CHAPTER 1

INTRODUCTION

1.1 Background of Study

Value of a construction project is determined by various factors such as the geography, population, purpose and etcetera. But, the most overlooked factor in Malaysia, and the most important factor, is the management of the project itself. The reason being, only within the construction phase, you can still manage the cost, materials and material acquisition. The way these factors are managed will seriously affect the final value of a project.

It was found that the management of the project was overlooked mainly because, lack of awareness. There is a serious lacking of awareness among decision makers in a construction project, on what really determines the value of their project. To overcome this, Value Analysis is the most suitable answer.

As defined by the Office of Management and Budget of America, value analysis (VA) is "an organized effort directed at analyzing the functions of systems, equipment, facilities, services, and supplies for the purpose of achieving essential functions at the lowest life-cycle cost consistent with the required performance, reliability, quality, and safety." VA is the most generalized term associated with the application of value-based processes. Other terms include "value management"(VM) and "value engineering"(VE). Historically, VM has focused on organizational and management processes, while VE has been applied to manufacturing processes and procedures. In the construction industry, the terms have been used interchangeably and often applied to cost reduction efforts that use few, if any, value-based processes. To start afresh, the term "value analysis" is used in this study.

The benefits of applying VA are achieving better value for money in satisfying the customer's need, savings in project costs by elimination of unnecessary cost, better understanding of the project's objectives, enhance the function of the project, improved team-working among the construction professional, and enhanced creativity through interaction of different professionals and external experts in construction field.

1.2 Problem Statement

Even though the VA concept has been widely accepted in other countries like U.S. America and Japan, and providing huge success, Malaysia is still behind in this category. Not only there is only little implementation in the construction industry, but also in other industries. It is necessary to understand the current state of VA implementation in Malaysia's construction industry, and measure its effectiveness in increasing value of a project. By doing this, we can show in an organized and objective way, that VA can be implemented in Malaysia's construction industry to improve the value of a project and subsequently, increasing the profit margin.

1.3 Significance of Study

This study is necessary as Malaysia is severely lacking in the VA implementation. In U.S. America, there are a law that dictates to utilize any value based method in handling any projects. Although there is some level of awareness about it, but the effort to promote it widely in Malaysia is severely lacking. There is no continuous study done by any government bodies to track the usage of VA. Studies on VA in Malaysia have always been done by private parties, they are so far and between, and the impact is minimum (Lai and Bachan, 2005). It is hoped, that through this study, the awareness of VA in Malaysia will improve, so that any government bodies in Malaysia will take this matter seriously.

1.4 Objectives

- To determine the state of VA awareness and understanding in Malaysia's Construction Industry
- To determine the state of VA implementation in Malaysia's Construction Industry.
- To measure the effectiveness of VA implementation in Malaysia's Construction Industry.
- To identify investigate the obstacles and drivers in implementing VA in Malaysia's Construction Industry.

1.5 Scope of Study

- The survey will be focused on stakeholders, who are involved in the construction industry in Malaysia, ranging from contractors, consultants and clients.

CHAPTER 2

LITERATURE REVIEW

2.1 What is Value Analysis?

VA is an organized/systematic approach directed at analysing the function of systems, equipment, facilities, services, and supplies for the purpose of achieving their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety (Dell'Isola, 1988). The implementation of the VA process on a problem typically increases some combination of performance, reliability, quality, safety, durability, effectiveness, or other desirable characteristics. Because "costs" are measurable, "cost reduction" is often thought of as the sole criterion for a VA application. However, the real objective of VA is "value improvement," and that may not result in an *immediate* cost reduction (Kinnan and Martin, 1997)

In fundamental terms, VA is an organized way of thinking or looking at an item or a process through a functional approach. It involves an objective appraisal of functions performed by parts, components, products, equipment, procedures, services, etc., basically anything that costs money. VA is performed to eliminate or modify any element that significantly contributes to the overall cost without adding commensurate value to the overall function.

VA is not primarily centred on a specific category of the physical sciences; it incorporates available technologies, as well as the principles of economics and business management, into its procedures. When viewed as a management discipline, it uses the total resources available to an organization to achieve broad management objectives. Thus, VA is a systematic and creative approach for attaining a return on

investment (ROI) by improving what the product or service does in relation to the money spent on it (Dell'Isola, 1988).

2.2 History of Value Analysis

VA evolved in 1940s, during the World War II, when shortages of materials and labour forced the companies to look for other substitutes. Harry Erlicher and Lawrence Miles, employees of General Electric Company in America, are the pioneers who developed a system of techniques called VA, that when applied to production processes, made significant improvements that happen systematically rather than by accident. These methods were developed and applied to other industries. Later the name of VA changed to VE. Today the two names are used synonymously (Cheah and Ting, 2005).

The VA technique was subsequently introduced into construction by the US Navy and the Army Corps of Engineers circa 1963 through the adoption of incentive provisions and sharing clauses in construction contracts. Over a short period, other public agencies in the US, such as the Department of Transportation and the General Services Administration, followed suit. Outside the US, VA practices and applications were introduced in Japan, Italy, Australia and Canada – all during the 1970s. Construction-oriented value engineers were also found in India, South Africa, England, France, Sweden and Germany. Successful applications had been reported in many cases of construction projects (Shekvet and Celik, 1999).

2.3 Value Analysis in Construction Industry

VA has been used in the construction industry up to about 1970s, to introduce the use of VA more widely, especially in construction industry, the Bureau of Reclamation provided training course to its engineers in 1965. Soon after that year, the stated the VA clause in construction contract in 1966. Then in 1969, US Public Service of the General Services Administration started to set up VA Program.

In the twelfth annual conference of Society of American Value Engineers (SAVE) in 1972, emphasized on the use of VA in construction industry. (O'Brien, 1976) VA is now a growing management tool in the construction industry as well and many

construction clients and firms have adopted the VA approach to improve teamwork and maximize value-for-money.

2.4 Benefits of Value Analysis

VA has been proving, time and time again of its usefulness. VA is capable to give benefits to all parties. The best part is, not only the parties who are involved in the project will reap the benefits, but also the public. The benefits of VA (Kadir and Arazi, 2008):-

I. To achieve optimum value of money in satisfying the customer's needs

The decision to build, refurbish or extend premises or facilities involve a huge investment of time, effort and money. So that it need to using VA to achieve the construction customer's needs and reach the optimum value for money and provides a first step in understanding VA for the construction customer, their consultants and contractors.

II. Elimination of unnecessary cost

The traditional cost planning approach has its defects and every design contains certain amount of unnecessary cost which does not contribute to function in the proposed project. In order to minimize all the unnecessary cost, VA should be applied.

III. Enhance the function of a project

VA has the general aim of giving the client value for money. But it focuses upon function and searches for alternative ways in which these functions can be performed. It will question that part of the cost which does not contribute to function, for example the unnecessary cost.

IV. Reduce the cost of a project without adversely affecting the quality or performance of the project

Besides, a further benefit is that when implementing a VA study, it is possible to identify project constraints or problems and to develop strategies to manage those problems that happen at any stages in the construction process whether from feasibility stage or construction stage.

V. To arrive a more effective design

One of the objectives of implementing VA is better understanding of the customer's specific needs, in simple, clear terms. So the VA team will considers all the options, alternatives and innovative ideas to produce a more effective design to achieve the optimum value for money in satisfying the customer's requirements. In addition all professionals are allowed to make suggestion to create solutions for the more effective design.

VI. Existing of VA Manual

Since 1947, the application of VA has greatly increased around the world and it still continuous to expand. A VA manual or standard had introduced by SAVE International Professional Certification Board to defines the commons terminology, it also including the standardized job plan methodology, typical profiles of the Value Manager, Value specialist, duties of a VA team, glossary etc. This manual can be used by the VA team to perform a VA study for any construction projects.

2.5 Timing for Application

For civil engineering works such as buildings, highways, factory construction, and water or sewage treatment plants, it tends to be one time applications. Since these are one-time capital projects, VA must be applied as early in the design cycle to achieve maximum benefits. Changes of design can be accomplished without extensive redesign, large implementation cost, and schedule impacts. Usually for large construction projects, specific value studies are conducted during the schematic stage and then again at the design development (up to 45%) stage. Additional value studies may be conducted during the construction or build phase (Bryant, 1998).

VA can be implement in any stage in the development of a project, there is no rules about the VA study duration. The 40 hour job plan methodology is one of the well-established duration. Adequate justification for use the time and resources on VA activities need to be considered when a VA study is initiated. There are several key indicators which may be used by managers to provide the necessary justification:

- Potential for saving.
- Complex, high cost or innovative projects.
- Project acceleration.

Most people in the industry would prefer to implement VA at the early stage of a project's life. This is because the earlier in the design process that the study is undertaken, the higher the cost reduction potential and the lower the unnecessary design costs. Therefore, delay of the application of VA study until the construction phase would be limits its potential of cost reduction. (Please refer figure 2.1)

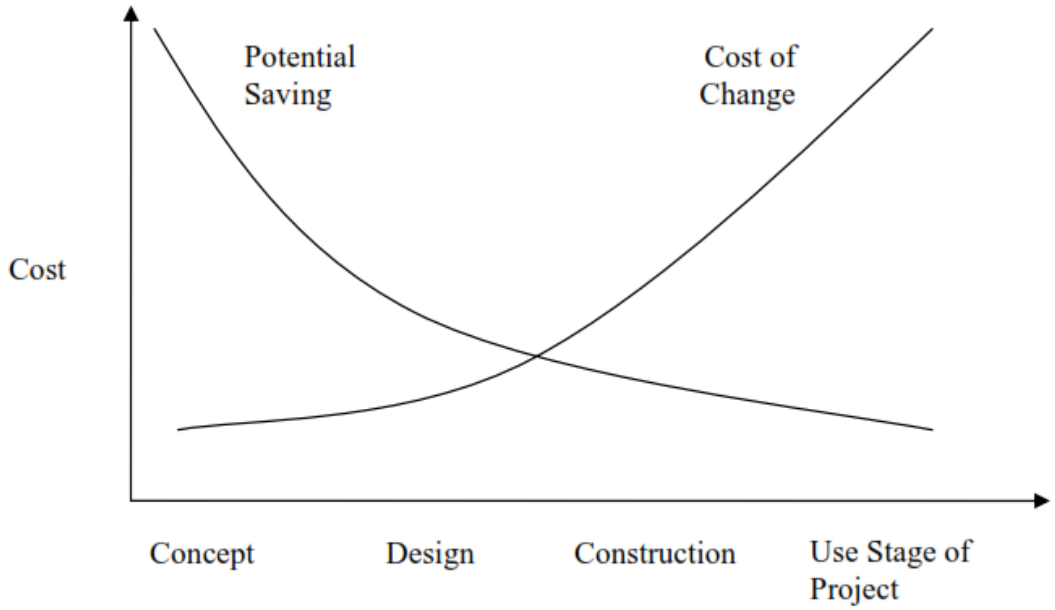


Figure 2.1: Potential Saving To Cost of Change (Source: Mazlan, 1998)

Hasnan (1994) also believe that the maximum cost reduction potential occurs early in the briefing or design process. In the traditional design process, the preliminary estimates and financial analysis taken almost 20 times to achieve a satisfy situation. This is due to so many respective consultant and they provide different ideas and assumption base on their own area of expertise.

But while implement the VA study, the VA workshop process will explore the overlapping area of knowledge and experience between various disciplines and expertise (Please refer to figure 2.2). So the time taken to prepare the design plan is much reduced.

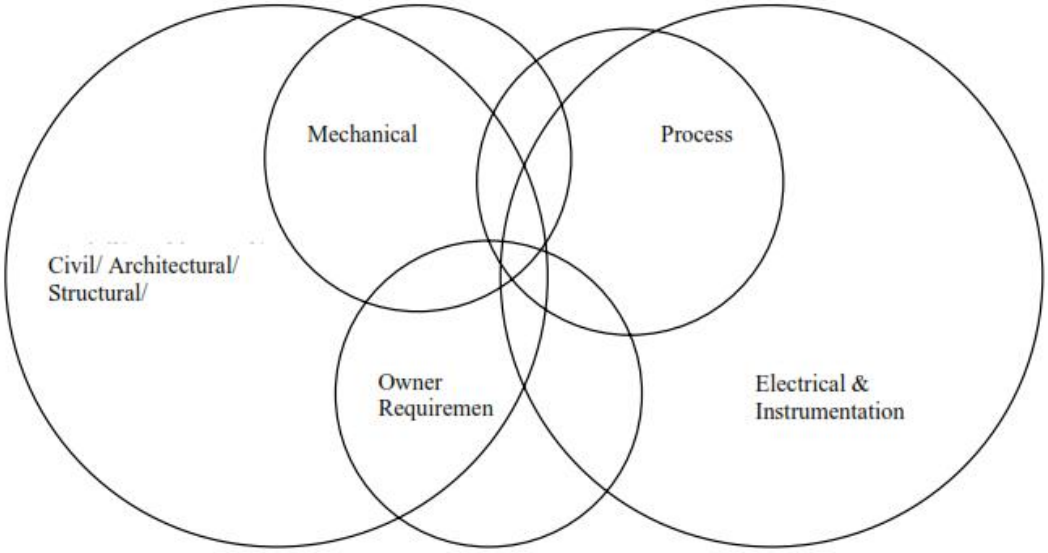


Figure 2.2: Constructive Overlap (Source: Mazlan, 1998)

2.6 Composition of the Value Analysis Team

Basically, a VA team includes a trained and experienced, independent VA facilitator from within or outside of the organisation; the client; the project team and any other stakeholders including end-users. The main way in which VA is implemented is through structured workshops led by value manager. The qualities that a good facilitator will require include:

- Authoritative leadership
- Analysis of complex problems
- Managing a team as a facilitator
- Understanding of project's relationship to the customer's organisational and strategic policy
- Sensitivity to influence of organisational politics and hidden agendas
- Securing the confidence of workshop participants and senior managers
- Ability to encourage search for innovative solutions
- An understanding of construction projects

As Kelly and Brown (1990) suggested, the VA team should include normally six to eight professionals, who may or may not have previous VA experience. But if is for

heavy engineering projects, the professionals with engineering backgrounds should be included.

Indirectly, this means that the VA team members may have varying expertise, background and experience. He or she may be a civil engineer, structural engineer, quantity surveyor, architecture and have expertise outside the construction field. However, it doesn't really matter who is involved in the VA team. But it is important that the team is multidisciplinary and contains a wide range of expertise. In addition, the team composition should also reflect equal organisational status.

Besides that, an appropriate VA study participant should have the characteristics of:

- Superior mastery of the individual's area of technical expertise;
- Above average creative abilities and skills;
- Have desire to improve the project;
- Above average communication skills; and
- Ability to get along with people.

After the characteristic of the team members has been identified, there are generally three ways to assemble the VA team:

- Use the present professional team
- An outside professional team of architects, engineers and quantity surveyor are gathered together to look at the scheme once again
- Integrate the existing professionals with client's representatives

Although these three ways of assembling the VA are different, each way has its own advantages. The existing team is familiar with the details of the project, as a result it can reducing the time required for briefing and transfer of information.

2.7 Implementation of Value Analysis Practice

For small or occasional construction customers implementing and maintaining a VA approach might include:

- Attending VA awareness seminars
- Training an in-house value manager/facilitator
- Trying a VA exercise
- Collecting and maintaining an information database
- Feedback from post project review to demonstrate level of VA success achieved.

2.7.1 Project Selection Techniques

In the construction industry, there are thousands of items involved in this field. Every item of potentially low value and high cost must be identified before the VA approach can be applied. It is not an easy task to find out items or areas that represent the unnecessary costs.

However, there are some techniques can be used to find out items or areas that are potentially low value and high cost such as analysis of previous study areas, study of life-cycle cost impact and breakdown analysis.

2.7.2 Analysis of Previous Study Areas

During the operation of the VA program, source of information and areas previously studied can be used for selecting projects, Dell' Isola (1988) mentioned that the experience of the application of VA and analysis of data from organizations with VA program can develop approximately 30% of savings.

2.7.3 Life Cycle Cost Impact

Life cycle cost for an item defined as overall cost exists in the item life time (Rosnah, 2005). Life cycle cost in construction process including preliminary design cost, detail design cost, construction cost, testing cost, operation and maintenance cost, and finally is demolish cost. Refer to figure 2.3, life cycle cost started from the concept phase which is to identify the customer needs and end by demolish activity.

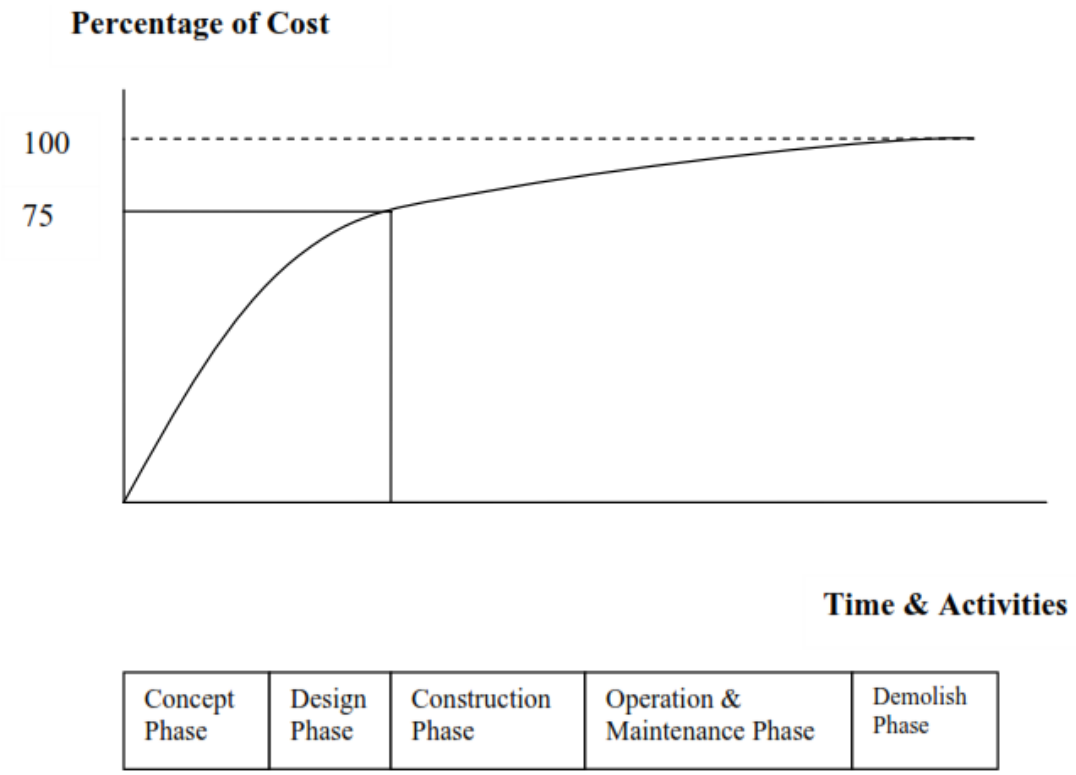


Figure 2.3: Life Cycle Cost in Construction

Commonly the life cycle cost for an item can be divided into collective phase and operation and maintenance phase. Collective phase started with the activity to identify the customer's needs to achieve requirement function in the project. It is in the initial stage in the construction process which including concept phase and preliminary stage of design. While the operation phase is included the construction stage, operation, maintenance and last with demolition.

Refer to figure 2.3; it proves that 75 percent of the life cycle cost come from the collective phase which is includes the concept phase and preliminary stage of design. Therefore it is a critical phase to find out items or areas that are potentially low value and high cost and it can be eliminated.

2.7.4 Breakdown Analysis

In breakdown analysis, the systems, subsystems, and special equipment are ranked from highest to lowest in terms of total cost per unit to describe the distribution of expenditures. The analysis is further refined by breaking down unit costs into functional areas such as electrical, mechanical, and structural. This analysis is based on the principles expressed by Pareto's law.

Pareto's law meaning that 20 percent of the system elements contain the greater percent (80%) of the overall cost (Dell'Isola, 1988). Therefore a small number of elements will contain the greater percentage of unnecessary costs. During the VA study, all these elements will be analysed to identify the greater amount of unnecessary cost.

2.8 Value Analysis Methodology

There are several approaches or methodology can be selected to implement the VA in the construction industry which includes the, 40-hour job plan methodology, The Value Analysis Audit, The Contractor's Change Proposal, and Japanese 3 hours Compact Value Engineering Program.

2.8.1 The Value Analysis Audit

The value analysis audit is a service offered to value managers by large corporation companies or government departments to review expenditure proposals put forward by subsidiary companies or regional authorities (Hasnan, 1994).

In this approach, the value manager will visit the subsidiary companies or the regional authorities and undertake a study of the proposal from the perspective of providing basic functions which normally last for one to two days following the procedures of the job plan. After the study, the value manager will submit a report regarding the most cost-effective approach to provide the basic functions.

2.8.2 The Contractor's Change Proposal

This is a post tender change approach made by the contractor. In this approach, the client may include a clause in the conditions of contract which states that the contractor will receive a certain percentage of the cost saved if the change submitted is accepted by the design team. This is to encourage the contractor to recommend the effective solutions to the project.

This is considered to be a low cost approach because it uses the creative talents of contractors and the expertise of the contractors, especially on the technical aspects of the projects. But it may also delay the progress as the design team has to evaluate the changes proposed by the contractors.

2.8.3 Japanese 3 hours Compact Value Engineering Program

The Society of Japanese Value Engineering has developed a compact "3-hour Value Engineering program" for the use on construction site to improve construction methods and allocation of resources. In this approach, it focuses on the potential parts for improvement. But unlike the formal 40-hour workshop, this approach only lasts for 3 hours. A compact studies will be carried out frequently on construction sites (Phuah, 2000).

2.9 Value Analysis Job Plan Methodology

This 40-hour workshop is the most often adopted approach in VA. As defined by Hasnan (1994), it involves the review of sketch design of a project by a second design team within a working week under the chairmanship of a value manager. The procedures of the workshop are briefly outlined as follows:

- The client informs the design team of the intention of implementing a VA exercise,
- The client appoints the VA Team Coordinator (VATC or the value manager)
- The VATC appoints a VA team,
- The workshop is held either in a hotel or in the client's office,
- The workshop commences and the team follows the methodology of job plan.

Based on the VA standard introduced by SAVE, the VA job plan will cover 3 major periods of activities which include Pre Study, VA Study and the Post-Study (Bryant, 1998).

2.9.1 Pre-Study

In this stage, it will include the preparation tasks which involve six areas such as identify client's needs, gathering a complete data file of the project, determining evaluation factors, scoping the specific study, building appropriate models and determining the team composition.

2.9.1.1 Identify client's needs

The objectives to identify the client's needs are:

- Identify the importance of characteristics of the product or project
- Determine the degree the seriousness of client's complaints of the product or project

When the project is just started like a new construction project, the analysis may be tied to project goals and objectives. The results of this task will used in the Information Phase.

2.9.1.2 Gather and Complete Data File

Sources of information can be divided into Primary and Secondary. People and documentation are the primary sources. People sources include clients, original designer, architect, quantity surveyor, the builders (manufacturing, constructors, or systems designers), and consultants. While the drawings, project specifications, bid documents and project plans are part of the documentation sources.

Literature such as engineering and design standards, regulations, test results, failure reports, and journals articles are the secondary sources. Another major source for secondary source is through site visitation by the VA team.

2.9.1.3 Determine Evaluation Factors

The VA team will determines and discusses with clients what will be the criteria for evaluation of ideas and the relative importance of each criterion to final recommendations and decisions for change.

2.9.1.4 Scope of the study

The scope statement for the specific study will be developed. This statement defines the limits of the study based on the data-gathering tasks. The limits are the starting point and the completion point of the study. The scope statement also defines what is not included in the study.

2.9.1.5 Build Model

Based on the scope statement, the team may compile models for further understanding of the study. These include models such as cost, time, flow charts, and distribution for each study.

2.9.1.6 Determine Team Composition

The study team composition is reviewed to assure all necessary customers, technical, and management areas are represented. Value Manager will confirm the actual study schedule, location and need for any support personnel.

2.9.2 Value Analysis Study

The study or session usually follows an organized and systematic job plan, which is strongly stress by VA methodology. It should compromise of the following common stages:

- Information stage
- Functional Analysis stage
- Creativity stage
- Evaluation / judgement stage
- Development stage
- Recommendation stage

2.9.2.1 Information stage

This phase of the workshop is purposed to obtaining and understanding of the system, operation or item to sharing and dissemination of information relating to the project includes identifying the problem situation like high cost areas and identifying the project functions at the high cost areas. The more chance to reduce the project's cost where there is a problem in a particular areas or elements (Goldhaber and Macedo, 1977).

The project clients and/or designer brief the VA team to provide an opportunity for them to ask questions based on their data research. If a site visitation was not done during Pre-Study, it should be completed during this phase. Finally, the scope statement is reviewed for any adjustments due to additional information gathered during the Information Phase.

2.9.2.2 Functional Analysis stage

In this phase, the function of the project is identify and analyzed (Goldhaber, et al, 1977). It may be represented in a hierarchical format and displayed on a function diagram. Function Analysis is basically a disciplined approach to meet the needs and required functions.

Function Analysis System Technique (FAST) diagram was used to illustrate how depending functions are graphically arranged to allow for "how" and "why" questions to be addressed logically. The technique assisted in the analysis of each function to eliminate unnecessary processes and provides a framework to seek better ideas or options. It is a useful technique to determine the function interrelation in analysing a whole system or a major portion of a system and gives a better understanding of the interaction of function and cost (Miles, 1989).

It is proved that by using the FAST diagram, it can concentrate the mind of the VA team to a concept to identify the functional requirement. They also can identify the item of the project which requires higher cost but functional approach is relatively low (Hasnan, 1994).

The FAST diagram has developed to suit various situations over the years. In the functional analysis stage, the team will perform the following steps (Bryant, 1998):

i. Recognize functions of the product, project, or process. This is often referred to as Random Function Definition.

ii. Categorize the functions as basic or secondary

iii. Make a function Model - Function Analysis System Technique (FAST) diagram.

iv. Assign cost or other measurement criteria to those functions

v. Establish worth of functions by assigning the previously established client's needs to the functions

vi. Compare cost to worth of functions to establish the best opportunities for improvement

vii. Choose functions for continued analysis

viii. Refine study scope

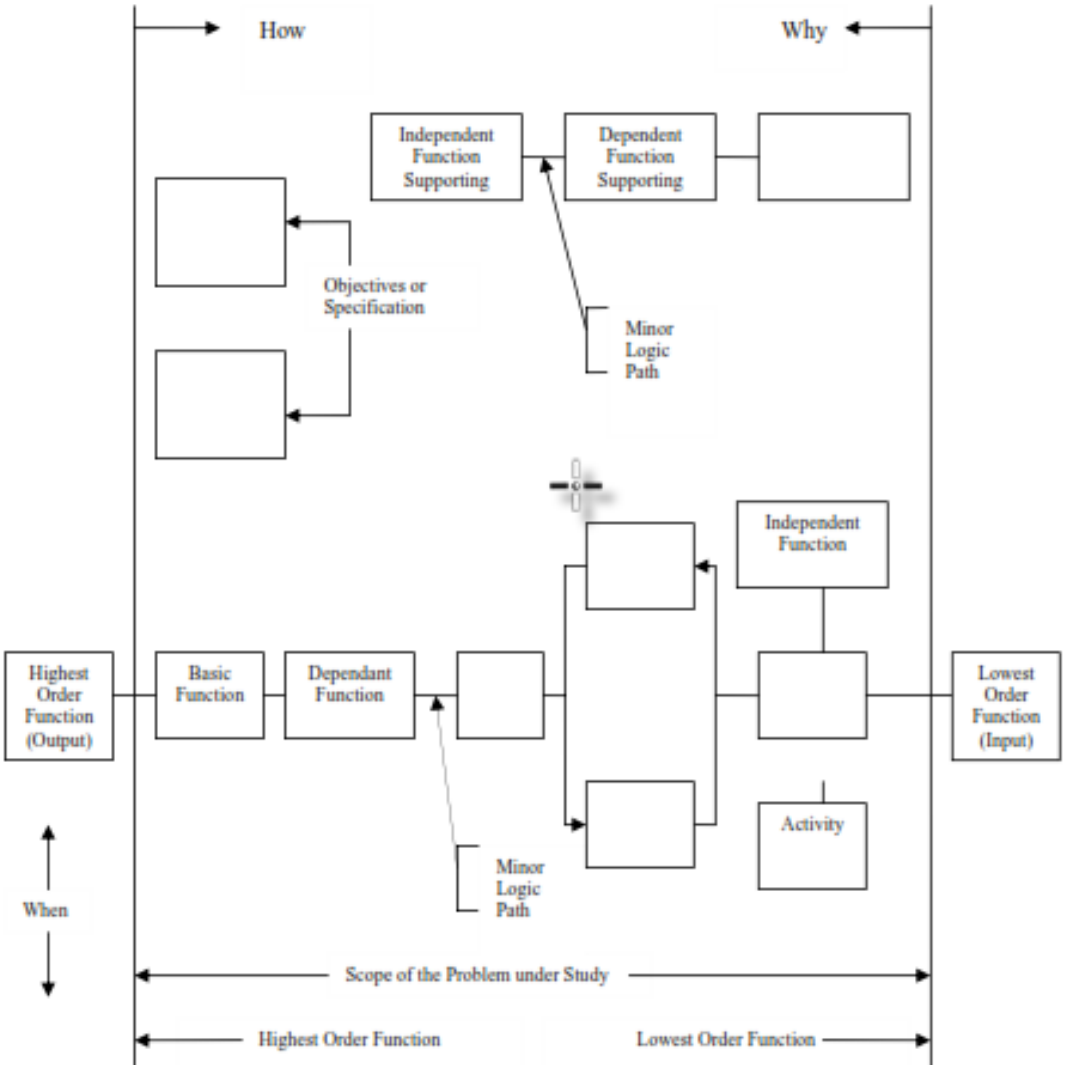


Figure 2.4: The basic FAST diagram (Source: http://www.value-eng.org/)

2.9.2.3 Creativity / Speculation stage

In the creativity phase, the VA team will explores the alternatives approaches for achievement of functions, and generates alternatives by creativity simulating techniques, such as brainstorming. During this phase, the question will be asked is "what else will perform the required function?". More outstanding of solution will be develop when there is a greater amount of alternatives generated. (Goldhaber, et al, 1977) And the ideas generated were focused on the basic functions established at the earlier stage. Then all ideas will be evaluated and developed in the next stage. Creativity is a mental process in which past experience is a combined and recombined to form new combination. The purpose is to create new combinations which will perform the desired function at less total cost and improved its performance.

Brainstorming

Azlan (2005) mentioned that brainstorming is a lateral thinking process which can help to break out of thinking pattern into a new ways of looking things. It is also a tremendous way of establish positive thinking and develop creative ideas and solution to a specific problem. The ideas should be develop as fast as possible and create as broad as possible during the brainstorming session. No criticism of ideas during brainstorming session because the judgment and analysis at this stage will stunt idea generation.

2.9.2.4 Evaluation / Judgement stage

Evaluation phase uses the list of ideas produced in the creativity phase to search for and come up with one or two approach that will meet the needs of the client and project. The ideas selected for evaluation should be determined on the basis of:

- Probability of significant saving
- Available of time and resources
- Probability of implementation
- Probability of developing alternates of lower life cycle costs

Jamal, Khalid and Reena (1997) mentioned that the evaluation phase was carried out in two stages. In the first stage, all suggestion was studied and those that could not be adopted because of the quality and reliability reasons were eliminated. In this stage, VA team member will evaluate both advantages and disadvantages of the ideas selected. After that, short listed ideas were critically studied with respect to feasibility, practically of production and other factors. Those ideas that have potential for cost savings or improvement to the project are then developed further. If none of the ideas meet the criteria, the VA team will returns to the creativity stage (Bryant, 1998).

Evaluation Matrices

The prioritizing matrix and the weighted evaluation matrix in Appendix I are usually adopted by some practitioners during this evaluation stage. The prioritizing matrix is adopted to determine the team perception of the importance of various factors relating to a single item, products or system. The weight evaluation is used to assist in the evaluation of range or options available relating to a particular problem.

2.9.2.5 Development stage

The objective of the Development Phase is to select and prepare the "best" alternative(s) for improving value. And also develop final written recommendations for the surviving alternative. This process will involve detail technical, economic evaluation and consideration of the probability of successful implementation (Macedo, Dobrow and O'Rourke 1978).

This stage consists of a critical and detailed analysis of the ideas selected for further studied. The process in this phase must include:

1) Start with the highest ranked alternatives, develop a benefit analysis and implementation requirements, including estimated initial costs, life cycle costs, and implementation costs.
2) Carry out performance benefit analysis.
3) Gather technical data package for each proposed alternative:
    a) Written descriptions and sketch of original design and proposed alternatives

b) Clearly showing the differences of cost and performance data between the original design and proposed alternatives
c) Technical back-up data such as information sources, calculations, and literature.
d) Analysis of the overall impact of the change.

4) Implementation plan established which including proposed schedule of all implementation activities, team assignments and management requirements.

2.9.2.6 Recommendation stage

This stage comprises two phases, first is visual presentation followed by a written report submission to the clients. The presentation encompassed the various stage outcomes and the final recommendations put forward to the clients for their consideration and approval to implement the recommended alternatives. The presentation may be in oral or written form.

It is up to the value manager to determine the real reasons. The job of the value manager is to identify the problem, make a diplomatic approach, and logical reasoning, thus reducing the probability of failure. If the proposal depends upon a generalized statement, the validity of the entire study may be doubted.

This phase of the VA job plan includes the following steps (Goldhaber, et al. 1977).

1) Written report showing consideration and calculation involved for every alternatives.
2) Preparing and presenting the VA proposals
3) Presenting a plan of action to show areas of increased value to ensure implementation of the selected alternatives
4) Obtaining a decision of positive approval
5) Written final report and confirms the implementation plan accepted by clients.

2.9.3 Post-Study

After the VA proposals has approved, it must be implemented as soon as possible. The recommendations must be converted into actions. The VA team should be required to prepare first drafts of handbooks, specifications, change orders, drawings,

and contract requirements. Such drafts help to ensure proper transformation of the idea into action to monitor progress of final implementation. VA team should responsibility to implement the VA change. Progress should be reviewed periodically to make sure that the roadblocks which arise can be overcome (Goldhaber, et al, 1977). In post-study, the team will perform following steps:

1) Provide assistance, clear up misconceptions, and resolve problems that may develop in the implementation process.
2) Minimize delays encountered by the proposal in the implementation process
3) Audit actual results for comparison with what originally had been expected
4) Submit to clients a report on the cost savings.
5) Submit to clients a report on any technical innovations so that they can be considered for other projects.
6) Identify any problems and recommend corrective action for the next project.
7) Obtain copies of all completed implementation actions as information for future projects and VA studies.

In short, the established of VA methodology has proved that it can be eliminate the unnecessary cost. This systematic process helps the design team to improve the understanding client's requirements. Besides, it also offers optimum value for money. Table 2.1 shows the comparison of VA approach. While Figure 2.7 shows the timing of application of for different VA Methodology**.**

Table 2.1: Comparison of VA Approach (Source: Fong, et al, 1998)

VA approach	**Duration of study**	**Time of study**
Value Analysis Job Plan - 40 hour workshop	5 days, 40 hours	After sketch design
The Value Analysis Audit	1-2 days	Briefing stage
Contractor's Change Proposal	Not regular	Site operation
The Japanese Compact Study	3 hours	Site operation

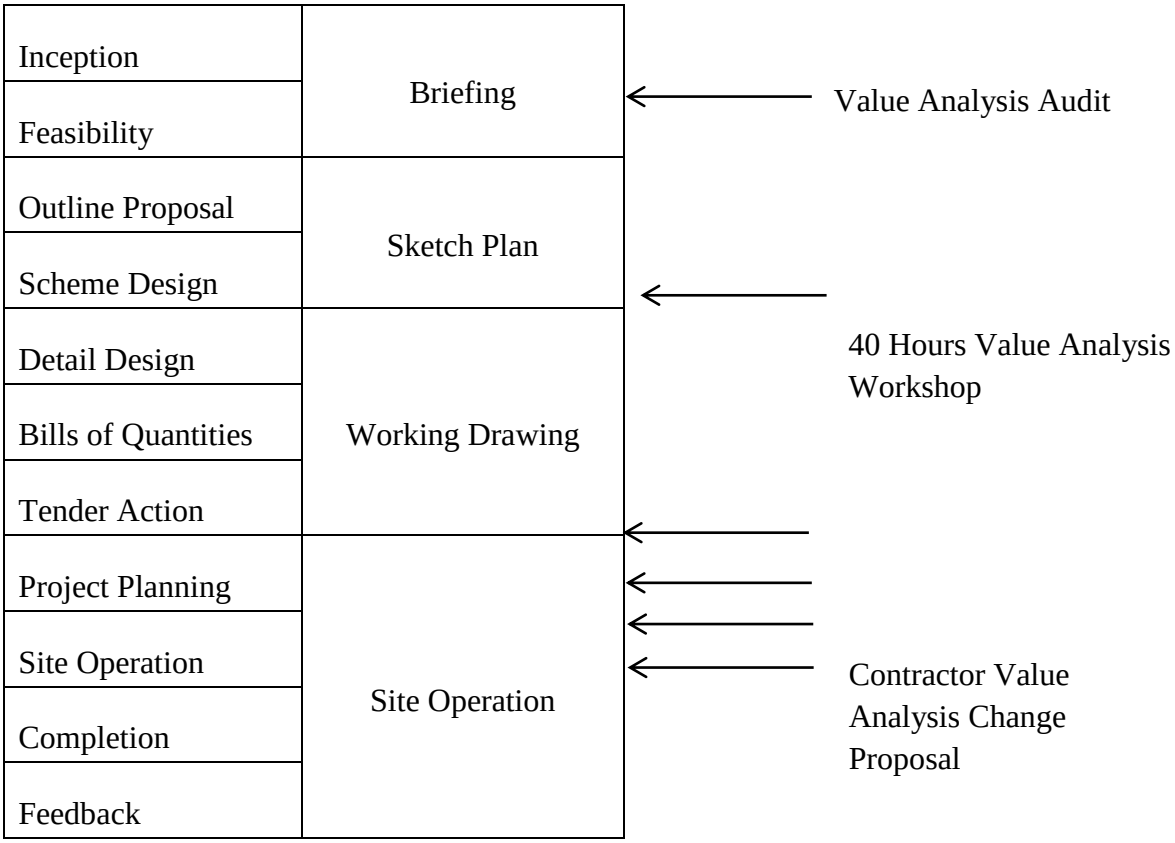


Figure 2.5: The timing of application for different Value Analysis

2.10 Value Analysis in Malaysia

Based on the report by Mazby, et al (2008), Malaysia's involvement in VA, particularly in the construction industry, is still very low. The report states that many of Malaysian contractors have high awareness regarding VA. But unfortunately the level of implementation is only average. This report however, did not take into consideration the effectiveness of the implemented VA and as the sample number is quite low the results and finding are a bit questionable.

VA was formally introduced in 1986 by Assoc. Professor Roy Barton from Canberra University, Australia to the Quantity Surveying Department in the Universiti Teknologi Malaysia (UTM). During the year of 1999, the first National Seminar on VA was organized by IKRAM, JKR, officiated by Tun Daim Zainudin, then Minister of Finance Malaysia. Due to the positive response from the construction and manufacturing industries, in May 2000, the Institute of Value Management of Malaysia (IVMM) was registered and formalized with 20 founding members. Currently the membership of the Institute has grown to 210 members. The immediate function of the institute is to promote the value culture into the country to the public

and private sectors as well as to create a widespread awareness to the community of the benefits to be derived from the application of VA in Malaysia (Jaapar and Torrance, 2004)

2.11 Obstacle in Implementing Value Analysis

Despite a positive belief in VA prospects, it is also important to identify the major problems that might hinder the successful of VA application in construction industry. Osterberg (1999), in his report has list out some potential obstacle in implementing VA, but the most relevant or Malaysia are:-

I. <u>There is no monetary gain for any parties involved to go through VA assessment.</u>

   Money is the universal motivation and without any monetary gain the motivation to do something will quickly be shot down. Especially in Malaysia, where the society love to look for small, short term profits, rather than investing in big, long term profit.

II. <u>Owner lack of interest and awareness.</u>

   In Malaysia, the owner usually leave all decision making in the hands of their consultant, without knowing there is any potential to save their own money. Most of the owner has a mindset that they lack in technical capabilities and their consultant should make all the decision for them.

III. <u>Lack of awareness about VA process.</u>

   As I stated countless time before, Malaysians have really low awareness on VA, particularly the owner of projects. This is a major pitfall, because without awareness on VA, how can it be implemented.

Cheah, et al (2005) suggest the same issue, it is a necessity to educate parties who have authority to make decisions in a project, in the construction industry context, this points out to the owner. But the report further explains that without knowing the true concept of VA, the owner will dispel any suggestions made by the contractor as an attempt to cheapen the cost and reduce the quality. This explanation hits the Malaysian typical way of thinking square on, and highlights the grave need for a serious awareness on VA.

2.12 Misconception s of Value Analysis

Kinnan, et al (1997) highlights to some misconception about VA. This misconception, if not straighten out can be a major obstacle in implementing VA. Some of the misconceptions among people who are involved in the construction industries in Malaysia are:-

I. The product is as good as it can be.

There is nothing in this world that is perfect that it can't be improved. The power difference between the contractors and consultants in Malaysia are quite large. The consultants are very hard to accept recommendation from contractors, thinking that their design is already fine as it is. By doing this, it eliminates many value improving opportunities.

II. Everyone has agreed with the proposed concept.

This has always been the major obstacle against change. Projects start out with a finished and agreed upon design, plan and budget. It is easy to get locked into a concept and obtaining agreement to deviate from the original can be excruciatingly difficult. Particularly in Malaysia, where the society is notoriously popular on its defiance to any form of change.

III. We already do VA

This statement has always been put out by the professionals involved in the project. This statement comes from the misconception between putting value in your engineering and actually doing VA. For example, putting value in your engineering will solve the problem, but performing VA will make sure the right problem is being solved. This is why the results of the report by Mazby, et al (2008) are quite doubtful. As this misconception can easily happen, particularly in Malaysia, the report had failed to justify that the company that claim they are doing VA is actually putting value in their engineering.

2.13 Surpassing these Obstacles

Osterberg (1999) also includes how we can surpass these obstacles. Some of the ways to surpass these obstacles for Malaysia are:-

I. **Owners, consultants and contractors need to be made aware of the possibility of saving money and improving designs by using the VA process.**

   Since the awareness on VA among Malaysian is questionable, this matter should be taken seriously. If these parties are made to aware on VA, there is little doubt that they will opt for it in their projects.

II. **Provide monetary rewards if engineer managed to improve design or save cost through the VA process.**

   As I stated before, money is a great motivator, and what could be better to motivate people to actually implement VA. If you didn't agree in seeing it that way, look it as a compensation for the engineer for the time and effort he/she put in.

Other than that, the government should take the lead in Promoting VA (Cheah, et al 2005). The government has the means to take the charge in this matter but why there is yet to be a sizeable measure taken in promoting VA, other than the establishment of Institute of Value Management Malaysia (IVMM) on 9 October 2001 (The Star, 10 Oct 2001), but since then nothing had been done to further promote VA. In U.S. America there is a law that made it compulsory to perform VA on all construction projects funded by the government with an awarded budget of more than USD 500,000 (Shans, Jijssel and Steenderen, 2000). It is expected that the government itself does not have a firm grasp on VA. Because, if the government is already aware about VA, it would be unrealistic to opt not to promote it.

CHAPTER 3

METHODOLOGY

This research was conducted in 8 stages which are background of study; identify the problem, objective and scope of study, literature review, collecting both primary and secondary data, evaluation and analysis of data, conclusion and recommendation of the research, and last with the feedback from supervisor and panels. Methodology of this study is shown in the figure 3.1.

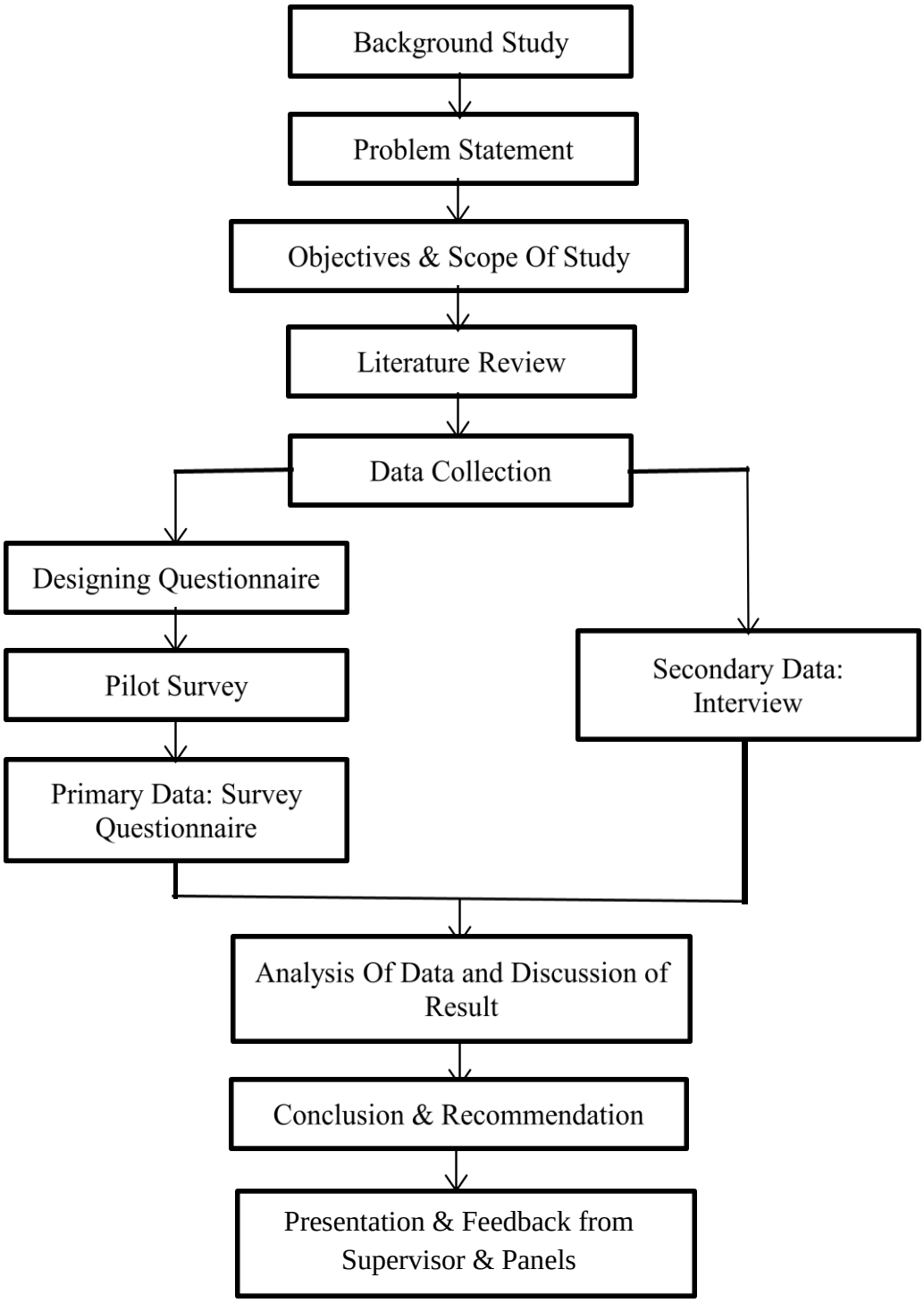


Figure 3.1: Methodology flowchart

3.1 Collecting Primary and Secondary Data

The data of this research will be collected through interviews, literature review and survey questionnaires. A questionnaire need to be design and mainly focuses on the general perceptions, knowledge, understanding and experiences in the application of VA. The surveys widely obtain the views of construction professionals (including consultants, contractors and developers) about factors that hinder and encourage the implementation of VA in the construction industry.

At this stage, more practical information is obtained from the answer from the questionnaire and some can be from interview with the relevant individual. But before designing the questionnaire, a very important point need to be considered, which are the questions have to be short and simple without touching any sensitive or confidential issues as subject may be offended.

3.2 Follow- up interview

Follow- up interview is the most difficult part for the whole research as not everyone who is willing to answer the questionnaire wants to be interviewed. The main purpose to have the interview is to get a more detail understanding and knowledge about VA. Besides that, the answers from the interviewees are more practical than the theories obtained from texts of journals. This means that the information collected is more relevant to real life local construction industry.

3.3 Data Analysis

All the collected data will be stored and analysed by using SPSS (Statistical Package for Social Science). SPSS is a computer program used for survey authoring and deployment (IBM SPSS Data Collection), data mining (IBM SPSS Modeller), text analytics, statistical analysis, and collaboration and deployment (batch and automated scoring services).

Average Index (AI)

The data obtained from the questionnaires are analysed using Average Index (AI). Al-Hammad and Assaf (1996) stated that the formula for Average Index is as follows:

$$\text{Average Index (AI)} = \frac{\sum \alpha_i x_i}{\sum x_i}$$

Where:

α_i = constraint describing the weight given to
x_i = constraint describing the frequency of the response for i = 1,2,3,4,5 and illustrated as follows:

x_1 = Frequency of the 'strongly disagree' response and corresponding to:

$a_1 = 1x_2$ = Frequency of the 'disagree' response and corresponding to:

$a_2 = 2x_3$ = Frequency of the 'neutral' response and corresponding to:

$a_3 = 3x_4$ = Frequency of the 'agree' response and corresponding to:

$a_4 = 4\ x_5$ = Frequency of the 'strongly agree' response and corresponding to: $a_5 = 5$

The classification of the rating scale is like following (Al-Hammad, et al, 1996):-

a) Strongly disagree : $1.0 \leq$ Average Index < 1.5
b) Disagree : $1.5 \leq$ Average Index < 2.5
c) Neutral : $2.5 \leq$ Average Index < 3.5
d) Agree : $3.5 \leq$ Average Index < 4.5
e) Strongly agree : $4.5 \leq$ Average Index ≤ 5.0

3. 4 Gantt Chart

Gantt chart for FYP 1

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**Selection of Final Year Project topic**															
2	**Preliminary Research**															
	i) Meeting and discussion with supervsor															
	ii) Searching relevant literatures															
	iii) Preliminary research planning and structuring															
	iv) Preparing Extended Proposal															
3	**Submission of Extended Proposal**															
4	**Proposal defence**															
5	**Continuation Of Research**															
	i) Designing of survey questionnaire															
	ii) Pilot Suvey															
	iii) Submission of questionnaire to related parties															
6	**Submission Of Interim Draft Report**															
7	**Submission Of Interim Report**															

Gantt chart for FYP 2

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**Continuation Of Research**															
	i) Collection of replied questionnaire															
	ii) Data analysis															
2	**Submission of Progress Report**															
3	**Continuation Of Research**															
	i) Data intrepetation															
	ii) Interview															
4	**Pre-SEDEX**															
5	**Submission of Draft report**															
6	**Submission of Dissertation (soft-bound)**															
7	**Submission of Technical Paper**															
8	**Oral presentation**															
9	**Submission Of Dissertion (hard-bound)**															

3.5 Key Milestones

Key Milestones includes:-

Final Year First Semester

- Selection of Final Year Project topic
- Submission of Extended Proposal
- Proposal defence
- Submission Of Interim Report

Final Year Second Semester

- **S**ubmission of Progress Report
- Pre-SEDEX
- Submission of Dissertation (soft-bound)
- Oral presentation
- Submission Of Dissertion (hard-bound)

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The data for this research were collected through questionnaires and by follow up interview with some of the respondents. The questionnaire is focused on the respondent's knowledge, understanding and experiences in the application of VA in construction industry. All this data will be stored and analysed by using SPSS (Statistic Package for Social Science). And the result of the analysis will be presented by using pie chart, bar chart or descriptive statistic like average index. The main purpose of using SPSS to analyse the data is to create a result so that can achieve the objectives of the research such as:

1) To identify the degree of awareness of VA in the construction industry.
2) To investigate the level of understanding of VA in the construction industry.
3) To identify the main factors that hinders the application of VA in construction industry.
4) To identify the main factors that encourages the implementation of VA in construction industry.

4.2 Questionnaires collected

To achieve the objectives of the research, there were 120 set of questionnaires distributed to the different respondents, with different background in construction industry during International Constructional steel Conference (ICSC 2012). However, only 35 respondents made response. Therefore only got 35 set of questionnaires were collected. Which mean that the questionnaires collected were only constitute about 29.17 % of the total amount of questionnaires posted (Please refer Figure 4.1). Although it was below my expectation, but a general picture of the present status of VA in construction industry can still be formed.

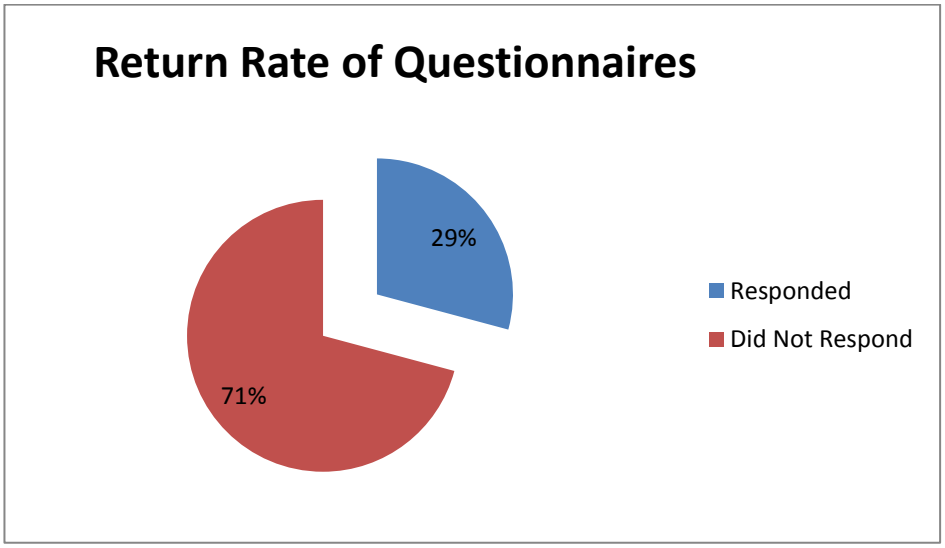


Figure 4.1: Return Rate of Questionnaires

4.3 Respondent's Background

The respondent's background was studied to better understand the condition of VA in the construction industry. The background study will ultimately give answer to the question, "what are the factors that affect the awareness of VA?"

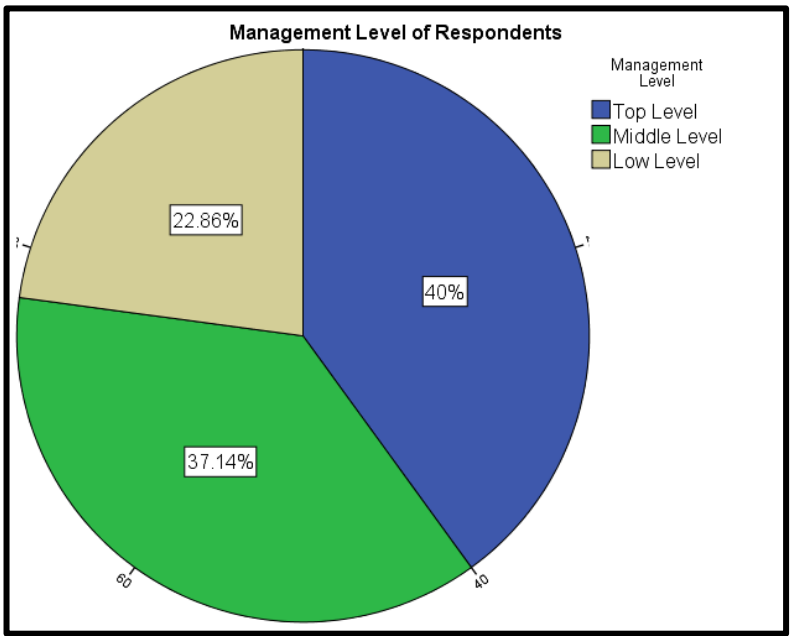


Figure 4.2: Management Level of Respondents

The designation of the respondents for this survey varied greatly, ranging from site supervisor, to architects and even executives and project manager. To better analyse the data, the respondents are divided to three main groups depending on their management level.

Based on Figure 4.2, the respondents are evenly distributed throughout the three groups with top level contributing to 40% while middle level and low level constitute to 37.14% and 22.86% respectively

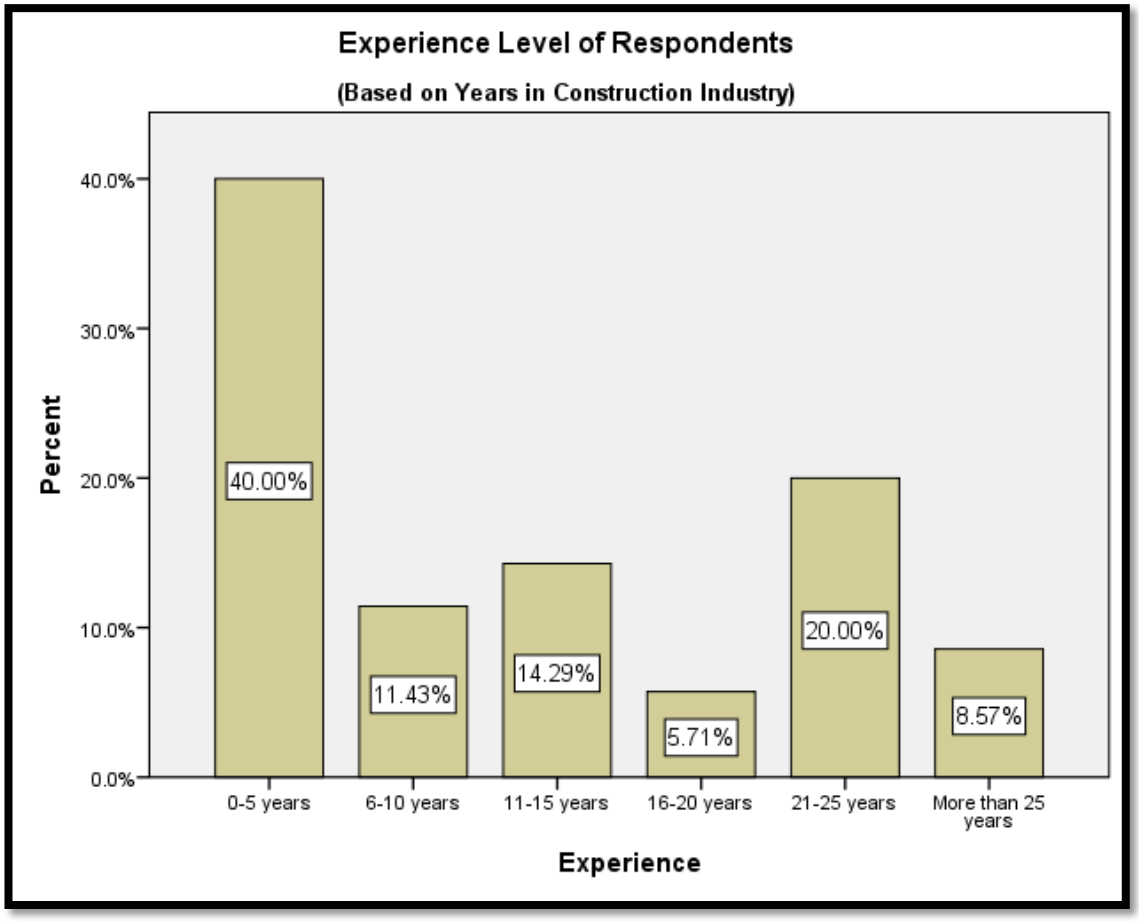


Figure 4.3: Experience Level of Respondents

Figure 4.3 reflects the respondents experience level, based on years involved in the construction industry. 40% and the majority of the respondents, have up to 5 years of experience. 11.43% have up to 10 years of experience. The respondents who have up to 15 years, 20 years, 25 years and more than 25 years constitute to 14.29%, 5.71%, 20% and 8.57% respectively.

Also from this graph it is clear that majority of the majority of the respondents from the 0 to 5 year experience group come from the middle management group. This is probably because most of them are fresh graduate engineers.

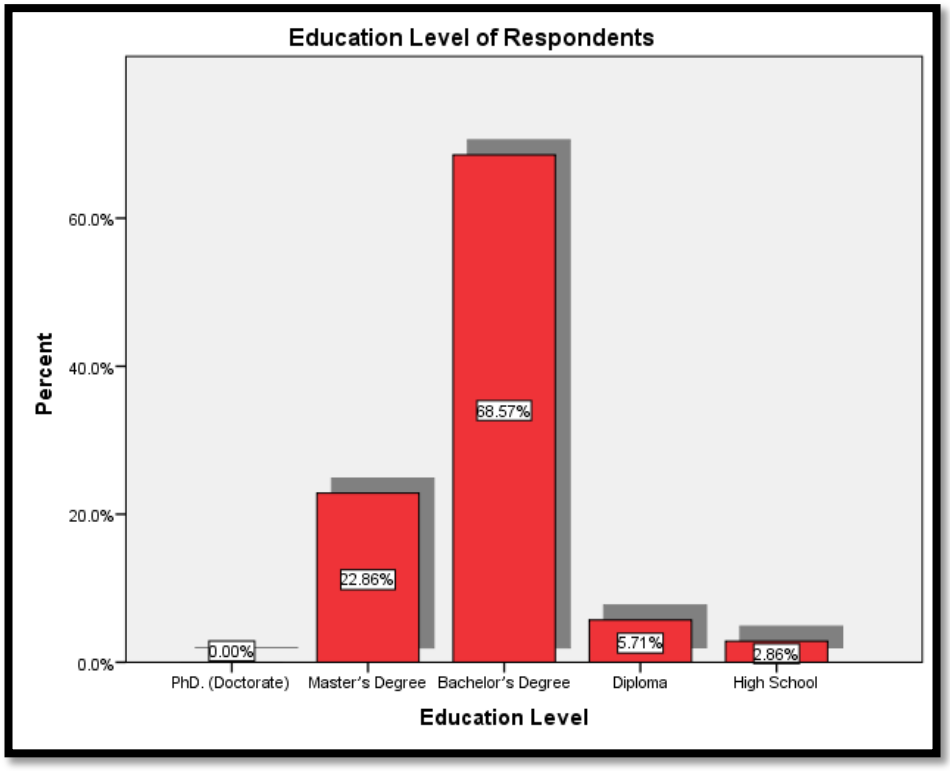


Figure 4.4: Education Level of Respondents

The education level of the respondents is not evenly distributed. Based on figure 4.4, 58.67% of the respondents, have a Bachelor's Degree. Respondents with a master's degree, Diploma and High School education each contributes to 22.86%, 5.71% and 2.86%.

This graph support what has been said before, majority of the respondents that have a bachelor's degree come mainly from the middle management and 0-5 years of experience group. This shows that majority of the respondents is a fresh graduate engineer.

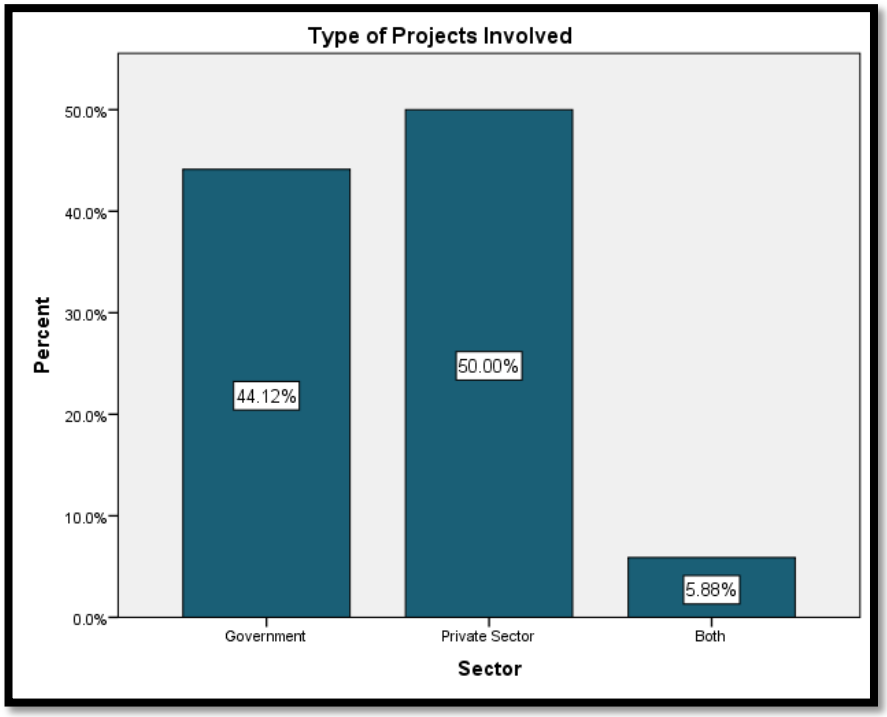


Figure 4.5: Type of Project Involved

The type of project is evenly distributed, with private sector projects contributing to 50% and government project contributes to 44.12%. 5.88% of the respondents claim that they do both sectors project evenly.

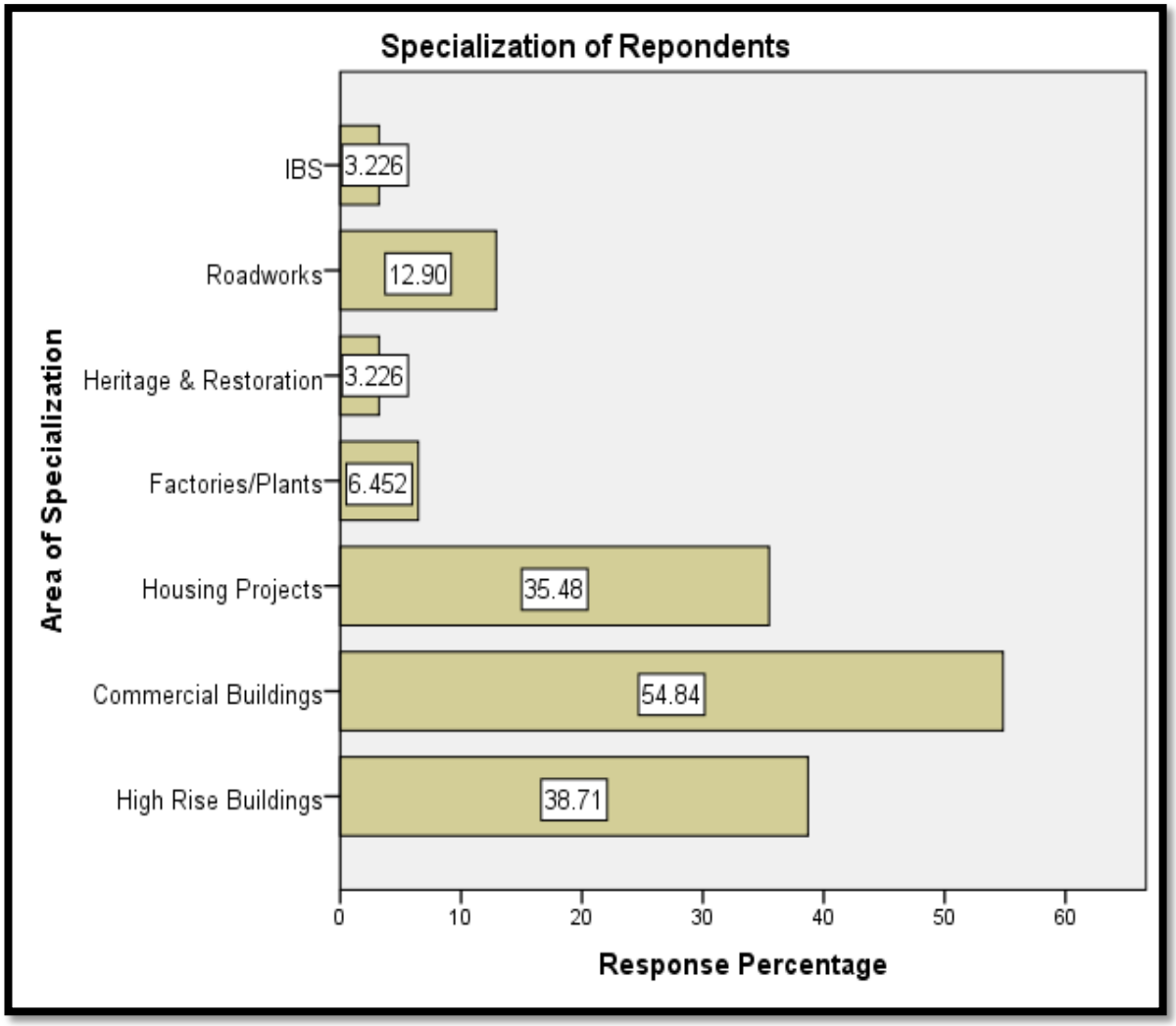


Figure 4.6: Specialization of Respondents

The main specialization area of the respondents is also being analysed to see its effect on effectiveness of the VA. Majority of the respondents (54.84%), specializes in Commercial buildings, 35.48% and 38.71% of the respondents also specialize in housing projects and high rise building respectively. Other areas of specialization include IBS (3.23%), roadworks (12.9%), heritage & restoration (3.23%) and factories or plants (6.45%).

4.4 Discussion of Result

Table 4.1: VA Awareness

	Frequency	Percent	Cumulative Percent
Strongly Disagree	2	5.7	5.9
Disagree	1	2.9	8.8
Not Sure	8	22.9	32.4
Agree	18	51.4	85.3
Strongly Agrees	5	14.3	100.0
Total	35	100.0	

Table 4.2; VA Score

Mean	3.68
Mode	Agree
Std. Deviation	.976

Table 4.1 shows the respondent's answer to the statement "You are aware of the term VA". This is used to analyse the respondent's awareness on VA.

Table 4.2 shows the score or analysis on the responds. From the mean score of 3.68, we can say that the awareness level is still a bit above average. Even though the mean score is low, the mode of the responds is "agree" or mean score of 4, and it represents 51.4% of the respondents.

Based on the mean and mode of the responds, the VA awareness in the construction industry is almost good.

Table 4.3: VA Awareness VS. Management level

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agrees	Total
Top Level	0	1	2	8	3	14
Middle Level	2	0	4	6	2	13
Low Level	0	0	2	5	0	7
Total	2	1	8	18	5	35

When comparing the VA awareness to the management level, we can see that the respondents from the low level management are surprisingly better than the other two. 5/7 respondents are aware of VA.

Even though only the respondents from the middle management (2/13) and top management (3/14) have claimed they are really aware of VA, Three respondents from the two groups are not aware of VA. So, we can safely say that the management level have little to no effect on the awareness of VA.

Table 4.4: VA Awareness VS. Education Level

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agrees	Total
Master's Degree	0	0	1	4	2	7
Bachelor's Degree	2	1	7	11	3	24
Diploma	0	0	0	2	0	2
High School	0	0	0	1	0	1
Total	2	1	8	18	5	34

Although the education level of respondents is not evenly distributed, we can still compare it to the VA awareness. As you can see from table 4.4, all the respondents with Diploma and high school education are aware of VA. But almost half the respondents with a Bachelor's degree are not aware of it. It is clear that based on these responses that, education level also have little or no effect on the awareness level.

Table 4.5: VA awareness VS. Experience

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agrees	Total
0-5 years	2	0	7	4	0	13
6-10 years	0	0	0	4	0	4
11-15 years	0	0	0	2	3	5
16-20 years	0	0	0	1	1	2
21-25 years	0	1	0	6	0	7
More than 25 years	0	0	1	2	1	4
Total	2	1	8	18	5	35

Referring to table 4.5, respondents that have less than 6 years of experience is easily the worst group in term of awareness of VA. More than two thirds of the group is not aware of VA. Almost all respondents with more than 5 years of experience (2/3 of the respondents) are aware of VA. It is safe to conclude that experience do affect the awareness level.

Table 4.6: VA awareness VS Sector of Project

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agrees	Total
Government	1	0	0	11	3	15
Private Sector	1	1	7	6	2	17
Both	0	0	1	1	0	2
total	2	1	8	18	5	35

Table 4.6 shows that, respondents that mostly involved in government sector project are more aware of VA. Only one of the respondents from the government sector group is not aware of VA, while more than half of the respondents from the private sector group are not aware of VA. So we can safely say that the sector of project the respondents are most involved in have a significant effect to the awareness level.

Table 4.7: VA Understanding

	B2	B3	B4	B5
Mean	3.53	2.94	3.79	3.06
Mode	4	3	4	4
Std. Deviation	.992	1.013	.729	.952

To analyse the level of understanding on VA, the respondents are given 4 statements (B2 -B5), that they score by using the likert scale (strongly disagree, disagree, etc.).

B2 is the statement "You understand VA". The mean (3.53) and mode (4) of this statement is good, meaning that the Level of understanding is also good. The mean score of VA understanding is consistent with the mean score of VA awareness (3.68).

B3, B4 and B5 are statements about VA to test the respondents of their understanding. B3 and B5 are false statements, while B4 is a true statement. Although the respondents have a high mean and mode score for B4, which is good, but it is contradicted by the average level score for both B3 and B5. From this, it can be said that the understanding level of VA is a bit low.

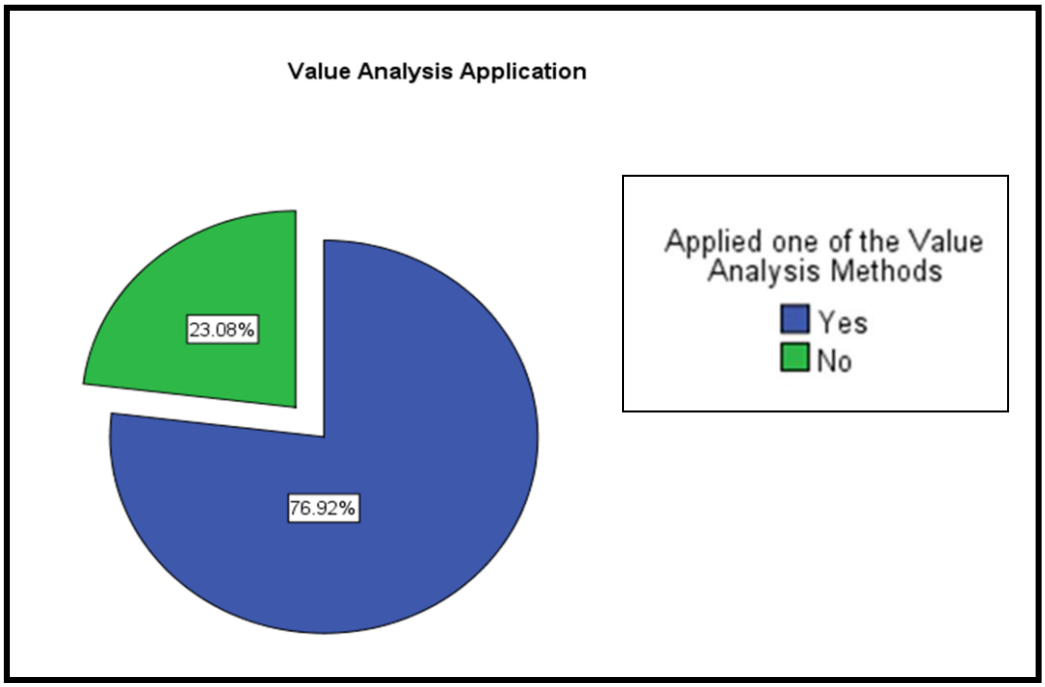


Figure 4.7: VA Application

More than three quarters (76.92%) of the respondents applied at least one of the VA methods (refer to figure 4.7). This means that the construction industry have already applied VA extensively

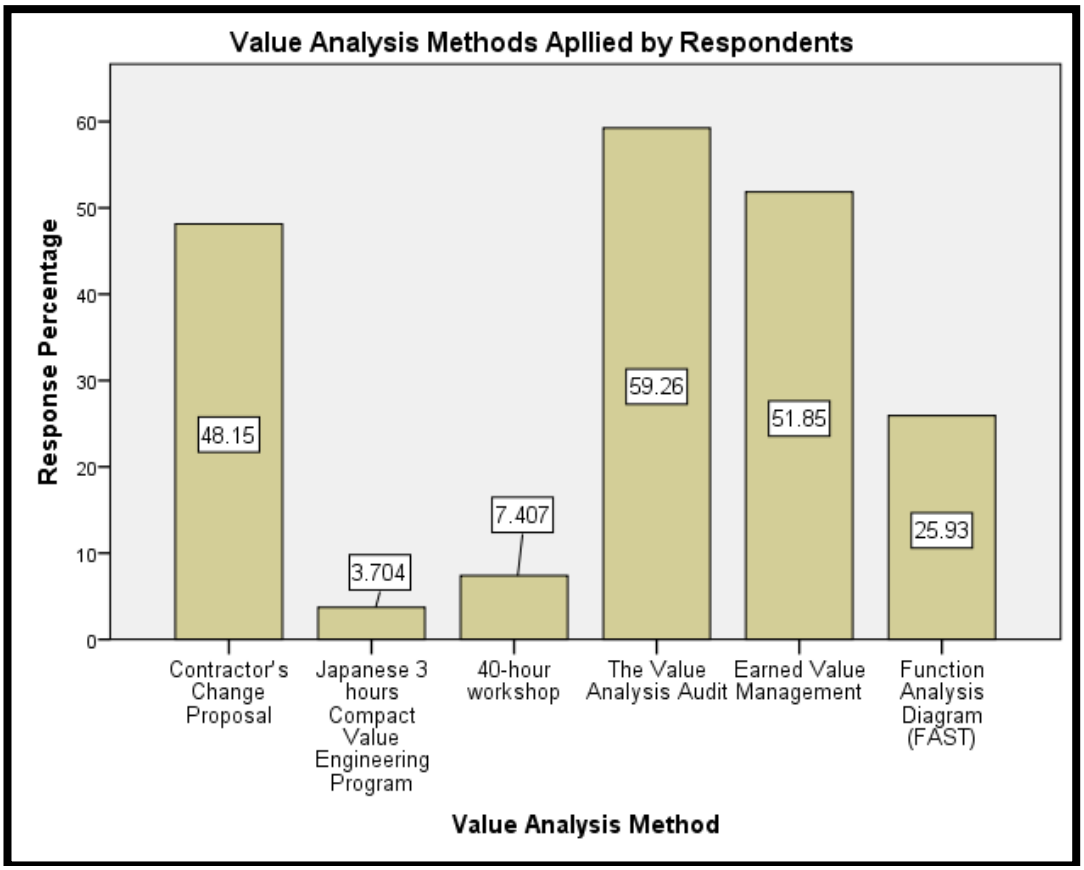


Figure 4.8: VA Methods Applied by Respondents

Figure 4.9 shows the six types of VA methods that the respondents have applied in their projects. The VA Audit, Earned Value Management and Contractors Change Proposal are the most popular where 59.26%, 51.85% and 48.15% of the respondents have applied it respectively. The other methods that the respondents have applied includes Japanese 3- Hour Compact Value Engineering Project (3.7%), 40-hour Workshop (7.41%) and Function Analysis Diagram (25.93%)

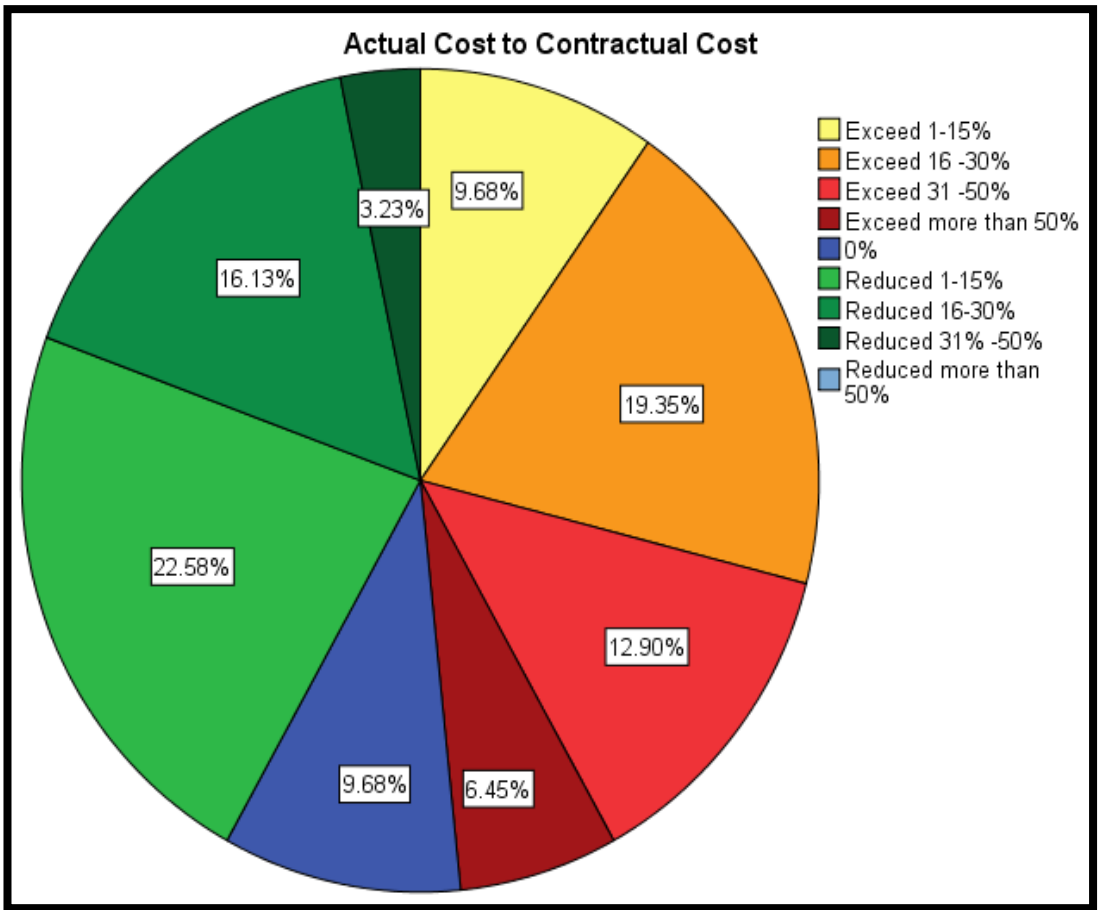


Figure 4.9; Actual Cost to Contractual Cost

Looking at Figure 4.9, we can see that less than half of the respondent's projects were over budget, although we must highlight that 6.45% of the projects have exceeded the budget more than 50%. For normal circumstances this might be normal, but considering 76.92% of the respondents claim they have applied VA in their projects, these numbers raises some questions. From these, we can deduce that although the rate of application is high, the effectiveness is still low. This can be justified due to the low understanding.

Table 4.8: Obstacles in Implementing VA

	Obstacles	Mean	Std. Deviation
1.	Consultants are very defensive of their original designs	3.59	.957
2.	Clients are reluctant to accept suggestions from contractors	3.26	.963
3.	VA takes a lot of time to implement	3.06	1.013
4.	The promotion of VA implementation by Malaysia's government is almost non-existent	3.03	.904
5.	VA implementation cost is high.	2.79	.845
6.	VA is not suitable for Malaysia's Construction Industry	2.38	1.045

Table 4.9: Drivers in Implementing VA

	Drivers	Mean	Std. Deviation
1.	VA can help to arrive at a more effective design	4.85	6.955
2.	Project's function can be improved by implementing VA	3.88	.591
3.	Implementation of VA helps identify a project's problems and constraints	3.79	.538
4.	VA encourage teamwork and creative thinking	3.76	.819
5.	VA can help to reduce project cost without adversely affecting the quality of the project	3.74	.790
6.	There is a lot of VA manual available for reference	3.03	.797

Table 4.8 lists out the obstacles in implementing VA, assorted from the most critical to the less critical.

The most critical obstacles are consultant's defensive attitude toward the original design. However, what really surprising are even the consultants gave a high for this obstacle. The second most critical is the client's reluctance to accept suggestion from contractors and again, the clients in this survey gave a high score to this. So why? Even though they know the main obstacle comes from them, they are not able to mitigate it. This can be explained by referring to the typical Malaysian mentality, we

are very resistant to change. Malaysians are happy to accept things as it is. Even though the process of VA can save a lot in term of costs, they resist it, just because it involves changing.

The respondents feel that the cost of implementing VA is not important as it is the second least critical obstacle. This can be factored by two things. First, improper implementation. VA is implemented but not properly, as to save time and money. This reasoning is backed by the low understanding level of the respondents. Second, the cost of properly implementing VA is being returned by the cost of project reduced. If the respondents have a higher level of understanding, the second factor is more likely, but the first factor is more likely in this case.

The least critical obstacle is self-explanatory; the respondents clearly believe that VA is actually suitable to Malaysian Construction industry. Although the implementation need to be done more properly. Other obstacles include Malaysia's government lack of promotion on VA and the time consumed to implement VA.

Table 4.9 lists out the drivers in implementing VA, assorted from the most awarding to the least. The respondents believe that implementation of VA will help to arrive at a more effective design and improved function, as it is the two most awarding drivers. The most surprising is the fact that VA reduces cost is ranked second last. This shows that the respondents feel that it is not important to reduce the cost, but it is really important to have the best design.

Availability of VA manual is ranked last in this list. This is probably because a lot of manual and books only explained the theory part, but little or nothing on how to implement it. The one that actually does comes from abroad and as of now, there is no standard manual on implementing VA in Malaysia. Other drivers include VA ability to identify problems and constraints of a project, and encourage teamwork & creative thinking.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In this final chapter, conclusion of all objectives of the research which listed earlier in chapter 1 will be briefly discussed. Through the analysis and observation of the result in chapter 4, all the objectives met its requirement. Besides, some recommendations were listed to improve the awareness and acceptance of VA in construction industry. And the final part of this chapter would be the suggestion for further study.

The respondent's awareness level on VA was above average. This represents a fairly high degree of knowledge that was expected, but it should be pointed out that the result might be a little higher than the actual figure, because there are many targeted respondents who never heard of these terms might not returned their questionnaires. Even though the awareness level is quite good, the same cannot be said about the understanding level. Most of the respondents claim they understand VA, but actually they did not understand it fully.

The level of implementation is very high, exceeded the expectations, and with more than three quarters of the respondents claimed they have implemented some form of it. The effectiveness however is quite low, less than half of the respondents actually managed to have their project cost reduced. This can be explained mainly by the low understanding level of VA.

The major factors that hinder the application of VA in construction industry base on the respondent's priority are listed as follows:

1. Consultants are very defensive of their original designs
2. Clients are reluctant to accept suggestions from contractors
3. VA takes a lot of time to implement
4. The promotion of VA implementation by Malaysia's government is almost non-existent
5. VA implementation cost is high.
6. VA is not suitable for Malaysia's Construction Industry

The main factors that will encourage the implementation of VA in construction industry base on the respondent's priority are listed as follows:

1. VA can help to arrive at a more effective design
2. Project's function can be improved by implementing VA
3. Implementation of VA helps identify a project's problems and constraints
4. VA encourage teamwork and creative thinking
5. VA can help to reduce project cost without adversely affecting the quality of the project
6. There is a lot of VA manual available for reference

5.2 Recommendation

Since the degree of acceptance of VA in construction industry is still very low. Below are some recommendation to improve the awareness and usage of VA in construction industry:

- Related organization such as IEM and CIDB can establish more seminars or training program to introduce VA and its application in construction industry
- The government needs to encourage and promote the use of VA in construction industry, since the majority of the private sector may not be willing to take the first step to implement it.
- Top management of any organization need to exposed on VA, then support and apply it in their organization to promote the method to their employees and their partnership organization.

- Institute of Value Management Malaysia (IVMM) should play an important role to use any marketing strategies to promote VA in the industry.
- Construction professional should try to acquire new knowledge as a whole and must reduce fragmentation in professional studies.
- Establish a local VA implementation guideline, since we are following the American standard for so many years. Furthermore, it may not suitable to the construction industry in our country.

5.3 Suggestion for further study

There are some suggestions for the further study in VA, such as to identify the future expectations for VA in Malaysia's construction industry. Then to develop a strategy plan that can help clients for future improvement when implementing VA in their organization. The last suggestion is to develop a local VA guideline for the facilitators to carry out the VA session.

REFERENCES

Al-Hammad, A., Assaf, S. (1996),"*Assessment of the Work Performance of Maintenance Contractors in Saudi Arabia*," Journal of Management in Engineering, ASCE, Vol. 12, No. 2, (pp. 44-49).

Azlan, A.R. (2005). *"Civil Engineering Systems and Problem Solving".* FKA, UTM. Page 10.

Bryant, J.W. (1998), "*Value Mythology Standard*" Society of American Value Engineers. Page 1- 8.

Cheah, Y.J., Ting, S.K. (2005), *Appraisal Of Value Engineering In Construction In Southeast Asia,* International Journal Of Project management 23.

Dell'Isola, A. J. (1988). "*Value Engineering in the Construction Industry*". Smith Hinchman & Grylls, Washington DC. Page 8, 52-68, 71.

Fong, P. S., Shen, G. Q., Chiu, E. W. and Ho, C. M. (1998). " *Applications of Value Management in the Construction Industry in Hong Kong*." Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong

Goldhaber, C.K., Macedo, M.C. (1977). "*Construction Management, Principles And Practices*". John Wiley & Sons, New York. Page 139, 161-166.

Hasnan, A. (1994). "*Pengurusan Penilaian Dan Praktis Ukur Bahan*". Unit Penerbitan Akademik, UTM, Skudai. Page 4, 19.

Jaapar, A., Torrance J. B., (2004) *Value Management?.* Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA

Jamal, A.A., Khalid, E., Reena, J.P., (1997). "*A Value Engineering Approach to Determine Quality Lightweight Concrete Aggregates*". ABI/ Inform Global. Pages 25.

Kelly, J., Brown, A.P. (1990). "Value Management in Quantity Surveying Techniques." New Directions, BSP Professional Books, London.

Kinnan, M., Martin, S. (1997), *But We Already Do It, And Other Misunderstandings,* SAVE International Conference Proceedings.

Lai, N.K., Bachan, S. (2005), "*Value Management in Construction Industry*" Faculty of Civil Engineering, Universiti Teknologi Malaysia.

Macedo, M. C., Dobrow, P. V., O'Rourke, J. J. (1978). "*Value Management for Construction*". John Wiley & Sons, New York. Page 25, 247.

Mazby, K., Arazi (2008), *Study of Value Engineering Implementation Among Contractors In Malaysia,* Universiti Teknologi Petronas.

Mazlan, C.M., (1998), "*The Challenges and Potential of Value Management in Local Construction*". Faculty of Building Environment, UTM. Page 6, 10-11.

Miles L.D. (1989). "*Techniques of Value Analysis and Engineering*". Lawrence D. Miles Value Foundation. Page 300, 321-324.

O'Brien J.J. (1976), "*Value Analysis In design And Construction*". McGraw- Hill Book Company. Page 1-5.

Osterberg, J. (1999), *Value Engineering – A Great Concept, Why Isn't It Used More Frequently?,* Ohio River Valley Soil Seminar.

Phuah B. (2000). "*Value Management*" Deakin University, Geelong Waterfont Campus. Page 18.

Rosnah M.S.. (2005). "*Teori asas ekonomi Kejuruteraan*". Fakulti Pengurusan Teknologi, Kolej Universiti Tun Hussien Onn. Page 3-8, 3-9.

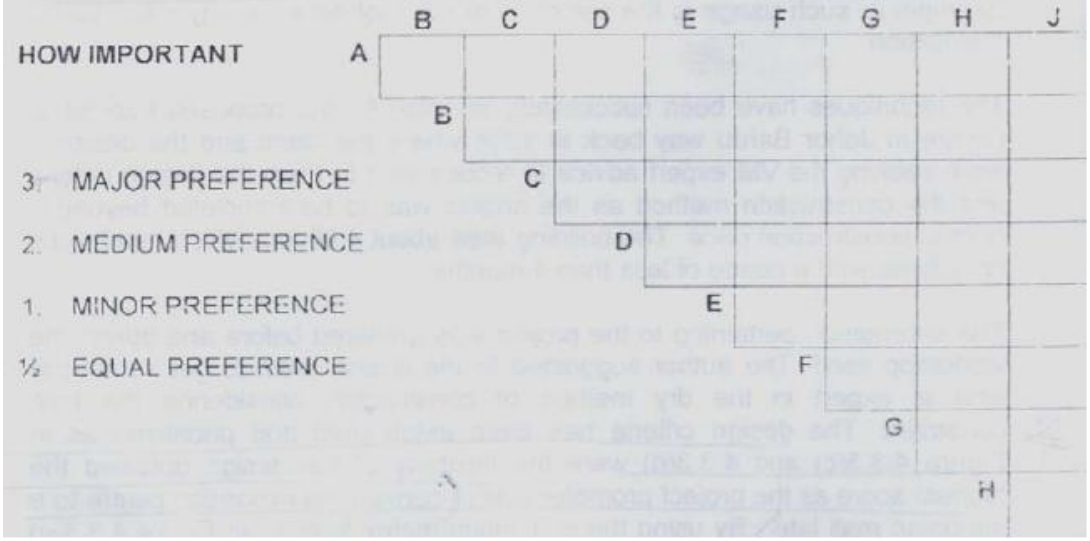
Shans, E.V.D., Jijssel, J.W.N., Steenderen, P.V. (2000), *Value Analysis: Capturing Total Cost Ownership,* Netherlands Journal of Geosciences 80.

Shevket, H., Celik, T. (1999), *Value of A Product: A Definition,* International journal Of Value-Based Management 12

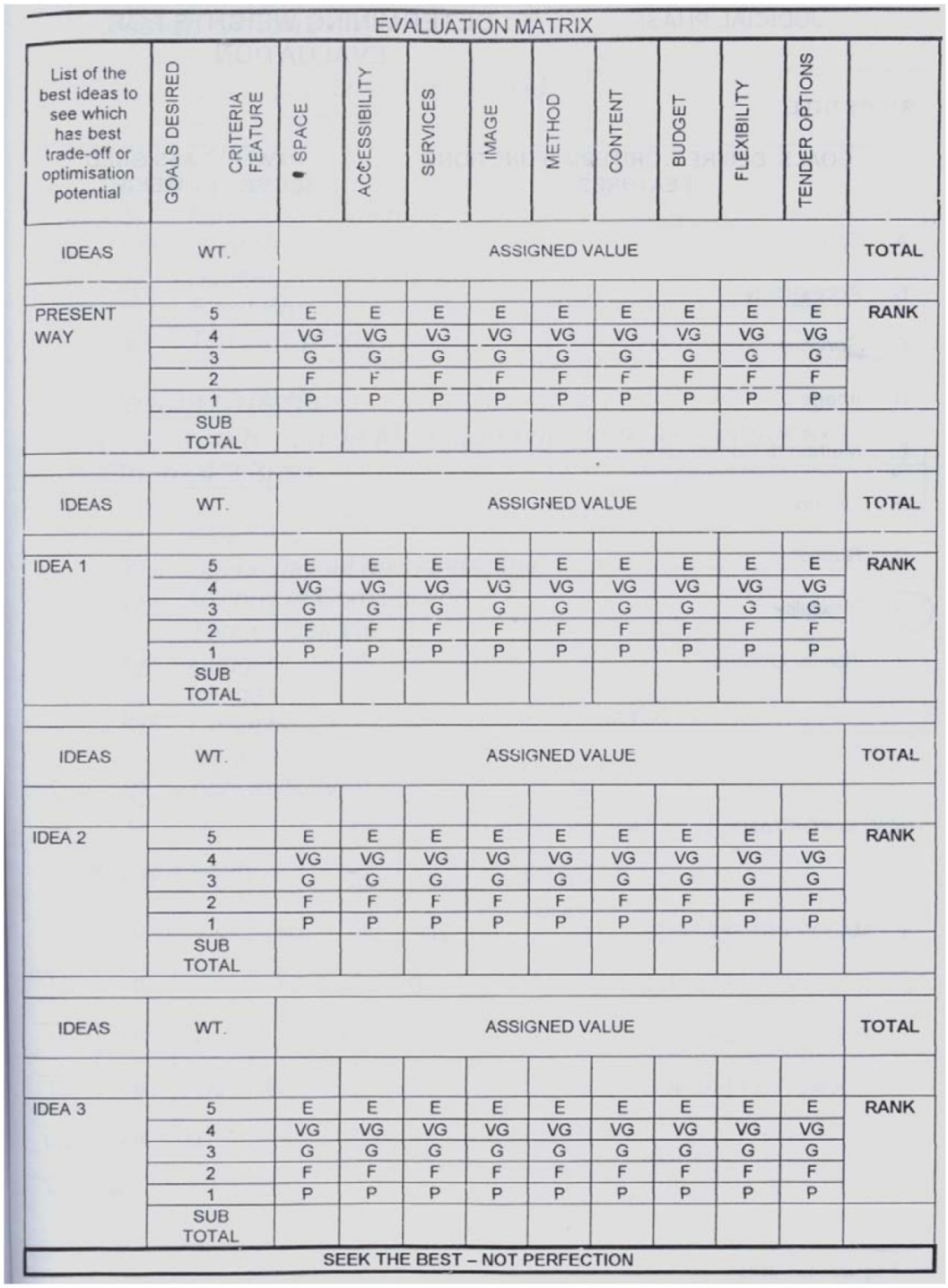
APPENDIX I

(Prioritizing Matrix and Evaluation Matrix)

JUDICIAL PHASE	DETERMINING WEIGHTS FOR EVALUATION	
STUDY TITLE		
GOALS, DESIRED, CRITERIA, FUNCTIONS, FEATURES	RAW SCORE	ASSIGNED WEIGHT
A.		
B.		
C.		
D.		
E.		
F.		
G.		
H.		
J.		
TOTAL		



Prioritizing matrix (Mazlan, 1998)



EVALUATION MATRIX

List of the best ideas to see which has best trade-off or optimisation potential	GOALS DESIRED / CRITERIA FEATURE	SPACE	ACCESSIBILITY	SERVICES	IMAGE	METHOD	CONTENT	BUDGET	FLEXIBILITY	TENDER OPTIONS	
IDEAS	WT.	ASSIGNED VALUE									TOTAL
PRESENT WAY	5	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	
	SUB TOTAL										
IDEAS	WT.	ASSIGNED VALUE									TOTAL
IDEA 1	5	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	
	SUB TOTAL										
IDEAS	WT.	ASSIGNED VALUE									TOTAL
IDEA 2	5	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	
	SUB TOTAL										
IDEAS	WT.	ASSIGNED VALUE									TOTAL
IDEA 3	5	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	
	SUB TOTAL										

SEEK THE BEST – NOT PERFECTION

E = Excellent VG = Very Good G = Good F = Fair P = Poor

Evaluation matrix (Mazlan, 1998)

APPENDIX II

(Sample Questionnaire)

Department of Civil Engineering

Universiti Teknologi
PETRONAS

31750, Tronoh, Perak

Malaysia

I am Bachelore student at the department of civil engineering, Universiti Teknologi PETRONAS. My research fouces on application of value analysis (VA) techniques in Malaysian construction industry. The research aims to measure the stakeholder's awareness and general understanding of VA toward best practices and the degree of effectiveness of the Value Analysis job plan, obstacles in implementing value analysis and factors that encourage the implementation of Value Analysis.

In addition, to understand the nature VA in local construction project it is necessary to analyse sets of factors and variables from at top organization level. Therefore, I would appreciate if you could kindly answer these questions.

You can be assured that the answer you provided will be kept strictly confidential and used solely for academic purposes. Special precautions have been taken to protect the confidentiality of your answer. The successful completion of this research will depend on your immeasurable, valuable contribution and your help would be highly appreciated.

If you have any questions/queries, please contact me at 017-7871997 or by email at muhammadikhwanabdullah@gmail.com.

Thanking you in advance for your kind cooperation and help.

Yours sincerely,

Muhammad Ikhwan Bin Abdullah

Department of Civil Engineering

Universiti Teknologi PETRONAS

31750, Tronoh, Perak

Malaysia

<u>PART A</u> (GENERAL INFORMATION OF RESPONDENT BACKGROUND)
(Please put tick [√] between the provided bracket for the best answer)

1. What is your position in the company?

[ ] Project Manager
[ ] Structural/ Civil Engineer
[ ] SiteSupervisor
[ ] Other, pleasestate _____

2. How many years you have practiced in the construction industry?

[ ] 0-5 years
[ ] 6-10 years
[ ] 11-15 years
[ ] 16-20 years
[ ] 21-25 years
[ ] More than 25 years

3. What is your qualification?

[ ] PhD. (Doctorate)
[ ] Master's Degree
[ ] Bachelor's Degree
[ ] Diploma
[ ] High School

4. What is the sector of your company?

[ ] Government
[ ]Private Sector

5. What is the main area of specialization? (You may tick more than one)

[ ] High Rise Building
[ ] Commercial Buildings
[ ] Housing Projects
[ ] Factories/ Plants
[ ] Others, please specify ……

6. What is the type of your company?

[ ] Local
[ ] International

PART B (QUESTIONS ON VALUE ANALYSIS)

For Questions 1-5 please rate the statements on Value Analysis (VA) based on the scale of:

1- Strongly Disagree 2 – Disagree 3 – Not Sure 4- Agree 5- Strongly Agrees

1.	You are aware of the existence of "Value Analysis"	[ ]
2.	You understand the term, Value Analysis	[ ]
3.	Value Analysis is the same as traditional cost control methods	[ ]
4.	VA is a value enhancing tool, rather than just a cost reduction technique	[ ]
5.	VA is a new thing in the construction industry	[ ]

6. Value Analysis or Value Engineering method that have been applied in any construction project you were involved in includes (you can pick more than one):

[ ] Contractor's Change Proposal
[ ] Japanese 3 hours Compact Value Engineering Program
[ ] 40-hour workshop
[ ] The Value Analysis Audit
[ ] Earned Value Management
[ ] Function Analysis Diagram (FAST)
[ ] Other, please state _____

7. Based on a few recent projects you are involved in, how much is the difference of actual project cost to the contractual cost?

[ ]	Exceed 1-15%	[ ]	Reduced 1-15%
[ ]	Exceed 16% -30%	[ ]	Reduced16% -30%
[ ]	Exceed 31% -50%	[ ]	Reduced 31% -50%
[ ]	Exceed more than 50%	[ ]	Reduced more than 50%
[ ]	0%		

For Questions 8-19 please rate the statements on Value Analysis (VA) based on the scale of:

1- Strongly Disagree 2 – Disagree 3 – Not Sure 4- Agree 5- Strongly Agrees

8.	VA takes a lot of time to implement	[ ]
9.	VA can help to reduce project cost without adversely affecting the quality of the project	[ ]
10.	There is a lot of VA manual available for reference	[ ]
11.	VA is not suitable for Malaysia's Construction Industry	[ ]
12.	Project's function can be improved by implementing VA	[ ]
13.	Clients are reluctant to accept suggestions from contractors	[ ]
14.	VA implementation cost is high.	[ ]
15.	VA can help to arrive at a more effective design	[ ]
16.	The promotion of VA implementation by Malaysia's government is almost non-existent	[ ]
17.	Consultants are very defensive of their original designs	[ ]
18.	VA encourage teamwork and creative thinking	[ ]
19.	Implementation of VA helps identify a project's problems and constraints	[ ]

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Acknowledgement

I'm aware that you are extremely busy and therefore, I want to thank you for your willingness to complete and return this questionnaire. However, I will understand if you chose to skip any of the questions that you are uncomfortable with

I would also like to thank the organizing committee of ICSC 2012, Malaysian Structural Steel Association (MSSA) for consenting me to distribute this questionnaire during the event.