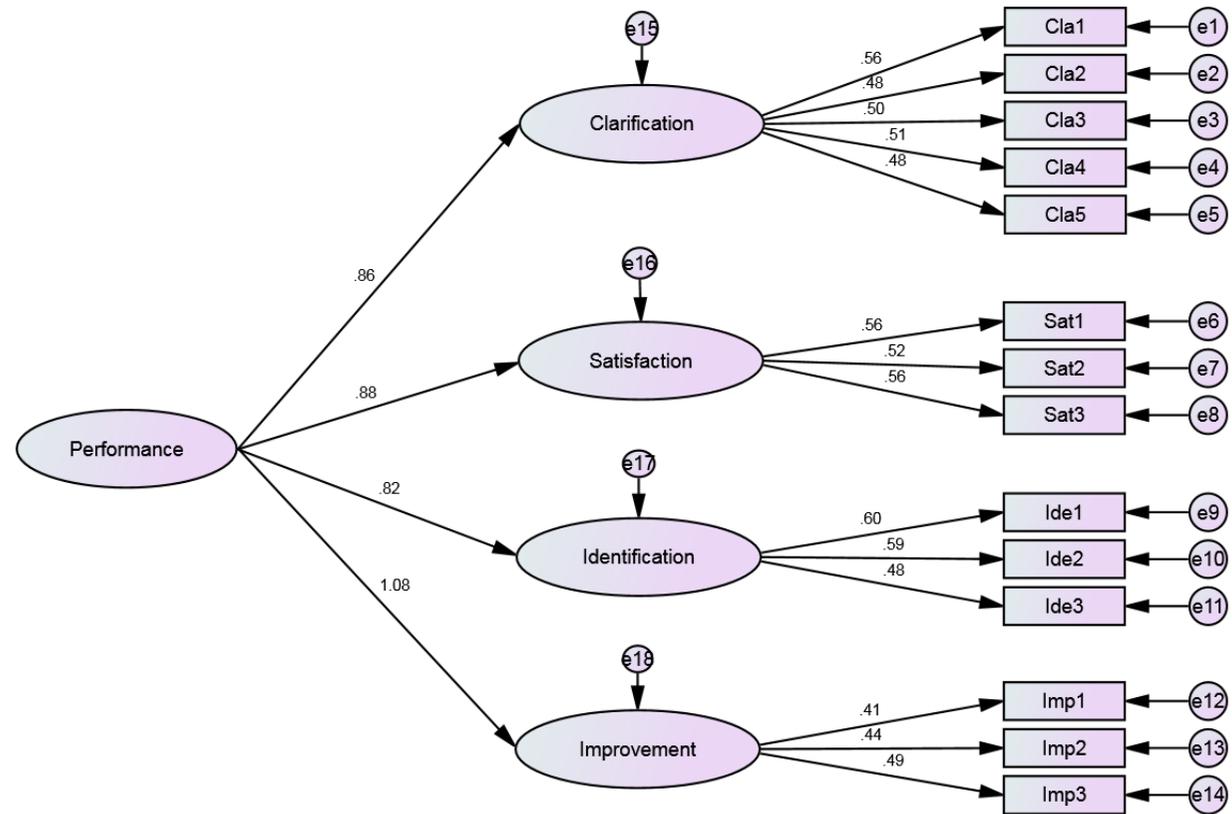
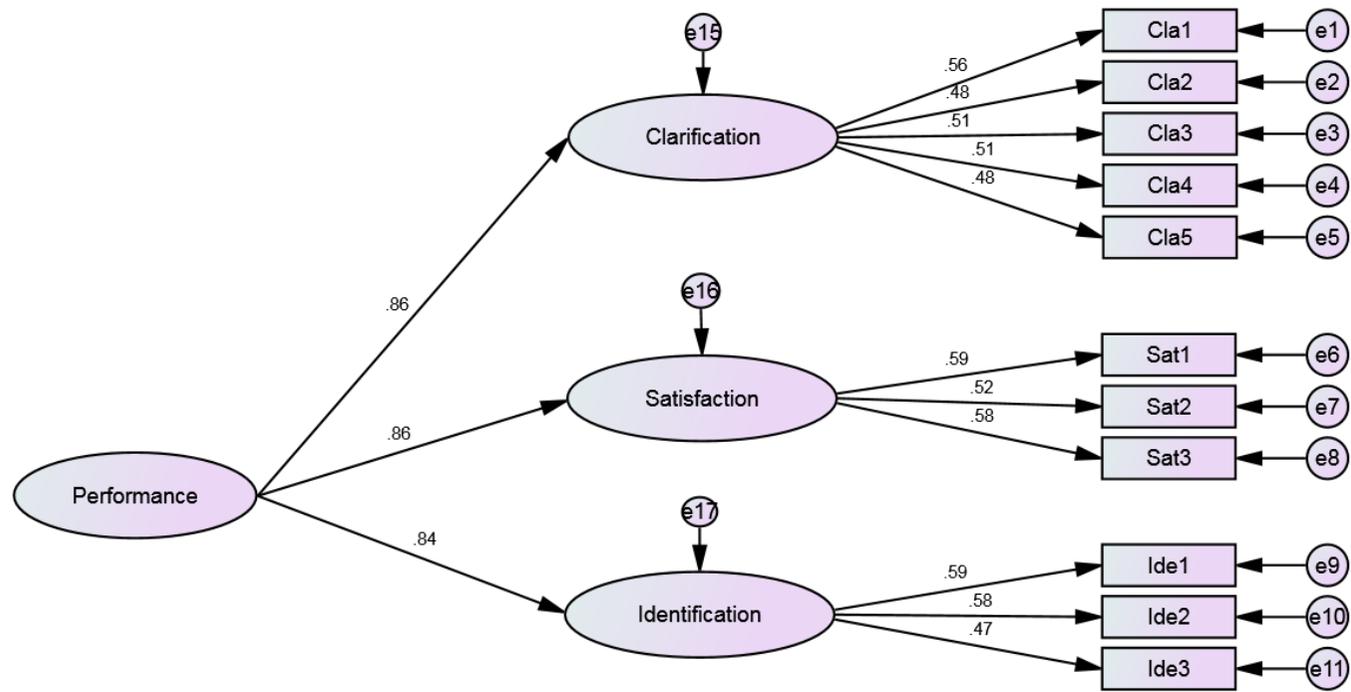


Figure 8.3 The initial structural model developed using AMOS



**Figure 8.4 The revised structural model**

### 8.2.2 Development of the Structural Model

As described before, SEM helps to test if a fit model represents the interrelationship between variables. The model's fit is measured through the Goodness of Fit (GOF). AMOS features were able to generate the GOF result. Since the initial analyses found that the initial measurement model (Figure 8.3) was not able to achieve a good fit, modifications were carried out per the recommendation by AMOS.

For this model, the first attempt was to remove several measured variables having a standardized coefficient value that is below 0.50. Imp1, Imp2, and Imp3 variables under the first-order latent variable of "Improvements" were removed because they interfered with the path between the second-order latent variable "performance" and first-order latent variable "Improvements".

**Table 8.3 Standardised coefficient estimates of the revised SEM model**

<b>Path</b>	<b><i>p</i>-value</b>	<b><i>t</i>-value</b>
Perf → Cla	0.86	1.38
Perf → Sat	0.86	3.45
Perf → Ide	0.84	1.22
Cla → Cla1	0.56	1.17
Cla → Cla2	0.48	0.56
Cla → Cla3	0.51	0.43
Cla → Cla4	0.51	1.45
Cla → Cla5	0.48	2.39
Sat → Sat1	0.59	1.50
Sat → Sat2	0.52	0.59
Sat → Sat3	0.58	0.68
Ide → Ide1	0.59	2.51
Ide → Ide2	0.58	1.04
Ide → Ide3	0.57	0.78

A subsequent run of the analysis based on the revised measurement model presented in Figure 8.4 managed to achieve an acceptable GOF. The standardised coefficient and *t*-value are summarised in Table 8.3.

In the revised structural model (Figure 8.4), all paths between the measured variables and the latent variables were significant in having a standardized coefficient value greater than 0.50 (Hair et al., 2010), with exceptions for three paths. The path between Cla2 “Clarifications of the end users’ objectives” and Cla5 “Clarifications of the project givens/assumptions” to Clarifications achieved a standardized path coefficient of 0.48, while the path between Ide3 “Identification of the option/alternative” to Identifications achieved a standardized path coefficient of 0.47. Care consideration into these three measured variables found that there are critical indicators in measuring the performance of VM implementation. In addition, their existence has minimal impact on the model’s fit. Therefore, all three variables were retained in the final model.

In the first-order latent variables, Sat1 “Satisfaction of the client” and Ide1 “Identification and clarification of the end user’s requirements” achieved the highest standardized path coefficient at 0.59. This was followed closely by Sat3 “Acceleration of the decision-making process” and Ide2 “Identification and clarification of the client’s requirements” at 0.58. The remaining measured variables (Cla1, Cla3, Cla4, and Sat2) achieved the minimum standardized path coefficient of 0.51 to 0.56. In the second-order latent variables, both “Clarifications” and “Identifications” achieved the highest standardized path coefficient at 0.86 and were followed by “Identifications” at 0.84. These values suggest that all three first-order latent variables have a very high

coefficient value out of 1.00. Hence, these findings support the hypothesis 1, 2 and 3 while hypothesis 4 was rejected.

The fourth construct “Improvement” was excluded from the detailed measurement of the model due to very low standardized path coefficient values for all its measured variables. Thus, it can be assumed that indicators related to the improvement are not justifiable for having a direct relationship with the performance of the VM implementation. Perhaps, all stakeholders must understand that VM is one of the available management tools under the bigger umbrella of project management, which is able to intervene at any point in the project development cycle. However, the data used to develop this model were based on the VM studies that were conducted at the initial stage of the project cycle. Therefore, the respondents could have found it difficult to justify any improvements that VM may offer to the construction projects based on the VM applications at the initial design stage.

### **8.2.3 Validation of the Model**

The validation of the model in SEM was conducted using the AMOS’s features. AMOS can generate a detailed analysis of the dimensionality, validity, and reliability of the proposed model. In evaluating the fitness of the model, there are several indexes, known as GOF that reflects how appropriate the model is and whether the model needs further revision. Within the vast literature on the subject, there is no agreement on which fitness indexes would fit a particular model. Therefore, multiple fit indices should be examined and reported when evaluating practical fit of the model. However, Hair et al. (2010) recommend the use of at least one of the indices from each category of model fit. Table 8.4 presents the list of indices, the respective range of acceptance level, and the value achieved by the revised model as compared to the initial model.

**Table 8.4 Value of index based on God of Fitness (GOF) test**

Category	Name of Index	Level of acceptance	Initial Model	Revised Model
Absolute fit	Discrepancy Chi Square (Chisq)	$x > 0.01$	0.01	0.02
	Root Mean Square of Error Approximation (RMSEA)	$x < 0.10$	0.074	0.082
	Goodness of Fit Index (GFI)	$0 \text{ (no fit)} < x < 1 \text{ (perfect fit)}$	0.858	0.880
Incremental fit	Adjusted Goodness of Fit Index (AGFI)	$0 \text{ (no fit)} < x < 1 \text{ (perfect fit)}$	0.827	0.845
	Comparative Fit Index (CFI)	$0 \text{ (no fit)} < x < 1 \text{ (perfect fit)}$	0.804	0.808
	Tucker-Lewis Index (TLI)	$0 \text{ (no fit)} < x < 1 \text{ (perfect fit)}$	0.792	0.793
	Normed Fit Index (NFI)	$0 \text{ (no fit)} < x < 1 \text{ (perfect fit)}$	0.602	0.637
Parsimonious fit	Discrepancy Chi Square / Degree of Freedom (Chisq/df)	$x < 2$	1.563	1.683

Based on the result depicted in Table 8.4, it was found that the measurement model fit the indices in all three categories. Hence, the model suggested that three crucial indicators have significant correlation with VM performances. A better understanding of the interrelationship between the KPIs and the performance of the VM implementation will provide valuable insight for all stakeholders, especially the client to devise ways and means to achieve better performance in the future.

Next, a reliability test was conducted to evaluate the appropriateness of the measurement model used in the revised model. The strength of the measurement model was established by performing Cronbach's reliability test. A cut value of 0.7 is used to indicate the acceptable level of initial consistency (Doloi et al., 2011). Table 8.5 presents Cronbach's  $\alpha$  value for all three first-order latent variables that show a high degree of reliability above the cut-off value.

**Table 8.5 Reliability testing on the final SEM model**

<b>First-order latent variable</b>	<b>Measured variables</b>	<b>Cronbach's <math>\alpha</math> value</b>
Clarifications	Cla1 (KPI-P1)	0.847
	Cla2 (KPI-P2)	
	Cla3 (KPI-P3)	
	Cla4 (KPI-P4)	
	Cla5 (KPI-P5)	
Satisfactions	Sat1 (KPI-O3)	0.901
	Sat2 (KPI-O4)	
	Sat3 (KPI-O5)	
Identifications	Ide1 (KPI-O1)	0.812
	Ide2 (KPI-O2)	
	Ide3 (KPI-O9)	

### 8.3 Performance Evaluation Model

Performance evaluation model is proposed to provide a systematic evaluation approach to evaluate the performance of the VM implementation based on the identified KPIs. Performance data collected at the end of each workshop serve as the basis for the evaluation by adopting fuzzy synthetic evaluation (FSE) approach. FSE provides a synthetic evaluation of an object relative to the objective in a fuzzy decision environment that involves numbers of indicators, multi-levels, and weighting factors given to specific indicators (Nassar and Abourizk, 2014) .

There are three basic elements to run the FSE: a family of the basic indicator,  $F = \{F_1, F_2, \dots, F_m\}$ , a set of alternatives,  $E = \{e_1, e_2, \dots, e_n\}$ , and an evaluation matrix of  $R=(r_{ij})_{m \times n}$  for every object  $u \in U$ . In the fuzzy environment,  $r_{ij}$  is the degree to which alternative  $e_j$  satisfies the criterion  $f_j$ . It is presented by the fuzzy membership function of alternative  $e_j$  with respect to the criterion  $f_j$ .

#### 8.3.1 Identification of the Mean Score

The mean score of each identified KPI can be identified based on the summation of individual scores of each KPI divided by the number of respondents. The calculation of the score was computed by the following formula:

$$= \frac{\sum_{i=1}^s s_i f_i}{\sum_{i=1}^s f_i}$$

where:

$s_i$  represents the weight assigned to each response,  $s_i = 1, 2, 3,$  and  $4$  for  $i = 1, 2, 3,$  and  $4$  respectively (based on four point Likert scale);

$f_i$  represents the frequency of each response; and

i represents response ratings of 1, 2, 3, or 4 corresponding to strongly disagree, disagree, agree, strongly agree.

### 8.3.2 Identification of the Weightage

The weighted of each indicator can be determined based on the mean scores identified in the previous step of 8.3.1. The calculation of the weightage of each KPI can be derived by using the following formula:

$$X = (X_1, X_2, \dots, X_m)$$

$$X_j(M_1, \dots, M_m) = \frac{M_j}{\sum_{j=1}^m M_j}$$

where:

$X_j$  represents the weightage of a particular KPI;

$M_j$  represents the mean score of a particular KPI; and

$\sum M_j$  represents the summation of mean scores of all KPIs.

The same process was repeated to identify the appropriate weightage for each KPI.

### 8.3.3 Identification of the Membership Functions

The membership functions of each indicator derived based on the data collected from the performance survey. For instance, the indicator in fuzzy performance evaluation is  $f = \{f_1, f_2, \dots, f_n\}$ ; and the ratings of performance level defined as  $E = \{1, 2, 3, 4, 5\}$  where it represents very poor, poor, average, good, and very good.

### 8.3.4 Identification of the Overall Score

The performance evaluation model using FSE approach includes three levels of membership function: level three refers to each of the KPIs; level two refers to each construct: and level one refers to the overall performance, which is presented as a single metric for each workshop using the equation below:

$$PL = \sum_{k=1}^5 (X * R_k) * L$$

where:

X represents the weightage of each construct;

R represents the level 1 membership function of each KPI construct;

$R_k$  represents the rating of each KPI, and

L represents the rating used to evaluate each of the KPIs, where 1 = very poor, 2 = poor, 3 = average, 4 = good, and 5 = very good.

A single metric generated through this evaluation model provide informative score to identify the performance level of the VM implementation. In the future, wide-ranging database on performance score of various categories of building could have been developed for benchmarking purposes and to support the decision by the relevant stakeholders for future applications of VM. Chapter 7 has showcased the ability of this model in evaluating the performance of the VM implementation.

#### **8.4 Performance Management Framework**

The performance management model is proposed to present the overall picture in managing the performance of VM implementation from a strategic management perspective. In doing so, a logic diagram was adopted by incorporating the relevant variables involved in managing the performance of the VM implementation within the project parameter in the construction industry. Both models previously described in this chapter formed part of this framework. It is believed that this framework enables the VM stakeholders to understand on the overall aspect of performance in applying VM and how it impacts the successful execution of the project. The following variables were included and presented in the proposed framework (Figure 8.5):

i) Client's goals and objectives

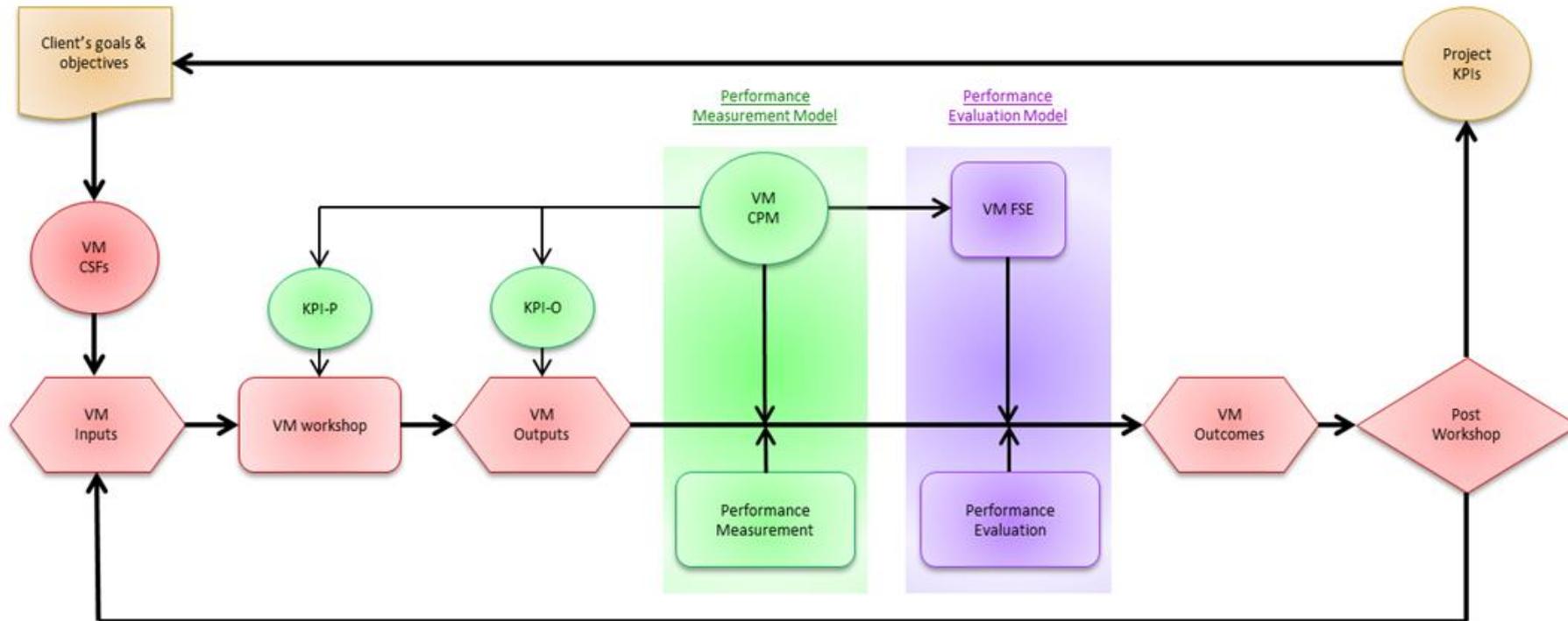
*At the very beginning, it is important for the clients to identify their goals and objectives. It started with the goal and objectives at the organisational level and is later translated into the project's goals and objectives. From a value perspective, the client's value system should be identified and the project's team should be aware of understanding how the clients perceive the value of their proposed project.*

ii) Critical success factors (CSFs) for VM implementation

*CSFs for VM implementation should be identified during the initial stage and planning for the VM study. The workshop facilitators play important roles to ensure that all CSFs were given necessary thought and consideration, with support from the clients and the other project team members. In this research for instance, 10 CSFs were identified and classified into 4 clusters: Client & End Users, Facilitators, Participants, and Processes.*

iii) VM implementation

*The VM should be conducted according to the agreed upon job plan. All necessary input should be available to warrant the smooth running of the workshop. The workshop is carried out in phases: commonly inclusive of information, function analysis, creativity, evaluation, development, and presentation. After completion, the recommendations of the workshop will be regarded as outputs of the VM.*



- i) *KPI-P* → *Process-related Key Performance Indicators (KPI-P)*
- ii) *KPI-O* → *Output-related Key Performance Indicators (KPI-O)*
- iii) *PMM* → *Performance Measurement Model*
- iv) *PEM* → *Performance Evaluation Model*

**Figure 8.5: The performance management frameworks for VM implementation in the construction industry**

iv) Performance measurement

*Performance measurement enables VM stakeholders to gather necessary data in measuring the performance level of the VM implementation. In this research, 15 KPIs were identified and classified into 4 clusters: Clarifications, Satisfactions, Identifications, and Improvement. These indicators serve as the yardstick to quantify the level of performance.*

v) Performance evaluation

*Performance evaluation enables VM stakeholders to evaluate the performance of VM implementation based on the performance data that were gathered. Evaluation helps to transform the data to be valuable information. In this research, the FSE approach was adopted to generate a single performance score that easily compares the performance of one VM application to another.*

vi) VM outcomes

*As a result of the performance measurement and performance evaluation, the outcomes of the VM implementation should be identifiable. The outcomes of the VM study should be beyond the outpost. At this stage, the outcomes will incorporate the findings of the VM study in total and how it affects the execution of the construction project.*

vii) Value review

*Value review enables the VM stakeholders to recap the overall planning, implementation, output and outcomes of the VM implementation. The result of performance evaluation can be scrutinised in detail. All stakeholders should be given an opportunity to respond and to suggest any ideas on how to improve in the future.*

*Any issues brought up during the review and found to be critical must be clearly recorded for reference in future VM implementation.*

viii) Project's KPIs

*The project's KPIs are the yardstick to measure the performance and success of the construction project. The KPIs may differ from one client's organisation to another. At this juncture, the project team may examine to what extent the performance of the VM study contributed to the successful execution of the construction project in meeting the client's goals and objectives of the project, as well as the client's organisational goals and objectives.*

## **8.5 Framework Validation**

Having completed the development of the models and the framework, it is then crucial to examine the validity of the overall framework for potential users in the future. Hence, the framework undergoing the validation process through FGM with practitioners that have been involved in VM within the construction industry in Malaysia.

### **8.5.1 Background of the Participants**

In order to increase the credibility of the validation process, practitioners with vast experience in VM application within the construction industry were identified and invited to participate. On average, all participants having more than 20 years of experience in the construction industry and have participated more than 20 VM workshops in the past. A summary of the background information of the participants is presented in Table 8.6.

**Table 8.6 Profiles of the participants for validation**

<b>Participant</b>	<b>Position</b>	<b>Academic Qualification(s)</b>	<b>Industrial Experience</b>	<b>Previous workshop(s)</b>
Participant 1	Deputy Director (J54)	Bachelor, Master	> 20 years	> 20 workshops
Participant 2	Deputy Director (J54)	Bachelor, Master	> 20 years	> 20 workshops
Participant 3	Principle Assistant Director (J52)	Diploma, Bachelor	> 20 years	> 20 workshops
Participant 4	Assistant Director (J44)	Bachelor	11 - 15 years	> 20 workshops
Participant 5	Senior Principle Assistant Director (J52)	Bachelor	> 20 years	> 20 workshops
Participant 6	Principle Assistant Director (J48)	Bachelor, Master	> 20 years	> 20 workshops
Participant 7	Senior Principle Assistant Director (J52)	Bachelor, Master, PhD	16 - 20 years	5 - 10 workshops
Participant 8	Managing Director	Bachelor, Master, PhD	> 20 years	> 20 workshops

The FGM began with a presentation of the summary of the research works. Among others, the problem statement and research objectives were presented to the participants in order to help them to better understand the research perspective. This was followed by the presentation of the findings in brief. Ultimately, the primary objective of the validation was to validate the proposed framework and incorporate the models. In the end, the criteria for validation were explained to assist the participants to complete the survey.

The validation survey was developed using a five-point Likert scale with items listed range one to five, represent between poor to excellent. The participants were requested to select the appropriate score on each criterion to represent their level of satisfaction on the proposed framework. On top of that, the participants were encouraged and welcomed to express any comments, recommendations, or

suggestions with appropriate justifications to improve the framework in open-ended spaces provided in the survey form.

### **8.5.2 Validation Criteria**

For the purpose of evaluating the framework, four criteria were identified that could justify the validity of the proposed framework. The definitions of each criterion are as follows:

#### *i) Comprehensiveness*

The degree of the model that is more likely to be a complete representation of components that is necessary for VM study implementation within the construction industry.

#### *ii) Reliability*

The degree of the model that is reliable refer in connecting the VM studies within the construction industry environment

#### *iii) Practicality*

The degree of the model that is realistic in nature and practical to be used by stakeholders of the project.

#### *iv) Adaptability*

The degree of the model that is easily to be used by the stakeholders of the project that would like to embark on VM studies on their project.

### **8.5.3 Discussions**

To summarize the results of the validation process by the practitioners, the mean score was deployed and present in Table 8.7.

**Table 8.7 Mean score of different criteria of framework validation**

Criteria	Poor -----> Excellent					Mean Score
	1	2	3	4	5	
Comprehensiveness	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (37.5%)	5 (62.5%)	4.63
Reliability	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (75.0%)	2 (25.0%)	3.75
Practicality	0 (0.0%)	0 (0.0%)	2 (25.0%)	4 (50.0%)	2 (25.0%)	4.00
Adaptability	0 (0.0%)	0 (0.0%)	2 (25.0%)	2 (25.0%)	4 (50.0%)	4.25

Apart from the relative score, the participants were invited to convey their comments, recommendations, or any suggestions to improve the proposed framework. The following issues were of concern to the participants and need to be given serious thought and reflection in the revised framework:

1. Ambiguous process flow at the decision stage
2. Misrepresentation of crossover between the straight lines and dotted lines
3. Positioning of VM outcomes and critical issues within the process flow

As the result of thorough discussion and consolidation of ideas between the participants, changes were made to improve the framework. The decision stage towards the end of the process flow was revised to reflect the actual process. At this point, the use of a diamond shape under the logic diagram theory represents the decision process. Shadings were used to highlight two models incorporated in the frameworks to avoid crossing between lines that could be interpreted in different ways.

The critical issues were incorporated as part of the VM outcomes after the performance being measured and evaluated. Any critical issues identified during the post-workshop will be useful information that should be taken care of in future workshops.

## **8.6 Summary of the Chapter**

This chapter addressed the fourth and fifth objectives of this research in developing the performance measurement model, performance evaluation model, and finally to develop and validate the performance management framework for VM implementation in the construction industry. The framework was developed by incorporating variables that collectively contribute towards the successful implementation of VM in the construction project parameter. It has been validated through FGM with practitioners that were applying VM within the construction industry in Malaysia. The framework underwent minor modification and improvement based on the recommendations by practitioners to increase the validity of the framework.

## **CHAPTER 9: CONCLUSIONS**

### **9.1 Introduction**

This chapter summarizes the study's findings and presents conclusions. Accomplishment of the research objectives is clearly explained by summarizing their attainment using different research methods. In addition, the study's contribution to the relevant body of knowledge is described, the limitations of the research methodology are identified, and recommendations made for future related research.

### **9.2 Review of the Research Aim and Objectives**

The aim of this research was to investigate to what extent successful VM implementation can contribute positively to the successful execution of projects. To help achieve the aim, it was conceptualized into the following objectives:

- To identify a set of CSFs and a set of KPIs for VM implementation from Malaysian construction industry perspectives with reference to international practices. *Using content analysis, a comprehensive literature review was conducted to examine the current trends of research in the field of VM in the construction industry; this was reported on in Chapter 1 and Chapter 2. Previous research works relevant to this research were described and compared in order to identify the research gaps. The focus then moved to the practices of VM in the Malaysian construction industry to justify the significance of this research and how it could benefit relevant stakeholders. The CSFs and KPIs were identified through a questionnaire survey, statistical analyses, and supplemented by semi-structured interviews. Both CSFs and KPIs were reported in Chapter 5 and Chapter 6 respectively.*

- To measure and evaluate the efficiency and effectiveness of the processes and outputs of VM applications in Malaysia.

*A case study approach was adopted to conduct in-depth investigations into measuring and evaluating the performance of VM applications in Malaysia. The case studies involved five real life public construction projects as reported in Chapter 7. Triangulated data collection methods were adopted involving self-observations, a performance questionnaire survey, and semi-structured interviews.*

- To investigate the critical issues encountered in implementing VM in Malaysia. *Similarly as objective 2, the investigations were extended to identify the critical issues encountered by VM stakeholders in implementing VM within public construction projects in Malaysia. This objective was achieved by examining the case study reports supported by semi-structured interviews with 20 representatives of different categories of stakeholders that have participated in VM workshops. Identification of the critical issues is crucial for enlightening stakeholders on remedial actions and improvement for future workshops.*

- To develop a performance measurement model and a performance evaluation model for VM implementation in the construction industry.

*Objective 4 was accomplished by using the raw data collected from objective 2 and 3 to develop models for systematically measuring and evaluating the performance of VM implementation. Content analysis was conducted to identify previously developed similar models. The development of the models was supported by the literature review on VM theory in Chapter 2 and performance management theory in Chapter 3. The models were validated through FGM with the practitioners as reported in Chapter 8.*

- To develop and validate a performance management framework for VM implementation in the construction industry.

*Objective 5 linked all the variables that are relevant to managing the performance of VM in any construction project. The framework is presented as a process-view approach using a logic diagram. Focus Group Meetings (FGM) were organised to validate the framework where feedback and recommendations of the practitioners were taken into account in finalising the framework. Details of the framework and validation process are provided in Chapter 8.*

### **9.3 Fulfilment of the Research Objectives**

By employing various methods for data collection and data analysis, the research objectives have successfully been accomplished as elaborated in further detail below.

#### **9.3.1 Identification of the Critical Success Factors and Key Performance**

##### **Indicators**

A thorough and comprehensive literature review was conducted to identify potential CSFs and KPIs for VM implementation as presented in Chapter 1. This was supported by a review of relevant VM literature in Chapter 2 and the theory of performance management in Chapter 3. The potential CSFs and KPIs were investigated and examined in detail through a questionnaire survey and statistical analysis, which are presented in Chapter 5 and Chapter 6 respectively.

The questionnaire was first piloted to sixteen respondents to ensure that it has been developed in such a way as to achieve its intended objective. The survey proper elicited 195 responses representing a 39% return rate. Based on a series of statistical analyses, ten CSFs under four constructs (client and end users, facilitator, participants,

and process) and fifteen KPIs under four constructs (clarifications, satisfactions, identifications, and improvements) were identified. Clear objectives and support from the clients, the participation of both client and end users, and discipline and attitude of the participants are among identified CSFs. Meanwhile, identifications and clarification of clients and end users requirements, the satisfaction of both client and end users, and acceleration of the decision-making process are among identified KPIs.

Both findings are relevant variables towards the ultimate objective of this research in developing a performance management framework for VM implementation in the construction industry. Moreover, the KPIs identified also used as the indicators in measuring and evaluating the performance of five workshops as the case studies in this research.

### **9.3.2 Measurement and evaluation of the Value Management Applications for Real Life Projects**

Triangulated data collection methods: observations, performance questionnaire survey, and semi-structured interviews were deployed in measuring and evaluating the performance of VM applications for the five real life public projects in Malaysia using a case study approach. Details of the work involved in attaining this objective are presented in Chapter 7. The projects were identified based on the availability of VM workshops during the time when data collection was in progress. The projects involved an academic building, commercial buildings, a healthcare building, and a sports and recreational building.

Self-observations were carried out during each of the workshops that lasted for five days. A performance questionnaire survey was carried out at the end of each workshop to collect data on the performance of the workshops. KPIs identified in

Chapter 6 were used where the respondents were invited to provide their views by indicating how they felt on a five-point Likert scale. In total, 103 performance surveys were returned and enabled the performance evaluation to be conducted using Fuzzy Synthetic Evaluation (FSE) approach. As a result, all workshops achieved an average good performance with the overall score between 3.74 and 4.29.

### **9.3.3 Identification of the Critical Issues in Value Management Implementation**

Self-observation and semi-structured interviews as previously described were also employed to attain the third research objective of identifying the critical issues in VM implementation. Several participants were approached and invited for semi-structure interviews to gain a better insight into the workshop performance, where they shared their views and insights on any critical issues that they had experienced throughout the application of VM. In total, 20 interviewees were interviewed separately upon completion of the workshops comprising of four participants from each workshop. Each of the four represented a different category of stakeholder to ensure a balanced view.

Detailed analysis was conducted using NVivo proprietary computer-aided qualitative data analysis software. The analysis resulted in the identification of the critical issues in four different areas from two different perspectives. From the **VM domain** perspective, critical issues were identified in respect of VM methodology, VM tools and techniques, VM outputs, workshop logistics. Among others, they issues include lack of knowledge on VM, needs for an automation system to support the workshop's process, lack of visual outputs, and availability and commitment of the participants. The second perspective emerged from the **VM stakeholders**. Critical issues were identified in each category of stakeholder: clients, end users, other participants, and

facilitators. Among others, the issue includes lack of project's information and details, lack of technical knowledge and experience, and competency of the facilitators in term of VM knowledge, technical knowledge, and soft skills.

Each critical issue is discussed in detail in the latter part of Chapter 7 in terms of understanding the root cause of problems and possible remedial action to overcome them and reduce their impact on future VM implementations.

#### **9.3.4 Development of a Performance Measurement and Evaluation Model**

Chapter 8 details the process of developing models for measuring and evaluating VM implementation. An SEM approach was adopted to develop the performance measurement model through modelling the interrelationship between the KPIs and performance of the VM implementation. The use of AMOS software for developing the model also enabled the model to be statistically validated and was found to achieve a satisfactory goodness of fit. The proposed model suggests that three hypotheses (H1-H3) are supported, and one hypothesis is rejected (H4).

The performance evaluation model was developed using the Fuzzy Synthetic Evaluation (FSE) approach, which provides a synthetic evaluation of an object relative to the objective in a fuzzy decision environment involving numbers of indicators, multi-levels, and weighting factors given to specific indicators. By adopting this approach, a single score was derived for each workshop to represent its performance level based on the 15 KPIs with appropriate weighting. It was found that the overall performance of VM applications for the five public project case studies can be regarded as average good with overall scores between 3.74 and 4.29 out of a maximum score of 5.00.

Both models were developed based on the data gathered from the five case studies. The proposed models help VM stakeholders to understand the interrelationship between the KPIs and VM performance, and provide guidance for collecting performance data and transforming them into valuable information for future implementation.

### **9.3.5 Development of a Performance Management Framework**

Based on the theories of VM and performance management, the fifth objective of this research highlighted the interrelationship between all variables involved in implementing VM within the construction industry.

The proposed framework not only represents the scenarios in the five case studies, but is also applicable to any construction project. However, the details of each component are subject to changes by stakeholders who might want to adopt this framework. The changes in details should be in line with the vision and objectives of the organisation of that particular stakeholder.

The proposed framework was validated by eight VM practitioners in Malaysia through FGM and achieved a rating above satisfactory. Modifications to the framework were carried out after taking account of recommendations from the FGM's participants. Hence, the revised framework presented in Chapter 8 is comprehensive, reliable, practical and easily adopted.

Based on elaborations in sections 9.3.1 to 9.3.5 inclusive, it can be summarised that the work carried out in this research accomplish the intended objectives by using various research methods as presented in Table 9.1 below.

**Table 9.1 Relationship between the research objectives and research methods employed**

No.	Research objective	Research Method				
		Literature review	Questionnaire survey	Semi-structured interview	Observation	Focus group meeting
1.	To identify a set of critical success factors and a set of key performance indicators for VM implementation from Malaysian construction industry perspectives with reference to international practices.	●	●	●		
2.	To measure and evaluate the efficiency and effectiveness of the processes and outputs of VM applications in Malaysia.		●	●	●	
3.	To investigate the critical issues encountered in implementing VM in Malaysia.	●		●	●	
4.	To develop a performance measurement model and a performance evaluation model for VM implementation in the construction industry.	●				●
5.	To develop and validate a performance management framework for VM implementation in the construction industry.	●				●

## **9.4 Original Contributions to the Body of Knowledge**

The original contributions of this research to the relevant body of knowledge are discussed from the following perspectives.

### **9.4.1 Comprehensive Exploration of Value Management Applications in Malaysia**

This research focused on VM applications in Malaysia with reference to the practices in other countries such as the USA, UK, Australia, and Hong Kong. The study identifies best practice for the application of VM in Malaysia by taking an original and comprehensive look into the performance aspect of VM applications.

The case studies allowed in-depth research to identify the critical issues in implementing VM in Malaysia. The findings from this research may support further applications within the industry by promoting the VM methodology, and disseminating the findings that showcase the success stories of VM applications and how VM can significantly benefit projects and stakeholders.

This research has provided new insight into the performance aspect of VM implementation by identifying the CSFs and KPIs. Although the identifications were based on the data collected in Malaysia, the findings may be applicable to the other countries that share a similar culture. Furthermore, this research has identified the critical issues in implementing VM and discussed them from the perspectives of the VM domains and the VM stakeholders.

Based on the gathered data, this research developed a conceptual framework for managing the performance of VM implementation in the construction industry. The performance management framework will benefit VM stakeholders, especially the

client and the government agencies responsible for overseeing the VM implementation within public sector projects in Malaysia. The applications of the proposed framework will enable monitoring of the performance of VM and determine how improvements can be made in the future. The proposed framework is in line with the concept of knowledge management and learning organizations.

#### **9.4.2 Empirical Works into Real Life Projects**

The findings of previous relevant research analysed for this study provided a platform for exploring further and finally identifying a new set of CSFs and KPIs. Uniquely, the findings have identified the crucial participation of end users in VM implementation.

Studying real life projects extended this research further. Through in-depth case studies, empirical data were gathered to measure and evaluate the performance of VM applications. This research has successfully explored the potential and capabilities of the FSE approach for evaluating the performance of VM implementation. Hence, this research has bridged a research gap by incorporating performance management into VM to evaluate VM's contribution to the successful execution of construction projects.

#### **9.4.3 Interpretation of Existing Theory**

Comprehensive reviews of VM and performance management theory provided a better understanding and enabled this research to propose the integration of both for the benefits of VM applications in the construction industry. Although there is no novel theory to support VM, the definitions, concept, and approach in applying VM has provided a sound foundation for its applications. The principle of the job plan and function-oriented approach have been accepted and received quite well across

industries and regions. Meanwhile, although there is no single definition of performance management, the literature reveals that there are strong arguments for it being seen as supporting improvements in any area of an organisation.

This research has successfully explored the performance aspect of VM implementation and how it contributes positively to the successful execution of construction projects. Although the framework is brief in nature, it does provide rich information for understanding the overall interactions of VM implementation within the construction industry.

#### **9.4.4 Research Methodology, Tools and Techniques**

During the initial stage of this research, a literature review and contents analysis was conducted to identify previous works done within similar parameters. The research methodology, tools and techniques vary depending upon the objectives to be achieved and the perspective of the research.

The triangulation method was adopted during the second stage of this research. Triangulation between the observations, a questionnaire survey, and the semi-structured interviews helped to maximise the amount of data collected. Furthermore, the weaknesses of one method can be overcome by another method. Hence, the method adopted in this research increased the reliability of the findings and ensured that it is sound and practical to be employed in the industry.

This research employed NVivo, a computer-aided qualitative data analysis software, to assist in the process of analysing the qualitative data from the semi-structured interviews. In addition, the SEM and FSE approaches were used to analyse the

quantitative data and apply it to this research. Both techniques of analyses are not extensively used in the field of construction engineering and management research.

## **9.5 Limitations of the Research**

Despite efforts taken to ensure that the research was conducted in the best manner possible, there were some limitations inherent in the research process. These limitations are discussed from the following perspectives.

### **9.5.1 Small Sample Size of the Survey**

The sample from the first stage data collection was relatively small at 39% (195 valid responses out of 505 distributed). The limited application of VM within the construction industry in Malaysia was the main hurdle in gathering more feedback from the survey. Moreover, a stratified sampling method was deployed to reach the specific sub-population in order to retain the credibility of the responses that may affect the research findings. These constraints contributed to a small target population for the surveys.

During the second stage of data collection (case studies), the survey forms were distributed at the end of the workshop, after all the processes have been completed. Based on the records, there were 218 registered participants at the workshops. However, by excluding those who were not present throughout their workshop only 143 surveys were distributed. Those excluded were not considered credential respondents for the purpose of measuring the overall performance of their workshop.

Of the 143 distributed questionnaires, 108 were returned representing a 76% response rate. It was observed that most of the participants were anxious to leave the workshop as soon as it finished, probably because after an intensive five days they were both

mentally and physically exhausted. None of those later contacted my email responded to a request to complete a questionnaire.

### **9.5.2 Varieties of Building Category**

The five case study projects consisted of five different categories of buildings (e.g. educational building, commercial building, healthcare building, sports and recreational building, and industrial building). The original intention was to use five projects all within the same category. However, this was not possible due to the unavailability of VM workshops for projects within a similar category. Consequently, this research used different categories of building for comparison of workshop performance.

It transpired that having a variety of building categories actually produced better findings, since a wider perspective of workshop implementations was covered. However, because the complexity of the projects is different, the workshop for each project produced a different story. Complex projects, such as the healthcare building, involved many more project components and complicated designs that required more innovative ideas for maximising value. It was much easier for the commercial building projects that used a much simpler and straightforward modular design.

### **9.5.3 Observation of the Workshops**

Observation was one of the methods of data collection during the second stage data collection. Theoretically, self-observation by the researcher has a limitation where bias judgement may exist in reporting the observations. An independent observer is an option to overcome such a limitation but it involves confidentiality issues over the contents of the VM workshops and would have required approval by the relevant bodies beforehand.

Another critical issue is the need for knowledge and understanding of an independent observer towards the VM methodology and to appreciate the motivation for the research. Perhaps, future research of a similar nature may be able to identify independent yet knowledgeable observers to assess the performance of VM workshops. The questionnaire survey and semi-structured interviews mitigated the impact of self-observation bias for this research.

#### **9.5.4 Validation of the Model**

The performance measurement model was developed based on a small sample size as described in 9.5.1 using the SEM approach, which is known to be sensitive to sample size. Hence, it would be useful if the model can be cross-validated using a new set of samples with a larger number of respondents to increase the model's fit.

#### **9.6 Recommendation for Future Related Research**

To help overcome the abovementioned limitations and to extent the boundaries of knowledge in the field further, the following future related research is suggested:

- i) Examining the validity of the performance measurement model through empirical study on a larger number of VM workshops for real life projects. A bigger sample size will enable the model to be cross-validated.
- ii) Developing a stakeholder behavioural model in successful VM implementation by examining how each participant behaves in a VM workshop and how this behaviour impacts the successful implementation of the workshop. Different stakeholders may behave differently throughout the workshop as they have different levels of project ownership.

iii) Developing an integrated information system to increase the efficiency and effectiveness of VM implementation by using current information technology support. It is possible to develop a customised integrated system to assist the process and implementation of the workshop. The effectiveness of the system may increase by thoroughly understanding the process involved in the workshop and interacting with the support system when appropriate.

iv) Examining the contractual implications of the conditions of contract for public projects in Malaysia for both conventional and design and build contracts. At present, the standard forms of contract used for public projects have not been revamped to reflect the mandatory application of VM. Only an addendum has been issued to address the implications of VM in relation to the contract. Some VM workshops, other than those used as case studies in this research, involve contractors where they have been appointed through a design and build procurement method.

## **9.7 Summary of the Chapter**

This chapter summarized the overall findings of this research. The research aim and objectives were reviewed, followed by an outline of the study's original contribution to the relevant body of knowledge. Limitations of the research methodology were acknowledged, and future related research recommended.

## **APPENDIX A: SAMPLE OF QUESTIONNAIRE SURVEY**

### **FOR CSFs AND KPIs**

#### **QUESTIONNAIRE SURVEY ON THE PERFORMANCE INDICATORS OF VALUE MANAGEMENT (VM) WORKSHOPS**

Thank you for your time to complete this survey.  
This survey will approximately take about 15 minutes.

VM has been implemented into public projects after the issuance of the  
Economic Planning Unit (EPU) Circular No.3 2009.

It is important then to measure the performance by investigating  
the efficiency and effectiveness of the VM workshops in contributing positive effects  
toward successful implementations of the construction projects.

In relation to these, the objective of this survey is to determine the  
**Key Performance Indicators (KPIs) of VM workshops** in Malaysia.

Your participation is important toward the developments of VM applications in the  
future.

The results of this survey may be published, but will be completely anonymous and  
all collected information will be kept **CONFIDENTIAL**.

**Should you have any query with regard to this survey and research, please do not  
hesitate to contact us.**

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**PART A: VALUE MANAGEMENT (VM) KNOWLEDGE AND EXPERIENCE**

Please indicate your answer by tick (✓) the appropriate box. You may tick (✓) more than one answer where relevant.

**1. To what extent would you describe your level of knowledge on VM?**

- Very Good                       Good                       Fair                       Poor                       Very Poor

**2. Have you attended any formal training on VM?**

- Yes                       No (**Proceed to Question 4**)

**3. Which training module(s) that you have attended?**

**a. Institute of Value Management Malaysia (IVMM)**

- VM Familiarisation                       VM Professional Module I  
 VM Professional Module II

**b. Society of American Value Engineers (SAVE International)**

- Module I                       Module II

**c. Other Modules**

- Organisational internal training**                       **VM course at institutions level** (e.g. university, polytechnic, college)  
 Others: \_\_\_\_\_

**4. How many times have you participated in VM workshop(s)?**

- More than 10                       6 - 10                       1 - 5  
 Never (**End of Part A**)

**5. What is your role in the previous VM workshop(s)?**

- VM Facilitator/Co-Facilitator/Assistant Facilitator (**Proceed to Question 6**)  
 VM participant (representing client/consultant/relevant stakeholders)  
 Observer  
 Others: \_\_\_\_\_
- } **End of Part A**

**6. How many VM workshop(s) have you ever facilitated?**

- More than 10                       6 - 10                       1 - 5



## **PART D: KEY PERFORMANCE INDICATORS FOR VM WORKSHOPS**

Please indicate your level of agreement to the relevant performance indicators to measure the performance of VM workshops by marking tick (✓) in the appropriate box. The meanings of the acronyms are given on top of the tables.

(SA: Strongly Agree      A: Agree    D: Disagree      SD: Strongly Disagree)

SA	A	Indicators related to <b>WORKSHOPS</b> of VM	D	SD
		Duration of each phase of VM workshops		
		Time controls for each phase of VM workshops		
		Satisfaction of the techniques used in each phase		
		Interaction between the workshop team members		
		Clarification of the client's objective(s)		
		Clarification of the End User's objective(s)		
		Clarification of the project's given/assumptions		
		Clarification of the primary functions		
		Total numbers of ideas generated		
		Efficiency rate of idea generated (total ideas/hour)		
		No. of ideas to be implemented		
		Others:		

## **PART D: KEY PERFORMANCE INDICATORS FOR VM WORKSHOPS (Cont'd)**

Please indicate your level of agreement to the relevant performance indicators to measure the performance of VM workshops by marking tick (✓) in the appropriate box. The meanings of the acronyms are given on top of the tables.

(SA: Strongly Agree      A: Agree    D: Disagree      SD: Strongly Disagree)

SA	A	Indicators related to <b>OUTPUT</b> of VM workshops	D	SD
		Duration taken to complete the workshop report		
		Quality and coverage of the workshop report		
		Percentage of action plan carried out		
		Identification and clarification of the client's requirements		
		Identification and clarification of the end user's requirements		
		Identification of the options/alternatives		
		Minimisation of project cost		
		Optimisation of project planning and scheduling		
		Return on Investment of VM study (proposed saving/cost of VM workshop)		
		Improve the overall quality/performance/appearance		
		Improvement to the buildability/constructability aspect		
		Acceleration of the decision-making process		
		Improvement of the communication among stakeholders		
		Satisfaction of the client		
		Satisfaction of the End User		
		Satisfaction of the facilitator		
		Satisfaction of the participants		
		Others:		

**PART E: PERSONAL INFORMATION**

Please indicate your answer by tick (✓) in the appropriate box. You may tick (✓) more than one answer where relevant.

**1. What is your academic qualification(s)?**

- Certificate                       Diploma / Advance Diploma                       Bachelor Degree
- Master Degree
- Doctor of Philosophy (PhD)                       Professional Certificate

**2. How long is your relevant experience in relation to construction industry?**

- More than 20 years     16 - 20 years     11 - 15 years                       5 - 10 years     Less than 5 years

**3. What type of organisation you are currently employed?**

- Government Department/Agency                       Developer                       Contractor
- Consultant                       Academic Institution
- Others: \_\_\_\_\_

**Would you like to receive a copy of the result of this survey?**

- Yes (Please indicate your contact detail for further action)                       No

**Would you like to participate in the later stage of this survey?**

- Yes (Please indicate your contact detail for further action)                       No

**Contact Details**

Name : \_\_\_\_\_                      Email : \_\_\_\_\_

**- END OF THE QUESTIONNAIRE. THANK YOU FOR YOUR PARTICIPATION -**

**APPENDIX B: SAMPLE OF OBSERVATION REPORT  
FOR VM WORKSHOP**

**CASE STUDY REPORT**

PROJECT CODE	:	<b>P4</b>
PROJECT TITLE	:	
CLIENT	:	<b>MINISTRY OF YOUTH AND SPORT</b>
LEAD AGENCY	:	<b>VALUE MANAGEMENT SECTION, EPU</b>

**PROJECT BRIEF**

Velodrome is the arena for track cycling sport. In recent year, there is a huge development program for track cycling sport, with the achievement at the world level (e.g. Asian Games, Commonwealth Games, Olympic Games, and World Championships).

Currently, there are two open velodrome in Malaysia that was built in 1980's as follow;

- Cheras Velodrome (Concrete track, 333.3m)
- Ipoh Velodrome (Timber, 250m)

Hence, the Prime Minister has announced the allocation of RM 80 Mil for the construction of the covered velodrome in the state of Negeri Sembilan. This will be the first velodrome that meet the specification of Union Cyclist International (UCI) to be qualified as the venue for the elite championship.

**The main objectives of the national velodrome project are;**

- To provide world class covered velodrome that meet the specification of Union Cyclist International (UCI) and Malaysia National Cyclist Federation (MNCF)
- To provide training facilities for world class athletes
- To host 1 international cycling event and 4 national cycling events annually

**The original scopes as registered under the SPP II are;**

- Cycling Track
  - Infield
  - Access to infield
- Grandstands
- Technical and Supporting rooms
- Cyclist rooms
- Administrative office

**The outputs to be achieved by the development of the national velodrome are;**

- Covered velodrome that meet the UCI specification for category 1 and MNCF requirements
- Training centre that provide facilities for the national athletes
- Venue to host the international and national championships
-

**The workshop managed to identify the following givens to the project;**

- Development cost approved of RM 80 Million
- Budget speech 2013 from the Treasury
- To meet the UCI standard for category 1 velodrome
- 

**The workshop managed to identify the following constraints to the project;**

- The total land area of 4.021 hectare is too small to build the velodrome. Limited numbers of parking facilities can be provided
- The site topography. Lower level of the area can be the detention pond
- Land ownership is not yet approved
- The allocated budget should be used by 31 December 2015 (PFI II project under MOF)

**The outcomes to be achieved by the development of the national velodrome are;**

- To train more cycling athletes at the international level
- To win the medal in Olympic Games 2020
- To host the cycling championship at international level

The workshop was informed by QS from PWD that the estimate was prepared based on the SOA and the other features of the velodrome as indicated in the concept drawing.

## PROJECT PROFILE

Type of building	:	<b>Sport facilities</b>
Procurement method	:	<b>Design and Build (D&amp;B)</b>
Tendering method	:	<b>Pre-Qualifying</b>
Stage of project	:	<b>Concept design</b>
Project cost	:	Budget Allocation: PDA : VA Model Cost : Post VA cost :

## WORKSHOP PROFILE

Date	:	<b>25 November – 28 November 2013</b>
Duration	:	<b>40 hours (4days 3 Nights)</b>
Location	:	<b>Putera Room, Empress Hotel, Sepang, Selangor</b>
No. participants & composition	:	<p><b>47 participants</b></p> <p>Ministry of Youth and Sport (KBS) [4]  National Sport Council (MSN) [2]  Perbadanan Stadium Nasional (PSN) [2]  Malaysia National Cycling Federation (MNCF) [2]  Ministry of Finance [1]  Seksyen Perkhidmatan Sosial, EPU [1]  Seksyen Pengurusan Nilai, EPU [7]  State Secretary Office (SUK) [1]  Public Work Department (PWD) [17]  Jabatan Perancang Bandar dan Wilayah [1]  Jabatan Bomba dan Penyelamat Malaysia [2]  Jabatan Pengairan dan Saliran [1]  Pejabat Tanah dan Galian [2]  Majlis Perbandaran Nilai [1]  Tenaga Nasional Berhad (TNB) [1]  Syarikat Air Negeri Sembilan (SAINS) [1]  Indah Water Consortium (IWK) [1]</p>

## OBSERVATION ON CRITICAL SUCCESS FACTORS

Critical Success Factors (CSFs)	Observation
<p><b>1. INFORMATION PHASE</b></p> <p>Client's support towards the VM workshops</p>	<p><b><u>Extent of the support provided by the client in terms of the financial, information and human resources</u></b></p> <p>i. Pre-workshop coordination with the facilitator &amp; other stakeholders :</p> <p>ii. Preparation of the logistic supports for the VM workshop</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Pre-workshop conducted earlier</li> <li>▪ The invitation letters have been sending to all stakeholders to the project. It was send to different office of the JPBD.</li> <li>▪ The venue of the workshop conducted in seminar room with round tables arrangements. Very comfortable venue, except that it was a bit cold.</li> <li>▪ Participants were divided into groups (architecture &amp; schedule of area (SOA), Schedule of Area, Mechanical &amp; Electrical, and Civil &amp; Structural) within the same seminar room</li> <li>▪ Not enough projector and extension provided to accommodate the needs from each group.</li> </ul>
<p><b>1. INFORMATION PHASE</b></p> <p>Years of experience of the facilitator in VM workshops facilitation</p>	<p><b><u>Number of years of experienced gained by the facilitator in facilitating VM workshops</u></b></p> <p>i. Name of the facilitator &amp; organisation:</p> <p>ii. VM methodology competency level :</p> <p>iii. Soft skills competency level :</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Mr.XXX from the VM Unit of EPU led the workshop. Able to control the workshop process with the required soft skills.</li> <li>▪ The briefing at the beginning of the workshop provide clear guide to the participants on how the methodology will be carried out.</li> <li>▪ Revised version of the PPT and detail elaboration of category of functions</li> <li>▪ Ice-breaking session was not conducted</li> <li>▪ Clear indication of VM job plan by the VMF throughout the workshop (Opening &amp; closing for each session). Hence the participants well aware what is happening and what to expect in the following phase.</li> <li>▪ Good commitment by the facilitators team</li> </ul>
<p><b>1. INFORMATION PHASE</b></p> <p>Team mix of the participants</p>	<p><b><u>Extent of the discipline mix among the participants representing different stakeholders of the project</u></b></p> <p>i. Total no. of participants &amp; composition:</p> <p>ii. Grouping of the participants :</p>

	<p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The overall participants represent various stakeholders with various background of disciplines</li> <li>▪ All related authorities were participated, except the representative from TM</li> <li>▪ There we no representative from the client and end user in the M&amp;E group.</li> <li>▪ Participants were divided into three groups (architecture &amp; Schedule of Area, Mechanical &amp; Electrical, and Civil &amp; Structural) with the members representing major stakeholders involved in the project</li> </ul>
<p><b>1. INFORMATION PHASE</b></p> <p>Background information collected</p>	<p><b><u>Extent of the information about the project obtained prior to the workshop</u></b></p> <p>i. Pre-workshop meeting conducted :  ii. Compilation of information provided to the participants :  iii. Stakeholders' representative presentation :</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The pre-workshop meeting was conducted beforehand.</li> <li>▪ The Schedule of Area (SOA) prepared by PWD based on the brief provided by the client and MNCF without proper interaction between parties in developing the SOA. Since it is a special building with a specific area and rooms to be made available, it is important for the designers (PWD) to understand the specific requirements (UCI) as well as the specific terms that should be interpreted in the design.</li> <li>▪ The design contest held by PWD in identifying the concept design of the national velodrome. The winning concept design used as the basis of the estimate.</li> <li>▪ The design team visited Guangzhou Velodrome and HK Velodrome to gain more practical information about the velodrome construction. The reports were presented as part of the information to all participants</li> <li>▪ Acknowledgement of the existing facilities nearby (Stadium) and potential of share facilities for a higher utilisation of facilities</li> </ul>
<p><b>1. INFORMATION PHASE</b></p> <p>Input from the relevant governmental departments and local authorities (e.g.: local plan)</p>	<p><b><u>Extent of support provided by the relevant stakeholders that have no direct relationship to the project, but may affect the smooth running of the workshop and the project as a whole</u></b></p> <p>i. Representative from the governmental departments and local authorities :  ii. Presentation during the information phase :  iii. Participation throughout the VM workshops according to the VM methodology</p>

	<p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ All relevant authorities participated the workshop except the representative from TM.</li> <li>▪ There were no specific presentations made by the representative. They were involved during the interaction with the PWD team.</li> <li>▪ Most of the representatives highlight the specific requirement by their organisation, especially on the contribution fees imposed to the project to be taken into account in the PDA. Others are set back lane, parking lots, existing power, and water supply, connection to the existing sewerage line and discharge to the public culvert.</li> </ul>
<p><b>1. INFORMATION PHASE</b></p> <p>Clear objective(s) provided for the VM workshops</p>	<p><b><u>Extent to which the objectives of the workshop were identified by the client through facilitation by the facilitator</u></b></p> <p>i. Establishment of the workshop objective : ii. Deliberation of the workshop objectives by the client/facilitator :</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The objectives of the workshop were not clarified directly during the workshop. The report templates were presented to the participants to inform that those have to be completed at the end of the workshop in order for the SPN of EPU make a recommendation for the approval of the project</li> <li>▪ Cost model was established to guide the overall workshop process. The PDA prepared by PWD based on the conceptual design and SOA of 30,000m<sup>2</sup>. The PDA amount is RM 157,522,000.00.</li> <li>▪ The project objectives were presented and made clear to all. Hence, that would be the direction of the project within the budget allocated (project givens)</li> </ul>
<p><b>4. EVALUATION PHASE</b></p> <p>Decision making authority granted to each participant by their respective organisation</p>	<p><b><u>Extent of the power to make a decision by the participants on behalf of their organisation as the stakeholder for the project</u></b></p> <p>i. Capacity of the participants to make decision :</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Most of the participants of the workshop consist of senior and middle manager of their organisation</li> <li>▪ Majority of the participants are well experience within their scope of works. Their level of seniority and experience did help them in doing judgment. Also the experienced during the technical visit to China and HK</li> <li>▪ They make decision by themselves on behalf of their organisation with reference to the guidelines/regulations etc. and also some cross reference with colleague.</li> <li>▪ The roof specialist was invited to provide realistic budget as it comprise of huge percentage to the project cost.</li> </ul>

<p><b>1. INFORMATION PHASE - 6. PRESENTATION PHASE</b></p> <p>Client's participation (representation) in the VM workshops</p>	<p><b><u>Extent of the client's representative participation throughout the workshop process according to the value methodology</u></b> i. Client's representative participation throughout the workshop process :</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The client representatives, representing different agencies (KBS, MSN, PSN) were involved throughout the process. However, they representative from KBS are quite young.</li> <li>▪ Both representatives from MSN and PSN have related experience on how the training being conducted and how do they operate and manage the velodrome.</li> <li>▪ En. Kamarudin attended the value implication presentation in the best capacity to decide. (e.g. athletes accommodation)</li> </ul>
<p><b>1. INFORMATION PHASE - 6. PRESENTATION PHASE</b></p> <p>End User's participation (representation) in the VM workshops</p>	<p><b><u>Extent of the end user's representative participation throughout the workshop process according to the value methodology</u></b> i. End user's representative participation throughout the workshop process :</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The end user continuously participated and involved during the workshop.</li> <li>▪ En. XXX is one of the UCI qualified technical officer. His experience and knowledge help the workshop to ensure the requirements of UCI were incorporated.</li> <li>▪ Also input from MSN, as the agency that manage and running the training of national athletes</li> </ul>
<p><b>1. INFORMATION PHASE - 6. PRESENTATION PHASE</b></p> <p>Disciplines and attitudes of the participants</p>	<p><b><u>Extent of the participants' discipline in terms of punctuality and attitude during the workshop process according to the value methodology</u></b> i. Discipline throughout the workshop process [e.g. punctuality, phone call, leaving in and out of the venue] : ii. Attitudes throughout the workshop process [e.g. active or passive participation, showing interest, willingness to contribute]</p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The workshop follow through the VM job plan very well</li> <li>▪ The workshop run on time in most of the sessions</li> <li>▪ Most of the authorities attended the first day session, except for JBPM &amp; PTG attended during the second day</li> <li>▪ Evaluation phase conquered by several participants. Minimum feedback from the design team (PWD).</li> </ul>

## OBSERVATION ON KEY PERFORMANCE INDICATORS (KPIs) – WORKSHOP PROCESSES

Performance Indicator	Observation
<p><b>1. INFORMATION PHASE</b></p> <p>Clarification of the client's objectives</p>	<p><b><u>The major objectives of the workshop were clearly addressed with interpretive documents for reference at the beginning of the workshop</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Presentation by En. XXX</li> <li>▪ Not that clear about the long term goal. E.g. what type of championship to host, which level</li> </ul>
<p><b>1. INFORMATION PHASE</b></p> <p>Clarification of the end user's objectives</p>	<p><b><u>The major objectives of the workshop were clearly addressed with interpretive documents for reference at the beginning of the workshop</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Interaction with En. XXX</li> <li>▪ Made reference to the requirement of the UCI</li> </ul>
<p><b>2. FUNCTION ANALYSIS PHASE</b></p> <p>Clarification of the primary functions</p>	<p><b><u>All the primary functions were identified and some secondary function are identified</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Objectives of the project as presented by En. XXX clearly stated the project objectives, primarily to build the cycling facilities that meet the category I of UCI</li> </ul>
<p><b>1. INFORMATION PHASE - 2. FUNCTION ANALYSIS PHASE</b></p> <p>Clarification of the project givens/assumptions</p>	<p><b><u>The most critical project givens/assumptions were clarified</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Access road, no SI conducted.</li> <li>▪ Power supply located nearby (USIM) is not available. Nearest source would be from Bandar Baru Salak Tinggi.</li> <li>▪ Uncertainties on the status of nearby land lot to be acquired</li> <li>▪ Option for STP to avoid higher contribution fee to IWK</li> </ul>
<p><b>1. INFORMATION PHASE - 6. PRESENTATION PHASE</b></p> <p>Interaction between the workshop team members</p>	<p><b><u>The interaction among team members is positive in most of the phases, without any domination by any members</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Interaction within the group is ok, but as a whole is not that good.</li> <li>▪ Gained participation during discussion and evaluation from key stakeholders, mainly the architect, client and the end user</li> <li>▪ No domination observed throughout the workshop</li> </ul>

<p><b>1. INFORMATION PHASE - 6. PRESENTATION PHASE</b></p>	<p><b><u>Support from most of the senior management of the client organisation</u></b></p>
<p>Client's support towards the VM workshop</p>	<p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Present of the different agencies under the client scope of work. (e.g MSN, PSN and MNCF)</li> <li>▪ En. XXX participation during the evaluation phase (value implication) – athletes accommodation</li> </ul>

## OBSERVATION ON KEY PERFORMANCE INDICATORS (KPIs) – WORKSHOP OUTPUTS

Performance Indicator	Observation
<p><b>2. FUNCTION ANALYSIS PHASE</b></p> <p>Identification and clarification of the client's requirements</p>	<p><b><u>All the client's requirements were identified and clarified</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ The requirements of the client were clearly presented during the information phase (Project must)</li> <li>▪ Lack of interaction between the architect with the end user and other client agencies in determining the area required for a specific room indicated in the SOA.</li> <li>▪ Function of the room was deliberated during workshop by the MSN and MNCF.</li> <li>▪ They have reviewed the need of the dedicated rooms and areas to utilise the floor area.</li> </ul>
<p><b>2. FUNCTION ANALYSIS PHASE</b></p> <p>Identification and clarification of the end user's requirements</p>	<p><b><u>Most of the end user's requirements were identified and clarified</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Concern more towards the equipment required to host an event/tournament</li> <li>▪ A bit on the necessary rooms for the officials</li> </ul>
<p><b>3. CREATIVITY PHASE - 5. DEVELOPMENT PHASE</b></p> <p>Identification of the options/alternatives</p>	<p><b><u>Many of options/alternative were determined and clarified during the workshop</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Typical ideas in optimising the cost</li> <li>▪ Sharing facilities concept with the stadium next to the proposed site.</li> <li>▪ Possible option to minimise the requirement of the MPN (parking bays) due to the limited size of the land</li> <li>▪ Simplify roof structure – minimise the column-free width</li> </ul>
<p><b>5. DEVELOPMENT PHASE</b></p> <p>Acceleration of the decision-making process</p>	<p><b><u>The outputs of the workshop were useful to support the decision-making process</u></b></p>

	<p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Major decision pending input from relevant authorities, which constitute a big amount of money to the project.</li> <li>▪ Many uncertainty since this is D&amp;B project. Nothing is cast in stone yet</li> <li>▪ Clear direction from PTG for the land status</li> <li>▪ KBS to negotiate further with SUK and USIM on the issues on shared facilities</li> <li>▪ Most of the items were captured in the action plan for further actions</li> </ul>
<p><b>5. DEVELOPMENT PHASE</b></p> <p>Optimisation of project planning and scheduling</p>	<p><b><u>Major optimisation for better project planning and scheduling were achieved</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Key issues not able to be solved by the workshop, but have been indicated in the action plan. If parties follow the schedule, other may run smoothly to meet the target of 31 Dec 2015. due to the absent of the relevant authorities and lack of information at this stage</li> <li>▪ Tight schedule for the construction works, including 4 months for the track installation by the specialist subcontractor</li> </ul>
<p><b>5. DEVELOPMENT PHASE</b></p> <p>Improvement to the overall quality/performance/appearance</p>	<p><b><u>Significant improvement in a most of aspects through the generated ideas for the project</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Utilised space and area as per function</li> <li>▪ Sharing room within development</li> <li>▪ Sharing facilities with the next door stadium</li> <li>▪ Simplified roof structure and covering</li> <li>▪ Less iconic as national velodrome</li> </ul>
<p><b>5. DEVELOPMENT PHASE</b></p> <p>Improvement of the communication among stakeholders</p>	<p><b><u>All the key stakeholders managed to build up a positive communication after the workshop</u></b></p> <p><b><u>Comment/Remark</u></b></p> <ul style="list-style-type: none"> <li>▪ Overall was a good interaction and communication.</li> <li>▪ A bit domination by VMF but after all that's the roles of SPN to ensure that the proposed project meet the allocated budget. Project can proceed with less complicated design.</li> <li>▪ No client representative for M&amp;E group</li> </ul>

6. PRESENTATION PHASE  Satisfaction of the client	<u>The client was satisfied with the workshop outputs</u>
	<u>Comment/Remark</u> <ul style="list-style-type: none"> <li>▪ Client seem to be ok with the workshop findings</li> <li>▪ They are happy with the commitments and contribution from all participants</li> <li>▪ Added value to provide more allocation for the loose furniture items for the athletes accommodation</li> </ul>
6. PRESENTATION PHASE  Satisfaction of the end user	<u>The end User was satisfied with the workshop outputs</u>
	<u>Comment/Remark</u> <ul style="list-style-type: none"> <li>▪ Client seems to be ok with the workshop findings, as long as the requirements by UCI were complied.</li> <li>▪ They have not raised any specific requirements other than that.</li> </ul>
6. PRESENTATION PHASE  Quality and coverage of the workshop report	<u>The report was not produced at all.</u>
	<u>Comment/Remark</u> <ul style="list-style-type: none"> <li>▪ Pending the final report to be finalized by the client and SPN</li> </ul>

### OVERALL OBSERVATION ON DIFFERENT PHASE OF VM JOB PLAN

Phase	Observation
1. INFORMATION PHASE	<ul style="list-style-type: none"> <li>• Presentation by the client, the implementing agency (PWD) on architectural, C&amp;S, M&amp;E, and costing.</li> <li>• Interaction with other participants. Feedback from the authorities' representatives.</li> <li>• Site visit</li> </ul>
2. FUNCTION ANALYSIS PHASE	<ul style="list-style-type: none"> <li>• Discussion on the project must within the workshop participants</li> <li>• Presentation of the FAST diagram by the lead VMF and agreed by the participants</li> </ul>
3. CREATIVITY PHASE	<ul style="list-style-type: none"> <li>• Repetitive works by SOA group to revisit the area provided for the velodrome components.</li> <li>• Template "CAN WE" during idea generation</li> <li>• Judgement of ideas within the workshop participants</li> <li>• Better feedback and involvement during the judgement</li> <li>• Present of the top management to help the decision making process</li> </ul>

<p><b>4. EVALUATION PHASE</b></p>	<ul style="list-style-type: none"> <li>• Template "VALUE IMPLICATION" to evaluate the</li> <li>• Good interaction for C&amp;S group under the facilitation of the group facilitator to attract the participation.</li> <li>• Didn't see much for the architectural and M&amp;E group. Discussions were separately and not involving all participants within their group.</li> <li>• M&amp;E – more of facilitators doing the template</li> </ul>
<p><b>5. DEVELOPMENT PHASE</b></p>	<ul style="list-style-type: none"> <li>• Workshop summary</li> <li>• Development of the action plan</li> <li>• Revised PDA and SOA</li> </ul>
<p><b>6. PRESENTATION PHASE</b></p>	<ul style="list-style-type: none"> <li>• All stakeholders' representatives attend the presentation. However, top management from KBS was not around to witness (En. Kamarudin)</li> <li>• The signing off will be done later on after finalisation of the report</li> </ul>

#### WORKSHOP OUTPUT

<p>Idea Generation</p>	<p>:</p>	<p>Total no. of generated ideas: <u>69</u>  Total no. of evaluated ideas: <u>34</u>  Total no. of implemented ideas: <u>13</u></p>
<p>Gross Floor Area (GFA)</p>	<p>:</p>	<p>Before VA workshop : <u>30,000.00M<sup>2</sup></u>  After VA workshop : <u>10,110.00M<sup>2</sup></u></p>
<p>Cost Implication during VA</p>	<p>:</p>	<p>Addition :  Omission :</p>
<p>Overall cost</p>	<p>:</p>	<p>Before VA workshop :  After VA workshop :</p>

## WORKSHOP TIME CHECK

Phase	Activity	Start	End	Total duration
Information	Presentations	9:40 (Mon)	10:40 (Mon)	<b>305 minutes</b> (5.1 hours)
	Site Visit	11:00 (Mon)	12:30 (Mon)	
	Project Givens & Constraints	9:20 (Tue)	10:30 (Tue)	
	SOA	9:20 (Tue)	10:30 (Tue)	
Function Analysis	Project Givens & Constraints	9:20 (Tue)	10:30 (Tue)	<b>170 minutes</b> (2.8 hours)
	Project Must	11:00 (Tue)	12:30 (Tue)	
Creativity	Can We	14:20 (Tue)	17:30 (Tue)	<b>470 minutes</b> (7.8 hours)
	Can We	9:30 (Wed)	12:30 (Wed)	
	Can We	14:30 (Wed)	17:30 (Wed)	
Evaluation	Value implication	9:30 (Thu)	11:00 (Thu)	<b>570 minutes</b> (9.5 hours)
	Value implication	11:00 (Thu)	13:30 (Thu)	
	Value implication	14:30 (Thu)	17:45 (Thu)	
Development	Lab Summary	9:40 (Fri)	12:30 (Wed)	<b>245 minutes</b> (4.1 hours)
	Action Plan	9:00 (Thu)	10:00 (Thu)	
	Action Plan	9:00 (Thu)	10:00 (Thu)	
Presentation	Report Template	10:30 (Thu)	12:30 (Thu)	<b>120 minutes</b> (2.00 hours)

## FACILITATORS' LIST

Economic Planning Unit (Value Management Section)
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## ATTENDANCE LIST

Ministry of Youth and Sport (KBS)
National Sport Council (MSN)
Perbadanan Stadium Nasional (PSN)
Malaysia National Cycling Federation (MNCF)
Ministry of Finance (MOF)
Economic Planning Unit (Social Section)
State Secretary Office (SUK)
Public Work Department (PWD)
Jabatan Perancang Bandar dan Desa (JPBD)
Jabatan Bomba dan Penyelamat Malaysia (JBPM)
Jabatan Pengairan dan Saliran (JPS)
Pejabat Tanah dan Galian (PTG)
Majlis Perbandaran Nilai (MPN)
Tenaga Nasional Berhad (TNB)
Syarikat Air Negeri Sembilan Sdn Bhd (SAINS)
Indah Water Consortium (IWK)

## IDEA GENERATION OUTPUTS

	Arch & SOA	C&S	M&E	Total
<b>Total ideas</b>	<b>31</b>	<b>24</b>	<b>13</b>	<b>68</b>
<b>Evaluate [N]</b>	<b>15</b>	<b>10</b>	<b>9</b>	<b>34</b>
<b>Discard [G]</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>18</b>
<b>Information [I]</b>	<b>9</b>	<b>7</b>	<b>-</b>	<b>16</b>
<b>Implement [L]</b>	<b>2</b>	<b>8</b>	<b>3</b>	<b>13</b>

**APPENDIX C: SAMPLE OF SURVEY FOR  
VM WORKSHOP'S PERFORMANCE**

*For Researcher's Use Only*  
PROJECT CODE NO. :

**CASE STUDY OF PERFORMANCE MEASUREMENT OF VALUE MANAGEMENT  
(VM)WORKSHOPS FOR PUBLIC PROJECTS IN MALAYSIA**

Thank you for your time to complete this survey.  
This survey will approximately take **10 minutes**.

Performance is referring to the efficiency and effectiveness of a particular process. To measure the performance, Key Performance Indicators (KPIs) method is widely used. In relation to these, the objective of this case study survey is **to measure the performance of the VM workshops** that you have recently participated by using the KPIs determined from the Malaysian perspective through the survey previously conducted. It was hypothesized that the efficient and effective VM workshops will contribute positively toward successful implementations of the construction projects.

The results of this survey may be published, but will be completely anonymous and all collected information will be kept **CONFIDENTIAL**.

Should you have any query with regard to this survey and research, please do not hesitate to contact us.

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*Chair Professor, Associate Dean & Head of Department*

BEng, PhD, CVS, VMF, FHKIVM, FCIQB, FRICS, MASCE, MIVM

**DR. ANN TIT WAN YU**

*Assistant Professor*

BSc, MSc, PhD, MIVM, MHKIVM, MAIB

**PART A: KPIs FOR THE WORKSHOP PROCESSES**

Please indicate your level of agreement to the related descriptions to describe the performance of VM workshops by marking tick (✓) in the appropriate box next to the description. Kindly ignore if the indicators belong to the organisation that you represent.

KPIs refer to the measurers that can be indicate as an objectives to be targeted that will add the most value to the project/organisation

Key Performance Indicators	Description
Clarification of the client's objectives	All the objectives of the workshop were clearly addressed with interpretive documents for reference at the beginning of the workshop
	The major objectives of the workshop were clearly addressed with interpretive documents for reference at the beginning of the workshop
	The objectives of the workshop were addressed at the beginning of the workshop
	The major objectives were addressed at the beginning of the workshop
	The objectives were not addressed at the beginning of the workshop
Clarification of the end user's objectives	All the objectives of the workshop were clearly addressed with interpretive documents for reference at the beginning of the workshop
	The major objectives of the workshop were clearly addressed with interpretive documents for reference at the beginning of the workshop
	The objectives of the workshop were addressed at the beginning of the workshop
	The major objectives were addressed at the beginning of the workshop
	The objectives were not addressed at the beginning of the workshop
Clarification of the primary functions	Both primary and secondary functions were identified and clarified by consensus of the team members
	Both primary and secondary functions were identified and clarified by consensus of majority of the team members
	All the primary functions were identified and some secondary function are identified
	Primary functions were identified but missing of some that is not clarified
	Primary functions were not clarified
Clarification of the project givens/assumptions	All the project givens/assumptions were clarified and well-documented for reference during the workshop
	Most of the project givens/assumptions were clarified
	The most critical project givens/assumptions were clarified
	Some of the project givens/assumptions were clarified but missing of some that is not clarified
	Project givens/assumptions were not clarified

Key Performance Indicators	Description
Interaction between the workshop team members	The interaction among team members is enthusiastic throughout the workshop
	The interaction among team members is positive in most of the phases, without any domination by any members
	The interaction among team members is positive in most of the phases, with some domination by few members
	The interaction among team members is positive but limited in a particular phases only
	The interaction among team members is limited and at the very minimum level
Client's support towards the VM workshop	Full support from the top management of the client organisation
	Support from most of the senior management of the client organisation
	Support from at least one of the senior management of the client organisation
	Support from the middle level management of the client organisation
	No support from the management level of the client organisation

#### **PART B: KPIs FOR THE WORKSHOP OUTPUTS**

*Please indicate your level of agreement to the related descriptions to describe the performance of VM workshops by marking tick (✓) in the appropriate box next to the description. Kindly ignore if the indicators belong to the organisation that you represent.*

*KPIs refer to the measurers that can be indicate as an objectives to be targeted that will add the most value to the project/organisation*

Key Performance Indicators	Description
Identification and clarification of the client's requirements	All the client's requirements were identified and clarified
	Most of the client's requirements were identified and clarified
	Most of the client's requirements were identified and clarified but missing of some that is not clarified
	Some of the client's requirements were identified and clarified
	The client's requirements were not identified and clarified due to misunderstanding among the team members
Identification and clarification of the end user's requirements	All the end user's requirements were identified and clarified
	Most of the end user's requirements were identified and clarified
	Most of the end user's requirements were identified and clarified but missing of some that is not clarified
	Some of the end user's requirements were identified and clarified
	The end user's requirements were not identified and clarified due to misunderstanding among the team members

Key Performance Indicators		Description
<b>Identification of the options/alternatives</b>		Plenty of options/alternatives were determined and clarified during the workshop
		Many of options/alternative were determined and clarified during the workshop
		Major of options/alternatives were determined and clarified during the workshop
		Some of options/alternatives were determined and clarified during the workshop
		Little number of options/alternatives were determined and clarified during the workshop
<b>Acceleration of the decision-making process</b>		The outputs of the workshop were significant to support the decision-making process
		The outputs of the workshop were important to support the decision-making process
		The outputs of the workshop were useful to support the decision-making process
		The outputs of the workshop were influential to support the decision-making process
		The outputs of the workshop have no influence to support the decision-making process
<b>Optimisation of project planning and scheduling</b>		Significant optimisation for better project planning and scheduling were achieved
		Major optimisation for better project planning and scheduling were achieved
		Better optimisation for better project planning and scheduling was achieved
		Minimum contribution in optimising the project planning and scheduling when missing the key milestone for the project
		No change and improvement to optimise the project planning and scheduling
<b>Improvement to the overall quality/performance /appearance</b>		Significant improvement in a lot of aspects through the generated ideas for the project
		Significant improvement in a most of aspects through the generated ideas for the project
		Improvement in most of aspects through the generated ideas for the project
		Minimum improvement in most of aspects through the generated ideas for the project
		No improvement through the generated ideas for the project
<b>Improvement of the communication among stakeholders</b>		All the key stakeholders managed to build up a positive communication after the workshop
		Most of the key stakeholders managed to build up a positive communication after the workshop
		Most of the key stakeholders managed to improve the communication after the workshop
		Some of the key stakeholders managed to improve the communication after the workshop
		No improvement on the communication among stakeholders after the workshop

Key Performance Indicators		Description
Identification of the options/alternatives		Plenty of options/alternatives were determined and clarified during the workshop
		Many of options/alternative were determined and clarified during the workshop
		Major of options/alternatives were determined and clarified during the workshop
		Some of options/alternatives were determined and clarified during the workshop
		Little number of options/alternatives were determined and clarified during the workshop
Satisfaction of the client		The client was highly satisfied with the workshop outputs
		The client was satisfied with the workshop outputs
		The client was quite satisfied with the workshop outputs
		The client was slightly satisfied with the workshop outputs
		The client was not satisfied with the workshop outputs
Satisfaction of the end user		The end user was highly satisfied with the workshop outputs
		The end user was satisfied with the workshop outputs
		The end user was quite satisfied with the workshop outputs
		The end user was slightly satisfied with the workshop outputs
		The end user was not satisfied with the workshop outputs

### **PART C: OVERALL PERFORMANCE OF THE WORKSHOP**

Please indicate your answer by tick (✓) the appropriate box.

(SA: Strongly Agree A: Agree D: Disagree SD: Strongly Disagree)

No.	Statement	SA	A	D	SD
1	The workshop was properly organised and implemented				
2	The workshop provide the room for me to express my concern towards the project				
3	The workshop facilitation allow me to actively participate				
4	The workshop was not dominated by any of the participants				
5	The workshop objectives were achieved at the end of the workshop				
6	The overall performance and outputs of the workshop are satisfied				
7	The VM workshop has significant benefits and impacts towards the project				
8	Successful VM workshop may contributes to the successful implementation of this projects				

**PART D: PERSONAL INFORMATION**

*Please indicate your answer by tick (√) in the appropriate box. You may tick (√) more than one answer where relevant.*

**9. What is your academic qualification(s)?**

- Certificate                       Diploma / Advance Diploma                       Bachelor Degree                       Master Degree
- Doctor of Philosophy (PhD)                       Professional Certificate

**10. How long is your relevant experience in relation to construction industry?**

- More than 20 years                       16 - 20 years                       11 - 15 years                       5 - 10 years                       Less than 5 years

**11. To what extent would you describe your level of knowledge on VM?**

- Very Good                       Good                       Fair                       Poor                       Very Poor

**12. Which category of stakeholders do you represent in this workshop?**

- Client/Project Owner                       End User                       Government Department/Agency/Local Authorities
- Consultant                       Contractor                       Others: \_\_\_\_\_

**13. What is your role in this VM workshop?**

- VM Facilitator/Co-Facilitator/Assistant Facilitator                       VM participant (representing stakeholders' organisations)
- Observer                       Others: \_\_\_\_\_
- \_\_\_\_\_

**14. Which party is the most appropriate to measure the performance of the VM workshops?**

- Client                       VM Facilitator                       Independent Consultant                       Others: \_\_\_\_\_

**- END OF THE QUESTIONNAIRE. THANK YOU FOR YOUR PARTICIPATION -**

**APPENDIX D: SAMPLE OF CONSENT FORM FOR  
SEMI-STRUCTURED INTERVIEW**

**Consent Form**

**PERFORMANCE MEASUREMENT OF VALUE MANAGEMENT  
WORKSHOPS FOR PUBLIC PROJECTS IN MALAYSIA**

I voluntarily agree to participate in this study in which the objective has been explained to me in writing. I understand that I will not be paid for my participation, hence I may withdraw and discontinue participation at any time without penalty.

I understand that most of the interviewees will find the discussion interesting and thought-provoking, if, however, I feel uncomfortable in anyway during the interview session, I have the right to decline to answer any question or to end the interview.

I give permission for the interview session to be tape-recorded for transcription purposes only. However, I still have the right to request it not to be recorded at a particular point when I feel uncomfortable and to stop the interview at any time.

I understand that the researcher will not identify me by name in any reports using information obtained from this interview, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

.....

Name : .....

Date : .....

## **APPENDIX E: SAMPLE OF SEMI-STRUCTURED INTERVIEW TRANSCRIPT**

### **SEMI-STRUCTURED INTERVIEW TRANSCRIPT**

<b>Project Code</b>	: P4
<b>Role of the Interviewee</b>	: Lead Facilitator
<b>Name of the Interviewee</b>	:
<b>Position</b>	: Deputy Director (J54)
<b>Organisation</b>	: Value Management Section, Economic Planning Unit, Prime Minister's Department
<b>Contact Number</b>	:
<b>Email</b>	:
<b>Date of Interview</b>	: 5 December 2013
<b>Venue</b>	: 5 <sup>th</sup> Floor, Block B6, Economic Planning Unit
<b>Time</b>	: 2.30pm – 3.30pm (60 minutes)
<b>Academic Qualification</b>	: Diploma, Bachelor Degree, Master Degree
<b>Category of Stakeholder</b>	: Government Agency
<b>Years of Experience</b>	: More than 20 years
<b>VM Knowledge</b>	: Good
<b>Workshop(s) Participation</b>	: >20 workshops
<b>Performance Assessor</b>	: Independent Consultant

#### **PART A: PERSPECTIVE TOWARDS VALUE MANAGEMENT APPLICATIONS**

##### **1. How do you define 'value' from the perspective of the public projects in Malaysia?**

The funding of our public projects was based on the five years programs through the allocation of the development expenditures (DE). There are many projects that can be done within the amount put up by the government for those 5 years. But then, if you look at the number of project or the scope of the project that is requested by the ministries, compared it again to the amount of fund that the government has, of course there is a mismatch. So when you say value for the government projects, is that, how best can the project serve, to fulfil social obligation, economic

obligation and environmental obligation of the government. The more projects that we can do, that's mean more benefits to the public. This value perspective only came in quite later in RMK-10. Because of some bad experience the government has before this. Perhaps during that time, value was not really the main priority. Priority at that time was to turn up as many projects as possible. We don't really give higher ranking/priority to the value. More of quantity, rather than the quality. So starting from RMK-10 that's what the government has done. They said that in RMK10 there have to be value for money.

**2. Can you describe your experience and involvement in applying VM into construction projects?**

Not much actually. If you look into it, in term of number of years, VM actually was launch in 2011. VM per say. So now it's 2013. WE have got only 3 years' experience in applying VM. But if you were saying the concept of VM, the concept of VM has been apply long time ago in EPU. It has a different name, different terms. The practice and activities involved in project evaluation has incorporated the characteristics of VM, ever since 1960'. It's just that, we didn't call it as VM. The term used was standard and cost. Standard and Cost Committee. So the concept was there all the time. But then, if you want to describe as VM, it's only for the past 3 years.

**3. Do you think that VM can bring significant benefits for the construction projects?**

Yes! Yes! There are so many approaches into construction project to achieve value for money. Some people call it partnering, rationalise contract, all these, even the ideas of Public Private Initiative (PFI) also to get more value for money. That's the concept. But the implementation is another thing. Going back to VM, VM done so far by us, I can see there were lots of benefits already. In term of how you bring everybody, the stakeholder to the right track. Some of the stakeholders not sure on certain things. While PWD as the implementing agency not really sure the exact requirements of the client. That is the beauty of VM, when you bring everyone in the same forum. You can ask the person seating next to you, what is their decision and we can decide there and then.

**4. If yes, from which aspect it can contribute to the successful implementation of the projects?**

**5. If to compare with projects in which VM was not employed, do you think VM has significantly contributed to the successful implementation of the projects? What are the major differences did you observed?**

If you look at VM versus the conventional approach, VM bring everybody in one room. We can bring them in the same forum. You can ask them there and then. In the past, we still have the all the stakeholders, but it was like a one way communication. When we did JSK, toward certain extend, we only bring stakeholders together for project costing MYR 100 Mil and above, because of the existence of the JSK which was chaired by the EPU's director. They called for meeting, not

workshop, where they presented their case and we decide there and then. It has less interaction. It's still not a consensus gathering forum. It's still a matter of delivering the yes or no answer. That is the difference. At time, we do have the VM characteristics, but it was not in the true sense of the word.

#### **PART B: OVERALL PERFORMANCE OF THE VALUE MANAGEMENT WORKSHOP (8:10)**

##### **6. Do you satisfied with the organisation and implementation of the workshop?**

Towards certain extend, yes. I would say JKR, if you want to know the history, at first, few months before the workshop, they were reluctant to have this VM. En. XXX from KBS once asked me whether they can deferral from VM. So, but in term of implementation, I'm quite satisfied. Not so much because of what they prepared for us, but the ultimatum given by the minister. Minister said that we have to have this velodrome tender out this year. So, actually they have tendered out, the pre-qualification. While the minister gave his statement in the TV3 news, he said that "we will be using the existing facilities for SEA games except for the velodrome, which was tendered recently". So he was correct in a way. They have tendered out the pre-qualification. So they said when we want to do this VM, they were reluctant if the VM may delay the process. But finally, they were quite grateful that we did the workshop, to give the project proper perspective, sizing, direction. I would be happier if PWD has got a proper design for the velodrome. When I said design, I refer to a proper proposal, rather than looking at architectural impression. It will be easier for us, or easier for the members from central agency to look at thing and how we can improve from there. But now, if the base is zero, you cannot save from zero. If we have two, you can always say, why not we go to 1.5 is a better, because there a quantum there. Without the design, there is no quantum. It's really hard for us to look into it. We mainly based on the SOA, GFA, and the technical inputs from UCI and MNCF.

##### **7. Have you able to actively participate during the workshop?**

Of course. This is quite obvious isn't? That's the way of I conducting the workshop.

##### **8. Do you think that the workshop processes provides you the room to express your view and concern towards the project?**

Actually, we at SPN do not come up with the report. That report was based on what has been done during the four days' workshop. KBS will eventually come up with the report. So, we will review the report, whether it is ok, phrasing, template etc. Then we say we give them to go ahead. But to talk about actively participate and try to register our concerns, sometimes if you doesn't have it structured like what we did, the 6 phases, maybe I would say for myself, probably I have miss a lot of things. But since the workshop was structured in a way, so you have time and opportunity to rise up issues whenever it's needed. I you have issue concerning with the Arch, M&E, C&S, and those principles issues, so there a time frame for us to actually express our concern. Time allocated for each phases.

**9. Do you observed any domination by any participants or a particular group of stakeholders involved in the workshop?**

Maybe our team was dominant. Owh so what you mean was is there any stakeholder that tried to corner or manipulate to their advantage? I don't think so. I think everybody was quite open. I think the MNCF, who is supposed to be the beneficiary of this project, look like they were quite open. Maybe they were aware that the cost was so high primarily before the workshop. So I think they don't really insist on the fantasies. What are they required are basic things. All the gold plating, they have learnt from the first day that there is no room for that.

**10. Do you satisfied with the overall performance and outputs of the workshop?**

Yes. I must say that is one of the better workshops that we have conducted. From the perspective of achievement in ensuring everybody aware about the project. Mind you that some of the PWD officers were not aware about the VM processes. I think some of them have confided personally to me that this VM make them clear about what is VM now. Secondly, I think the VM make KBS and JKR realized that with this much of money, this is what we can do. So our objectives to marry the scope with the cost, I think it was a successful.

**11. If you being given the chance to facilitate/manage the workshops, what aspect that you want to improve?**

Firstly, the design will be good as a basis. Secondly, time management. We schedule to start at 8.30am but at 9.00am we were not able to start. But I think I've been in the workshop in and out, that is the basis thing, common problems. You know that they are adults. They came in today, but not coming in the next day. I want everybody, the whole group, and all the peoples to be there all the time. But then, it didn't happen in that workshop because people got other commitments. Some attended the first day, absent on the second day, came in again during the third day. Maybe we were lucky that they were aware of the process. I've been to other workshop, whereby they present on the first day, missing on the second day, and come again on the third day and asking the question that we have discussed on the second day. It's actually delaying the process. It's seems that he/she didn't consider what other have done when he/she wasn't around. If you don't control the time within the process, hence at the end you have to speed up, then a lot of things may be left out. I've gone through that also. During the first and second day, we have the feeling that it is going to be something hard and slow. For the velodrome, we were still at the information phase during the second day. The Fire and Rescue Department (Bomba) and representative from the Land Office only came in on the second day. I thought that I've gone through the process on the first day. But we still have to entertain them on the second day. We were still lucky that that when we realized that SOA is the biggest chunk of the project, and we formed a special group out of the discussion to concentrate on the SOA. I think that's what save us because somebody want 5-6 peoples to seat separate from the rest of the workshop, by having that its help the rest of the workshop to move on the right track.

## **PART C: PERFORMANCE OF THE VALUE MANAGEMENT (VM) WORKSHOPS PROCESSES**

**(19:10)**

12. Please comment on the following key Performance Indicators in relation to the workshop that you have participated.

*KPIs refer to the measurers that can be indicate as an objectives to be targeted that will add the most value to the organisation*

### **i. Clarification of the client's objectives**

Normally, when we first started VM in 2011, we really have a lengthy session for background, scoping, objective, and outcomes for project. During that time, we all new to the VM processes. In the end, we found at it is too lengthy process. So what we did after that is to give them the template during the pre-workshop meeting, they go back and fill up the template themselves. So, by doing that, we found that we can save a lot of times because the project objective is part of the project proponent's (client) domain. We don't determine their objective for them. Each ministry has their own objectives and KPIs to be achieved. So, our roles there are to question those which are not clear to us, and try to get them to clear about the objectives. That's it. There sometimes the stakeholders understand it differently. So we want to streamline that understanding. So that is what we are doing now. I think we managed to streamline the objectives of this project. Of course the MNCF as the end user have their own objective, so do the KBS as the parent, and JKR as implementer, I think everybody now understand.

### **ii. Clarification of the end user's objectives**

*Refer item i)*

### **iii. Clarification of the primary functions of the project**

I think so. Because luckily in this project, it was quite clear. UCI is a very clear benchmark, very clear guidelines, very clear yardstick for us to achieve. Unlike some other things was scribbler, without proper direction. Always UCI, because that is the main objective was to achieve UCI Category I classification. Even though we did the FAST diagram, they were not very clear. FAST diagram was not things that I dream to fill up. The diagram I presented was based on the Dell' Isola's book. I found out from the book, there is an example for build a stadium. So I tried to study. Stadium and velodrome have a similar nature. In fact the first day, during the information phase, I've got some idea already. Later that day, I alter the diagram because it is important to have three critical information; project's must, given and constraint before developing the FAST diagram.

### **iv. Clarification of the project's givens/assumptions**

In fact, it was not only during the workshop. During the pre-workshop, we have already pointed out that there are certain things that they need to get confirmation. Whether that strips of land

can be used, other function for it, usage for it. For the constraint, possibilities that we can share the car park, entrance, and some facilities in the existing stadium. We asked them to clarify those. The discussion started even before the workshop. During the workshop, we did bring the matters up to let everyone aware about it.

**v. Interaction between the workshop team members**

So far I've gone worst workshop than this one. In term of interaction, I think this is good, in the sense that all stakeholders are open. Not a single stakeholder has got some hidden agenda. Everybody is quite open. If that the case, if that is has to be, it has to be. For a certain project, there were certain parties got the hidden agenda. I usually handle Army projects, they have some sort of mandate given by their superior. You have to defend this idea, whether you like it or not during the workshop. So, it becomes very intense when you find a particular stakeholder hold on to their agenda cold heartedly. They were not tolerating at all, not even want to discuss that matter. So that creates some sort of friction, tense. In this velodrome workshop, they all are quite open. They accept all and go along with the decision. It does look like that on the surface.

**vi. Client's support towards the VM workshop implementation**

I hope that we have turned KBS from being a pessimist to be more optimists. I think that is what we have done, toward certain extend. They were reluctant at first. Even the Secretary General of the ministry called me, 2 weeks before the workshop and asking that do they really have to go into this VM. He said that his minister want everything fast. The minister doesn't want any delay. It look like that he was being pessimist, not believing that we can help them to expedite, but causing delay to this project. So we have proven that. I hope En. XXX covey to his top management, that they are clearer now, which direction to go, what action to take and what time they should take those actions.

**13. Is the any other significant indicator(s) that you observed during your participation?**

No.

**PART D: PERFORMANCE OF THE VALUE MANAGEMENT (VM) WORKSHOPS OUTPUTS (29.30)**

14. Please comment on the following KPIs in relation to the workshop that you have participated.  
*KPIs refer to the measurers that can be indicate as an objectives to be targeted that will add the most value to the organisation*

**i. Identification and clarification of the client's requirements**

I think it was clear. Client would be able to make a decision. As for the outputs, I'm quite satisfied. But still I have my own reservation. You know why? Because our report is still subjected to buying in, singing of by the stakeholders. So, I presume it's going to be Secretary General of KBS. Anything can happen after this. That is beyond our control. But as far as the outputs are concern, I

am quite satisfied. But that's not guarantee that whatever we have discussed in the workshop will be the end result, and implemented.

## **ii. Identification and clarification of the end user's requirements**

*Refer to item i)*

## **iii. Identification and clarification of the options/alternatives**

Taken as an example, the SOA from PWD, when we first look into it, I gave impression that we should be doing away with our "What is my right?", "What I should get". For instance, there were a lot of meeting rooms. It was provided in the SOA a particular meeting room for this, meeting room for that, and you have meeting rooms everywhere. So I said, if there is no competition/tournament, there is no tournament, can't they use media room as their office? In the end, it is possible. So those alternatives that we suggest is correct, something possible, provided that our mind set have to be ready for it.

As we work together, can we put the press conference room in the lobby? They have a special room for press conference, which is going to be held like once a year. So they learnt about sharing of facilities, when we visit the functions. You have a special room for the souvenir shops. When there is no tournament, who will come and visit the souvenir shops? So that's only happen once a year, worst, once in 5 years. It's even worst. If possible, we can utilise some spaces within the lobby area, pre-function area, or open area to carry out this function, so that we can save some floor space. Every single square feet that we build, the maintenance cost will magnify over the years. Of course you would like to have more. But you must prepare to actually take care of that space in 20 to 30 years' time. So linear we are now, the better we go in 5 – 10 years.

## **iv. Acceleration of the decision-making process**

I think so. First, we trigger KBS to go and see all different parties to get the confirmation about parking, entrance, strip of land. If we not embarked into this VM workshop, I do think that this project will drag and on and on. And PWD will end up with a very small site which can only manage to cater the building. Even during the pre-workshop I have thought that. I did asked PWD why don't you shift the building to the left side of the site? I was not clear that, the boundary of the site was there, not right to the car park. They said cannot because the boundary line is here, not here. Only then we figure out that and check if we can use that strip of land. We save a lot because we move away from the slope. If we stick with that earlier decision, not acquiring that piece of land, the cost might be higher.

## **v. Optimisation of project planning and scheduling**

Of course. We already had some discussions way back a few months before the workshop. However, during that time, even KBS wasn't sure which site is the actual site. They were still considering either Cheras or Negeri Sembilan. You have 2017 as the target for the SEA game.

Even until that stage, they were not sure. Until they saw me one week before the pre-workshop, they confirmed that the site will be in Nilai. Then only we proceed with the preparation for the workshop. To me, ideally we should have the workshop earlier. But that was not possible because the site wasn't confirmed. If we have decided on site earlier, then we will have better time frame to allow for construction and completion by 2015. That will be more comfortable. That would be just in time. The action plan managed to highlight the important milestone, but then we did not manage to make the best out of it. If we conduct the workshop earlier, we probably will have lengthier time.

#### **vi. Improvement to the overall quality/performance/appearance**

For appearance I can't say because we have yet to develop the design. Performance to me, if you take UCI classification as the yardstick, we were not tolerable on that. If UCI is the reason yes, go ahead. We decided not to change the flooring into local timber. In the end, we said we have to follow. In that sense, I think and I hope we should be, provided there are no glitches during the construction, we should be able to obtain the UCI certification. In term of quality, for the seat just now, I suspect the client might want to revert back to full back rest, since they have the extra, access money. We had actually saved a lot more than what we anticipated. About MYR 2 Million. So I think if, the first thing they want to upgrade is those seats. In fact, we granted an additional amount of MYR 1Million provisional sum for the furniture. If not, our final estimate would be MYR 76 Million. We have given back to make it up to MYR 78 Million. On top of that, I think they will make sure use the remaining 2 Million. So I think in term of quality, it was first drop to the lowest possible, and then they have this "shopping" exercise. So in term of that, I hope the quality will improve form there.

#### **vii. Improvement of the communication among stakeholders**

You observed the workshop, so how do you find it? I think they have started the networking. Because back then, representatives from Majlis Sukan Negara (MSN), Perbadanan Stadium Nasional (PSN) weren't involved at all, they not even meet the representative from PWD. From this workshop, they have already seat together, even during meals. In that sense, there are something good came out from the workshop. So much easier to deal in the future. So it's networking.

#### **viii. Satisfaction of the client**

If you defined client as En. XXX, because he was the only representative present all the time during the workshop, I think he was very satisfied, but I can't say for sure that his top management will satisfied as he is. They might have some other ideas, which are beyond our control. As far as you defined En. XXX as the client representative, I think he was very grateful we did that workshop.

#### **ix. Satisfaction of the end user**

Unfortunately we did not specifically ask PSN or MSN their input whether they were satisfied or not. Unlike for TNB, we asked TNB specifically. For MNCF yes, they were involved, they know what they are getting at. But as far as MSN and PSN are concern, we actually did not invite them to give any specific time maybe at the end of the workshop to say whether they are satisfied or not. In that sense, I cannot measure. But I hope, in general, since we cover a lot of things that will help them in a way. But throughout the process En. XXX, he's the one who played active roles from MSN. PSN did join M&E group when they discussed about the camera equipment. In a way, it is in the picture. Just that we don't have formal session for them. That's the beauty, during the group discussion, idea generation. Just that they were not presence all the time during the workshop.

#### **x. Quality and coverage of the workshop report**

OK. If you ask me, I would say there are a lot of room for improvement. The templates were prepared using MS Power Point. PPT to some peoples is a bit clumsy to change. What I have in mind, is to get somebody to look at our templates now, and try to help us out how best we can actually, you punch in this one, it can be transferred into the "can we" template, then proceed to the next template, without you have to type it again. So it's more of the information technology (IT). What we have right now is consumed time. I realized that. It's just that I'm not an IT expert. But I think the younger officer can do something. How to make the process more users friendly? Simplify it. But, to look at it from the positive perspective, actually in 2010, when we conduct our very first VM, our mentor during that time still using the overhead projector. We wrote our ideas using handwriting. That's how we did. If you consider that as the improvement, we have actually moved to a better format. But then, there's always improvement is the continuous process. After doing so many workshops, now I realized that we have to do the same thing all over again. You copy then you paste, it's quite tedious. Somebody told me that it won't cost so much. If you can spend 500K, you can have one. Maybe I should talk to the director about this matter. We'll see how it goes.

#### **15. Is the any other significant indicator(s) that you observed during your participation?**

No.

## **PART E: PROBLEMS ENCOUNTERED IN RELATION TO THE VALUE MANAGEMENT (VM)**

### **WORKSHOPS (49:39)**

16. Do you encounter any problems with the following domains of the VM workshop?

#### **i) The VM methodology**

The methodology, six phases will be the best to be deployed in infrastructure projects. But if you dealing with programs, it was really hard for us to review the programs according to the VM methodology. Some of the methods/approaches not fit to be applied for programs. It is best suited for the infrastructure projects.

#### **ii) The techniques and tools**

As I said earlier, perhaps we need to improve the formatting of our workshop report. In term of the techniques, I would say that, a facilitator should also have the art of persuasion, the art of negotiation, and the art of expression himself/herself. Because that is what I think will carry you, take you far to be a good facilitator. The facilitation skills are important. It shows how you treat your communication techniques with the participants.

I would say there are a lot of room for improvement. The templates used during the workshop, and subsequently be part of the report were using MS Power Point (PPT). The PPT format to some peoples is a bit clumsy to change. What I have in mind is to get somebody to look at our templates now, and try to help us out how best we can. Say, when you key in one item (idea), it will also appear/link to the other templates, without having you to re-type the idea once again. It's more on looking into the possibility of exploiting the information technology (IT). What we have right now is consume time. I realized that. It is just that I am not goo in IT. But I think the younger officer can do something, in term of how to make the process more users friendly. We should simplify the process to make it easier and efficient.

Having said that, if we were to compare what we have today with what we used to use back then in 2010, I have to say there were improvement already. The consultant employed during that time still using the overhead projector and using his own handwriting during the workshop process. But then, there's always an area for improvement. Improvement is the continuous process. After doing so many labs, now I realized that after you key-in one of the items, you have to copy then you paste, it's quite tedious. Somebody told me that it won't cost so much to develop the system. If you can spend 500K, you can have one. Maybe I should talk to the director and see what the possibility is.

#### **iii) The outputs**

Output. If you consider that report as the output, it is still fresh, still new. The next question is whether we can convince the top management to agree and sign that report.

**iv) Logistic (duration, venue, facilities, food & beverages)**

I have no problem with the logistic, duration, F&B, and the venue. It is just that the availability of the participants throughout the workshop.

17. Do you encounter any problems with the following stakeholders of the VM workshop?

**i) Facilitator(s)**

So far I have no problem. I think they were quite committed. There were tried to help up, whenever they can.

**ii) Client**

For the Ministry of Youths and Sports (KBS), so far I think it's difficult to measure now, since this is the first time for them having VM into their project. They might still in the cautious at this stage. But later once they have better idea about VM implementation, it probably will change. As for now, they just follow. In that sense, I have no problem with them.

**iii) End User**

En. XXX and En. XXX from Malaysia National Cyclist Federation (MNCF) doesn't impose (required) many things. They just expressed their concern when we discussed about the function of the velodrome, in term of the usage to host the tournament, locally and internationally. However, I am also afraid if they hold back anything after realizing the constraints, especially on the budget. The other possibility was they were not giving the mandate to say so.

**iv) Other participants**

I would prefer if all participants can commit from day one until the last day. But yeah, it was really hard, especially for those from PWD. For example, the C&S engineer was on and off during the workshop. When we were about to finish, then only he came into the workshop. He wanted to add these and remove these. It has affected the process and flow of the workshop. Another thing, at one time I was mad at the organizer. One of them has accidently deleted the files from the C&S group. Maybe he wasn't sure which one to delete, even I told him to safe the master copy. So I was taken aback that time.

**18. Do you encounter any difficulty in participating and contributing to the success of this workshop?**

*(e.g confidence level, knowledge in VM, experience in VM, negative perception towards VM, decision authority)*

I was thinking that I may over acting during the workshop. Whenever I have the chance, I really want to talk.

## APPENDIX F: SAMPLE OF VALIDATION SURVEY

### RESEARCH VALIDATION

#### **STRATEGIC PERFORMANCE MANAGEMENT FRAMEWORK FOR VALUE MANAGEMENT IMPLEMENTATIONS IN THE CONSTRUCTION INDUSTRY**

Strategic performance management framework has been developed to support the applications of VM in the construction industry. The framework presents the causal performance relationship between the components related to the VM applications, mainly focusing on the critical success factors (CSFS) and key performance indicators (KPIs) for VM implementations in the construction industry.

The data used as the basis of the framework development were obtained from the questionnaire survey and semi-structured interviews of the participants in five real-life VM workshops for public projects in Malaysia.

The objective of this validation process is **to evaluate the proposed strategic performance management framework based on various criteria**. All the collected information will be kept **confidential**.

Should you have any query with regard to this research validation process, please do not hesitate to contact us.

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*Associate Professor*

BSc, MSc, PhD, MIVM, MHKIVM, MAIB

Please select (√) in the appropriate box the relative score for each criterion to present your extend of satisfactory level on the proposed model/framework.

		Performance Management Framework				
Features	The interrelationships between the components for VM implementation					
Validation Criteria	Poor -----> Excellent					
	1	2	3	4	5	
Comprehensiveness <sup>1</sup>						
Reliability <sup>2</sup>						
Practicality <sup>3</sup>						
Adaptability <sup>4</sup>						

**Definition of the criteria**

**<sup>1</sup>Comprehensiveness**

The degree of the framework that is more likely to be a complete representation of constructs that is necessary in VM applications and implementations within the construction industry.

**<sup>2</sup>Reliability**

The degree of the framework that is reliable to be source of reference in relation to the practices of VM studies within the construction industry environment.

**<sup>3</sup>Practicality**

The degree of the framework that is realistic in nature and practical to be used by stakeholders of the VM study and stakeholders of the project.

**<sup>4</sup>Adaptability**

The degree of the framework that is easily to be used by the stakeholders of the project that would like to embark into VM studies for their project.

**Please specify any comment, recommendations, or suggestion with appropriate justification to improve the proposed framework further.**

.....  
 .....  
 .....  
 .....  
 .....

**PERSONAL INFORMATION**

Name	:	
Position	:	
Organisation	:	
Academic qualifications	:	
Industry experience	:	
VM knowledge	:	
VM experience	:	



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