

**AN EXPLORATORY STUDY OF FACTORS AFFECTING THE ACQUISITION
METHOD OF CONSTRUCTION EQUIPMENTS AND MACHINERIES AMONG G7
CONTRACTORS**

By

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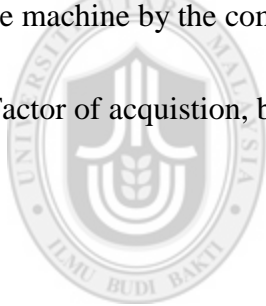
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ABSTRACT

Today contractors confront more than create, buying and construct in project construction. Contractors participate in various factors during dealing in buying or renting the equipment. As contractor, they must know how to budgeting with the capital they have with choosing the best to acquisition the equipment they want to have. This study examines the factors affecting the acquisition method of construction equipment and machinery among G7 contractors with the barriers and the problem solving for the barrier. Through 15 in-depth interviews and utilizing the constant comparative method of analysis, themes were identified including factor affecting the acquisition, barrier and also the problem solving. Price of machine as a reason for contractor to rent only emerged as a theme that was echoed by many of those interviewed. Whether it was the brand name of the machine or where the machines have much functionality made it become more expensive. Varieties of methodology are used to achieve the objectives, such as the literature review that give explanation of construction equipment and factor of acquisition. Participants' share all their experiences including give some advice and strategy to new start-up contractor during the interview. These situation need the intelligence of project manager to determine the most appropriate construction equipment used in the project. In addition, themes that emerged in the data included: how can contractor accept and reject offered the price of the machine by the company.

Keywords : Factor of acquisition, barrier, recommendation, cost and machine



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CHAPTER 1

1.0 Introduction

The words 'construction' and 'development' are commonly associated with construction activities and development of physical; involve several parties such as clients, contractors, architects, engineers and developers. The use of machinery and engines in the construction industry is encouraged to increase productivity hence, can reduce the number of foreign workers. There are a lot of heavy machineries and high-tech machines in the market, but the ownership of the equipment and machines is little because of the highly cost-effective purchase. Malaysia, as a developing country requires strength and competence in the field of construction industry as the provision of physical challenges in line with the National Development Program. Although the construction industry only contributes 4 % to the Malaysian Gross Domestic Product (GDP) in 2014, this industry is important for the country wealth creation as it acts as a catalyst, and has a multiplier effect on the economy; also allows other industrial, manufacturing, professional services, financial services, education and others to grow (CIMP, 2014).

Recently, a decrease in the performance of the construction industry has increased the need for Malaysian construction industry to determine the direction towards strengthening the foundations to face current and future challenges (Coker, 2007). When commercial distributor of heavy construction equipment begins, the absolute

way to obtain a new piece of equipment is through purchased outright (Lotker, 2000; Gransberg, Popescu, & Ryan, 2006). Traditionally, the process of purchasing the equipment is complete when a contractor buys the machine from a dealer. Today, the acquisition process includes the funding options and scenarios that banks, finance companies, leasing agencies and manufacture's offer (Shiu, 2007; Gransberg, Popescu, & Ryan, 2006). One of the big issues of construction companies is that the company needs the construction equipment but do not know whether to buy or lease land rent; in other words, the company does not know how to get it. (Lotker, 2000; Clappa, Shulera, Nobea, De Mirandaa, & Coker, 2007). There are various factors that good managers should consider in acquiring equipment. These factors are both financial and non-financial . (Lotker, 2000 ; Schmidt, 2002, Ghazi, 2002). A good construction manager should identify these factors and by assessing them decision-making is possible. (Lotker, 2000 ; Gransberg, Popescu, & Ryan, 2006). Based on the discussion above, therefore, it shows contractor needs to implicate the factors which are suitable before buying or renting the machine and equipment in return contribute to the success and prevent the delay of the project.

1.1 Background of study

Contractors and other users of construction equipment are concerned with a decision either purchase or rent equipment. Under certain condition it is financially advantageous to purchase, whereas under other condition it is more economical and satisfactory to rent it. Ghalib, (2000) states there are at least three methods under which a contractor may secure the use of construction equipment:

1. Purchase the equipment;
2. Rent the equipment; and
3. Rent the equipment with an option to purchase it at a later date.

Traditionally, a capacity of contractors and large capital size will be involved with the process of selecting the acquisition of machinery and equipment. This class of contractors also able to bid for high value projects; has sufficient capital to basically be able to purchase and use the equipment and machinery in construction work. Accordingly, registered contractors of G7 with CIDB have been selected as respondent for this study.

1.2 Problem statement

The greatest challenge face by the construction executives is how to manage their intellectual capital. The business environment has now entered a knowledge era, where knowledge has become powerful and learning rapidly and competently has become a pre-eminent strategy for success. (Kululanga, 2001& Mccaffer, 2001). Almost all the contractors in Malaysia are facing challenges and issues in the beginning of a construction project. One of the main real challenges is in selecting the type of equipment which best suited by construction activities (Hashim, 2004). Since the construction industry character is a concept project based, thus, contractor is having trouble to choose which type of acquisition can give more profit to them so that the machine and equipment they buy will not be wasted. So, the contractor should see whether the operation cost and the cost to buy are more expensive in terms of the selection of the best acquisition method. If the cost to operate these machines exceeds the cost to buy the machine, then the contractor is certainly should not buy or have the machine.

Previous cases showed that the contractor bought or rented all the machineries depend with the project that they received and the problem is the information they obtain is not one of the actual factors that are needed in identifying the acquisition method (Hashim, 2004). But today, the contractor must have to be smart and know the other factor in selecting the acquisition based on environment factor, cost effective and also other constrain problem so they can run the project smoothly

without any problems related with the machinery. There are several questions covered the element that wants to study this research:

1.3 Research Questions

- i. What are the factors affecting the acquisition method of construction equipment and machinery among G7 in the construction project?
- ii. What are the main obstacles for G7 contractors to have equipment and machinery in the construction project?
- iii. How to overcome the obstacles and enhance the strategy for acquisition of equipment and machinery among the contractors G7?

1.4 Research objectives

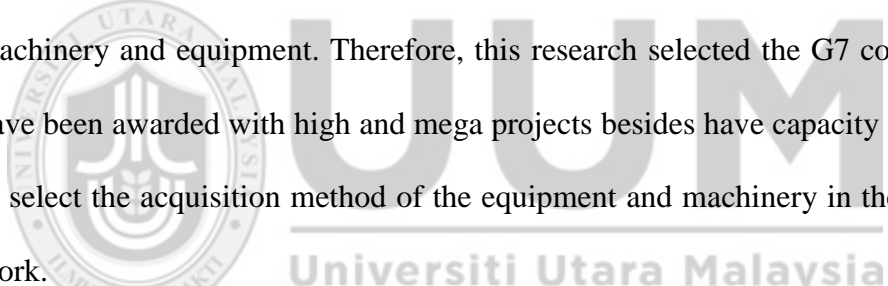
There are several objectives that more specified are identified as:

- i. To identify the factors affecting the acquisition method of construction machinery and equipment among contractors G7;
- ii. To discover the main obstacles for acquiring equipment and machinery among contractors G7;

iii.To identify the strategy and suggest the government role for acquisition of equipment and machinery among the contractors G7.

1.5 Scope of study

This research conducted among G7 contractors in the Northern region including Kedah, Penang and Perlis. This study will only focus on facts, obstacles and strategies that affect the acquisition method among the contractor. Contractor selection also based on the expertise and experience of the contractor had involved in large projects and the work of building and infrastructure which requires the use of machinery and equipment. Therefore, this research selected the G7 contractors who have been awarded with high and mega projects besides have capacity and capability to select the acquisition method of the equipment and machinery in the construction work.



1.6 Significance of the study

The researcher hopes that this study can be helpful to guide the contractor to select the acquisition method of construction equipment based on the factor that suitable with their objective project. Also, contractor can also apply what they had learned from this result to their project construction that they run now. All the knowledge and information from this study also can be useful for them to avoid the problem and obstacle that most contractors face. At the certain time, the contractor can share the

experience among others that they have gained in the interview so that other contractors also will gain that benefit. The new contractor also will have more understanding regarding on construction sector challenges in the real world. By applying this study knowledge throughout this study, it serves opportunity to the contractor to learn something more theoretical than just a practical experience.

The researcher hopes that this study will help the firm to investigate whether the factors affecting the acquisition method of construction equipment and machinery can bring positive impact towards the success of the project. Meanwhile, the firm can also identify the main obstacles for G7 contractors to have equipment and machinery and to discover the recommendation and strategies to get the acquisition. Thus, from this study it can help the contractor to determine the best action for the firm to achieve the target for the construction project and to prevent from being delayed.

The researcher hopes that this study will help the Malaysian construction industry becomes more growth due to the better understanding of all firm constructions. Construction industry is one the most important industries in Malaysia economy contributing many positive growth. By positive growth in Malaysian economy, the industry construction can overcome economic recession and world financial crisis. By positive growth, it also can give more job opportunity to the unemployment people thus, making a better future for the next generation.

1.7 Chapter Summary and Link

This chapter has provided an overview of the area of research that will be covered by this thesis. Furthermore, this chapter highlighted the factor of selecting the acquisition method of construction equipment and machinery among G7 industry in Malaysia. In addition, the barriers and strategy of recommendation has also been identified. From this discussion, the objectives of the study (sections 1.4) emerged, forming the development of a novel contribution to knowledge – a justification of primary and secondary data and the reliability. The next chapter endeavours to understand the concept and the real situation of the construction industry in Malaysia during the dealing stage and help to develop the new framework of the factor.



CHAPTER 2

2.0 Introduction

In the execution of various construction projects, one of the critical factors is equipment selection. In heavy construction project equipment plays an essential role in running the work. The largest portion capitals in construction project are the machine and equipment fleet, which may represent in this project. The successful contractors and construction managers are the people who know the substantial effect on their projects when the selection of the machine or equipment is not properly selected. Contractor nowadays tends to rely only on the historical data and experience of the similar project to guide them in constructing the strategy to choose the best method for the machine selection; mostly rely on myriad factors. Although this is a good approach at the initial stage of the project, it is not enough to choose the best method to buy the machine due to the constraints and environmental factors of the construction projects. While some approaches like expert system only could be helpful if it can integrate with the database of historical data. To overcome this problem, the proposed finding is developed based on the findings by the primary and secondary data which will be discussed in the group discussion later on. At this stage, however, the developed model includes only the primary data which mostly based on the previous literature review.

2.1 Concept of Affecting the Acquisition Method of Construction Equipment and Machinery

During the construction phase, selection of right equipment has always been a key factor in the success of any construction project. The best thing is they should think of the money they used for equipment as an investment which must recover back the money during the operation of the machine. A contractor does not pay for the construction equipment; the equipment must pay for itself by earning for the contractor more money than it cost. A contractor can never afford to own all types or sizes of equipment that can be used for the kind of work they do. It may be possible to determine what kind and size of equipment seem most suitable for a given project, but this information will not necessarily justify the purchase of the equipment, they may own a type of equipment that is less desirable than the proposed one, but, it may be benefit and less expensive than the proposed one. The identification of the factors that affecting on the equipment selection has been carried out using different literatures and by interviewing from experts in construction. (Siddharth & Pitroda, 2014)

“Anytime a unit of equipment will pay for itself on work certain to be done, it is a good business to purchase it. For example, if a unit of equipment costing \$25000 will save \$50000 on a project, a contractor is justified in purchasing it regardless of the prospects of using it on additional projects, or the prospects of selling it at a favorable price when the project is finished.” (Ghaleb,2002)

2.1.1 Construction Equipment

Construction works means the extension, installation, repair, maintenance, renewal, removal, renovation, alteration, dismantling or demolition of :-

- (a) any building, erection, edifice, structure, wall, fence or chimney, whether constructed wholly or partly above or below ground level;
- (b) any road, harbour works, railway, cableway, canal or aerodrome;
- (c) any drainage, irrigation or river control works;
- (d) any electrical, mechanical, water, gas, petrochemical or telecommunication works; or
- (e) any bridge, viaduct, dam, reservoir, earthworks, pipeline, sewer, aqueduct, culvert, drive, shaft, tunnel or reclamation works, and includes any works which form an integral part of. (CIDB,2007)

Equipment that is standard for a contractor may be special for another. But it may be defined as the equipment that can be used economically on more than one project, its repair parts may be obtained more quickly, and it can be easily disposed at more favorable price. (Merriam-Webster's online dictionary, n.d.). Equipment (also referred to in this manual as property or asset), as defined by Brown University, is tangible, non-expendable, personal property having an anticipated useful life of one year or more and having a unit acquisition cost of \$5,000 or greater.

2.1.2 Construction Machinery

The definition of machinery is “An assembly of linked parts or components, at least one of which moves, with the appropriate actuators, control, and power circuits, etc., joined together for a specific application, in particular for the processing, treatment, moving or packaging of a material” (Bradley, 1997). A machinery can be defined as a system by which action is maintained or by which some result is obtained. (Merriam-Webster’s online dictionary, n.d.) Another definition of machinery is a group of large machines or the parts of a machine that make it work. (Cambridge online dictionary, n.d.)

2.1.3 G7 Contractor

Contractor means a person who undertakes to carry out and complete any work but in this case we focus only in construction works. (Merriam-Webster’s online dictionary, n.d.). G7 Contractor is the highest class of contractors registered with CIDB. It is equivalent to the Class A contractor registered with Pusat Khidmat Kontraktor (PKK). G7 is the premier class of construction companies who are allowed to work on mega projects. (CIDB, 2007). It is assumed that their financial capability and competition with foreign companies should allow greater use of computers in their work processes. G7 also refers to the class of construction companies which do the civil engineering, building and/or mechanical/electrical construction work in Malaysia .

2.2 Factors it Affecting The Acquisition Method Of Construction Equipment And Machinery

Literature review on these factors showed several previous researchers that mentioned affecting the acquisition method of construction equipment and machinery which is critically important in construction project. Nunnally *et al.* (1977) stated that the equipment selection is a critical factor in the execution of many construction projects. This is to be more critical in heavy construction projects where the equipment fleet plays a vital role in performing the work. In this type of projects, the equipment fleet may represent the largest portion of the bid price. Tavakoli *et al.* (1985) describes that equipment productivity is a key factor that enables contractors to make a decision regarding the project scheduling, fleet selection, and project costs. Most contractors rely on their historical data and previous projects to obtain the productivity of selected equipment. Alwood (1989) states that equipment selection is a critical factor when trying to complete a project within a budget and on schedule. Without the proper working equipment, productivity decreases, delays increase, possible injuries occur, and unnecessary costs are incurred. Marzouk (2004) therefore states that, contractors should consider the selection of equipment fleet as a vital factor for any construction project to be successful. Tavakoli *et al.* (1989) describe that the equipment selection is a critical factor in the construction projects. Rational selection of equipment leads to profits for the contractors. At the same time, miscalculating the proper size and number of fleets require for the project may result

in losing the contract or suffering from overhead costs. Norris *et al.* (1995) find that the characterisation of the equipment selection process as an essentially multifaceted problem involving numerous, variegated considerations, often with complex trade-offs among them, implied that a suitable solution method might be found among the family of multiattribute-decision-analysis MADA methods. O'Brien *et al.* (1996); Schaufelberger *et al.* (1999); Nunnally *et al.* (2000); Harris *et al.* (2001); Peurifoy *et al.* (2006) describe that selecting the right equipment has always been a key factor in the success of any construction project; this is even more so in today's complex, highly industrialised projects. Vorester (2005) finds out that during the execution phase, the cost for construction equipment and machineries are approximately 30% of the total company assets. Gransberg (2006) states that industrial and heavy construction projects require intense and high utilization of machinery to carry out mass excavation, stabilizing, compacting, asphalt paving and finishing, pipelines, railroads and other special activities. Peurifoy (2006) states that the complexity of today's building projects make it harder to evaluate equipment alternatives and make the right selection from many alternatives. Tatari (2006) states that the primary agenda of the equipment selection process is to achieve higher productivity, more operational flexibility and viable economic considerations. The past research shows that the appropriate selection of equipment has always been considered as a strategic decision during the construction phase of any project. Yeo (2006) shows in the past research, the acquisition of heavy equipment constitute 36% of the total project cost and possesses high risk and uncertainties for the owners. Schexnayder (2009) finds that, equipment maintenance has not been given

appropriate attention and this contributes to about 40% of total construction project cost over run. Avetisyan (2012) states that equipment categorization, age and horsepower as well as type of the fuel used, can greatly affect rates of emissions. Chinchore (2014) states that selection is a process in which the most suitable equipment for a particular job is found out. Then, the decision is made whether to purchase the equipment or not.

2.2.1 Dimensions of Factors in Acquisition Method

After looking thoroughly the previous researches, there are 20 factors that affecting acquisition method of construction equipment which can be separated into two main factors;

- a) Financial factor
- b) Non-financial factor.

2.2.1.1 Financial Factor

- **Price of machine**

Purchase price is the price that an investor is willing to pay for a security. (investopedia online dictionary, n.d.). This price is important as it is the main component in calculating the returns achieved by the investor. Nichols (1976) states that purchase price of a machine is one of initial factor to select the best equipment. If the machine is too expensive, it will burn the capital needed for the project.

- **Equipment productivity**

Productivity is a measure of the efficiency of a person, machine, factory, system, and etc in converting inputs into useful outputs. Thus equipment productivity is computed by dividing the average output per period by the total costs incurred or resources (capital, energy, material, personnel) consumed in that period. (Business online dictionary, n.d.). Tatari (2006) states that the primary agenda of equipment selection process is to achieve higher productivity. While Tavakoli *et al.* (1985) describe that equipment productivity is a key factor that enables contractors to make a decision regarding the project scheduling, fleet selection, and project costs.

- **Breakdown**

Breakdown is a failure of a machine to function or an occurrence in which a machine (such as a car) stops working or a failure that prevents a system from working properly. (Cambridge online dictionary, n.d.). Schenayder *et al.* (2002); John *et al.* (2009) state that construction firms are often faced with problems related to high rate of equipment failure or breakdown thus it will affect the productivity of the project.

- **Condition of equipment/equipment quality**

Operational status of the equipment or "the totality of features and characteristics of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs can be defined as condition of equipment. (Business online dictionary, n.d.). Mayer and Stark *et al.* (1981) suggest that unit costs of operations that are affected by factors such as the condition of equipment. Nichols (1976) also states that equipment quality as one of the factor in selection of the equipment

- **Cost consideration/effectiveness**

Cost effectiveness/consideration is a relationship between monetary inputs and the desired outcome, such as between the expenditure on an advertising company and increase in sales revenue. (Business online dictionary, n.d.). Schaufelberger (1999) states a general factors that should be considered in the process of selection of equipment fleet is cost effectiveness; which involves the size of equipment besides the proper type. Shapira (2005) also studies that, a list of tangible (hard) and cost consideration as one of the list included. Bascetin (2003) also has established a decision support system by using qualitative and quantitative factors for the selection of open pit mining equipment and one of the criteria he had classified is cost requirement while Haidar *et al.* (1999) include operating cost to be one critical factor in selection of the equipment.

- **Equipment categorization**

The basic operations involved in the construction of any project are excavation, digging of large quantities of earth, moving them to fairly long distances, placement, compacting, leveling, dozing, grading, hauling, etc. Thus, a contractor must know which operation that equipment should be categorized. Avetisyan et al. (2012) state that equipment categorization can greatly affect rates of emissions.

- **Equipment characteristics along with manufacturer and model, number and operating life**

Characteristic can be defined as a feature that helps to identify, tell apart, or recognizably. (Cambridge online dictionary, n.d.). Thus equipment characteristic is a feature that distinguish its function along with its original condition manufacturer and model and matching the right equipment to the proper type of activity. Haidar et al. (1999) include equipment characteristics along with manufacturer, model, number and operating life. According to Gransberg et al. (2006), the first factor to consider would be matching the right equipment to the proper type of activity. Nichols et al. (1976) consist a number of factors type of equipment, total hours of use, type of use and years of useful life.

- **Equipment maintenance**

Maintenance is the up keep of property or equipment to preserve from failure and decline thus equipment maintenance as a service contract, which means an agreement which requires the specific performance of repairing, cleaning, altering, or improving of tangible personal property on a regular or irregular basis to ensure its continued satisfactory operation. (Cambridge online dictionary, n.d.). Schexnayder et al. (2009) conclude that cost and time that exceed the designated budget or schedule on projects are often resulted from poor equipment maintenance practice. He also found that, equipment maintenance has not been given appropriate attention and this contributes to about 40% of total construction project cost overrun. While lastly according to Gransberg *et al.* (2006) another factor would be the availability of the right equipment with proper service, maintenance, and repair reserves.

- **Fuel and horsepower**

Fuel is a substance that produces useful energy when it undergoes a chemical or nuclear reaction. It also depend on equipment how much consumption of fuel it needed to run. (Cambridge online dictionary, n.d.). The smaller the consumption the better the productivity of the project. Horsepower is a unit of measurement of power (the rate at which work is done). (Business online dictionary, n.d.). There are many different standards and types of *horsepower*. The most efficient energy for the best equipment productivity is a equipment that can achieve the highest horsepower but

consume less fuel. Avetisyan *et al.* (2012) state horsepower and as well as type of fuel used, can greatly affect rates of emissions.

- **Operational flexibility and versatility**

Operation flexibility is the ability to produce a work in different ways and versatility; a noun that means having a wide variety of skills. (Business online dictionary, n.d.). Thus a production with a machine that has variety and unique skills is needed in the heavy project construction. Schaufelberger *et al.* (1999) state another factor that should be considered in the process of selection of equipment fleet is versatility which involves selecting equipment that can perform multiple tasks at the site work. Tatari *et al.* (2006) state that the primary agenda of equipment selection process is to have more operational flexibility .

- **Overhead and ownership costs**

Overhead costs for a business are the cost of resources used by an organization just to maintain its existence. (Business online dictionary, n.d.) Overhead costs are usually measured in monetary terms, but non-monetary overhead is possible in the form of time required to accomplish tasks. (Cambridge online dictionary, n.d.). Examples of overhead costs for equipment include cost of electricity and operator personnel wages to operate the machine. Cost of ownership is an analysis meant to uncover all the lifetime costs that follow from owning certain kinds of assets.

Tavakoli *et al.* (1989) describe that equipment selection is a critical factor in construction projects. Rational selection of equipment leads to profits for contractors. At the same time, miscalculating the proper size and number of fleets required for the project may result in losing the contract or suffering from overhead costs.

- **Performance equipment**

James (1991) states that the most performance equipment can be grouped into one of the following six general categories. However, certain organizations may develop their own categories as appropriate depending on the organization's mission:

- a) **Effectiveness:** A characteristic process indicates the degree to which the process output (work product) conforms the requirements.
- b) **Efficiency:** A characteristic process indicates the degree to which the process produces the required output at minimum resource cost.
- c) **Quality:** The degree to which a product or service meets customer requirements and expectations.
- d) **Timeliness:** Measures whether a unit of work was done correctly and on time. Criteria must be established to define what constitutes timeliness for a given unit of work. The criterion is usually based on customer requirements.
- e) **Productivity:** The value added by the process divided by the value of the labor and capital consumed.

f) Safety: Measures the overall health of the organization and the working environment of its employees.

Chan *et al.* (2001) have developed evaluation criteria for the selection of material handling equipment. Their research work identified performance measure as one of the criteria while Haidar *et al.* (1999) include productivity rate of the equipment as the factor.

2.2.1.2 Non-Financial Factor

- **Economic consideration/market consideration**

Economic consideration can be defined by which is meant factors concerned with the inherent mechanisms whereby society's resources are allocated. (Clarke,1994); Tatari *et al.* (2006) state economic consideration as one of the factor while Chan *et al.* (2001) identify economic as the evaluation criteria. Shapira *et al.* (2005) also described that market conditions are also the selection factor of construction equipment in building projects that conclusions are further supported by findings of a field survey conducted among successful project managers.

- **Environmental constraint**

Environmental constraints are any limitations on strategy options due to political, external, competition, social requirements and expectations, cultural or economic

factors, technological or legal requirements. Environmental constraints is one of important aspect in selection.(Shapira ,2005)

- **Experience of the operators**

Experience is the knowledge or skill acquired by a period of practical experience of something especially in a particular profession. (Business online dictionary, n.d.). As an expert operator construction, they must have skill and style in what they are capable of. They must have completed training and have good performance. Mayer and Stark et al. (1981) suggest that unit costs of operations that are affected by factors such as the experience of the operators. Shapira *et al.* (2005) supports a successful project managers they have the operators with experience in the construction of sizable and complex projects. Schenayder *et al.* (2002);John *et al.* (2009) state that construction firms are often faced with problems related to poor training of equipment operators and often claimed as a major cause of equipment related accidents and accident resulting from unskilled operator's abuse. Amirkhanian et al. (1992) also state that operator performance is one of the factors and lastly Nichols at al. (1976) also propose that operator style as a factor to took into consideration.

- **Site and work conditions and safety consideration**

Generally, there are two types of differing site conditions. The first type is usually defined as instances when the contractor encounters subsurface or latent physical conditions that differ materially from those indicated in the contract. The second type of a differing site condition is usually defined as instances when the contractor encounters unknown physical conditions of an unusual nature that differ materially from those ordinarily encountered and generally recognized as inherent in the work at the project's location. (Business online dictionary, n.d.). Safety consideration means a standard precaution that machines have for the operator to operate it. (Business online dictionary, n.d.). Shapira (2005) studies a list of tangible (hard) and intangible (soft) factors and identified the tangible factors include site conditions while the intangible factors include safety considerations and Nichols et al. (1976) also propose a work conditions as critical factor. According to Gransberg (2006), he proposes one of the factors that can be considered when selecting proper equipment is included the distance to be travelled to the site project.

- **Type of soil & conditions**

Soil inspection or geotechnical inspection is very important in understanding the physical properties of soil and the rocks beneath. This is needed to ascertain the type of foundation required for the proposed construction. Amirkhanian et al.

(1992) develop an expert system model to interpret data pertaining to soil conditions. Mayer and Stark et al. (1981) suggest that unit costs of operations affected by factors such as the type of soil.

- **Strategic aspect**

Strategic can be defined as decisions or plans designed to impact favourably the key factors on which the desired outcome of an organization and the system. (Business online dictionary, n.d.). Chan et al. (2001) have developed evaluation criteria for the selection of material handling equipment and identified strategic aspects as the evaluation criteria.

- **Technical specifications /requirement**

A detailed description of technical requirements, usually with specific acceptance criteria, stated in terms suitable to form the basis for the actual design development and production processes of an item having the qualities specified in the operational characteristics as the definition of technical specification. (Cambridge online dictionary, n.d.). Bascetin (2003) has established a decision support system by using qualitative and quantitative factors for the selection of open pit mining equipment and classified selection criteria into operational technical requirements. Shapira (2005) also studied that the tangible factors include the technical specifications while Chan et al. (2001) identify strategic aspects as the evaluation criteria.

- **Company policies**

Company policies and procedures establish the rules of conduct within an organization, outlining the responsibilities of both employees and employers. (Cambridge online dictionary, n.d.). Company policies and procedures are in place to protect the rights of workers as well as the business interests of employers. Factors which are qualitative included company policies regarding equipment acquisition that has been supported by Shapira (2005).



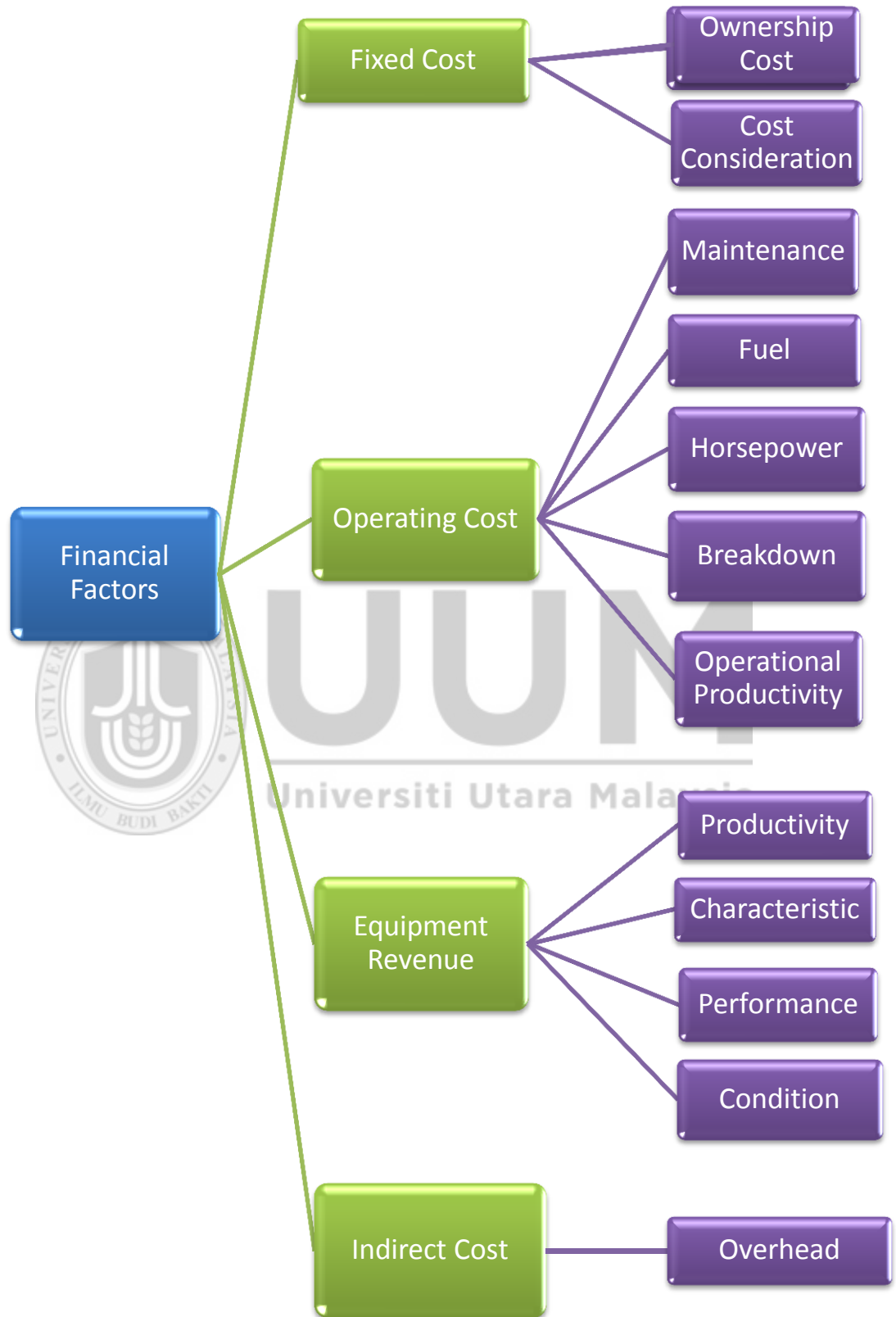


Figure 2.1:
Integrated Framework for Assessing Financial Factors Affecting the Acquisition Method

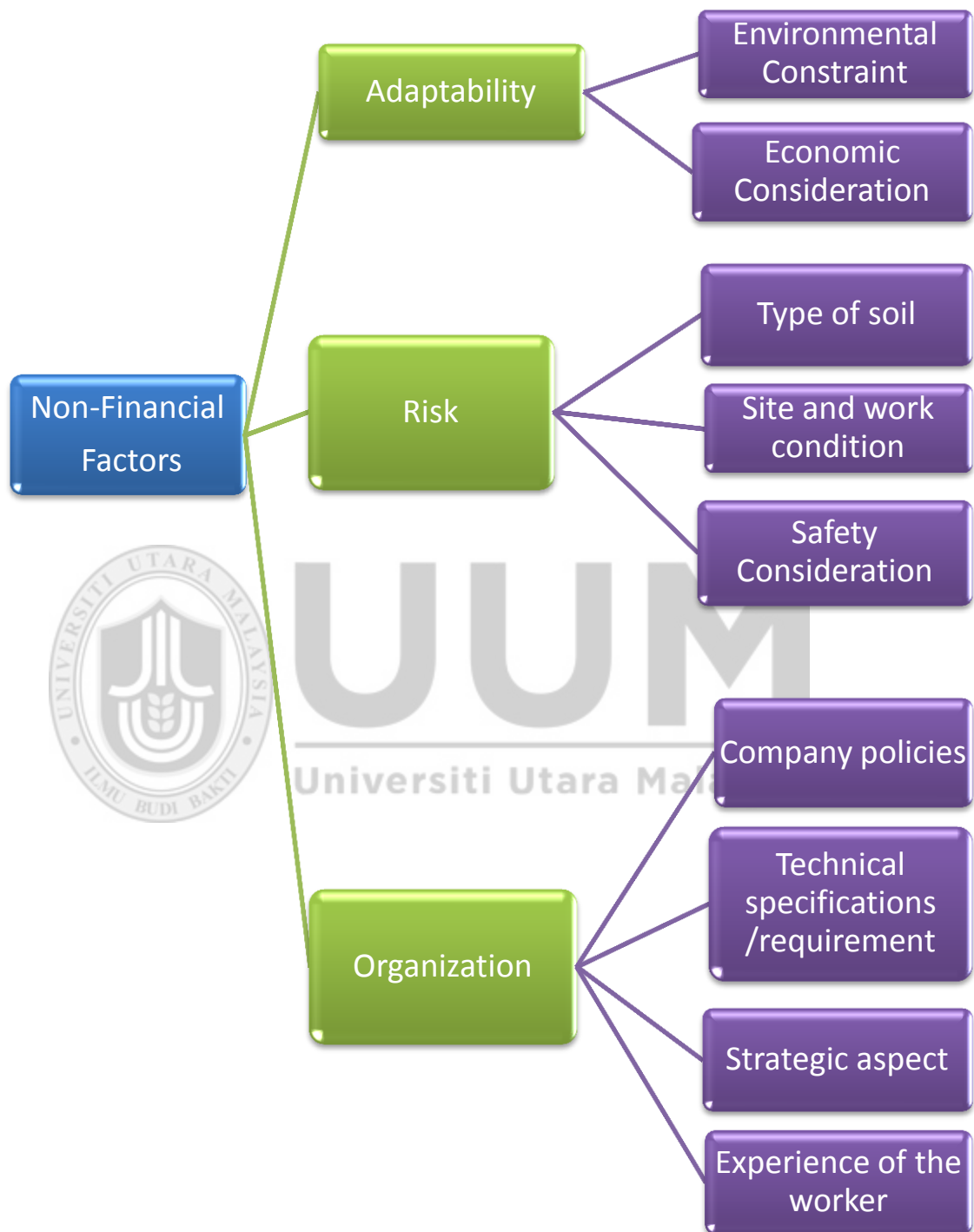


Figure 2.2 :
Integrated Framework for Assessing Non-Financial Factors Affecting the Acquisition Method

Table 2.1 :
Factors in Affecting the Acquisition Method of Construction Equipment and Machinery

Factor /Author	Nichols at al. (1976)	Tavakoli et al. (1985)	Stark et al. (1981)	Haider et al. (1999)	Tatari et al. (2006)	John et al. (2009)	Schenayder et al. (2002)	Haider et al. (1999)	Bascetin et al. (2003)	Shapira (2005)	Schaufelberger et al. (1999)	Avetisyan et al. (2012)	Gransberg et al. (2006)	Chan et al. (2001)	R. Clarke (1994)	Amirkhanian et al. (1992)	Mayer and Stark et al. (1981)
Price of machine	X																
Equipment productivity		X			X												
Breakdown						X	X										
Condition of equipment/equipment quality	X		X														
Cost consideration/ effectiveness				X				X	X	X	X						
Equipment categorization												X					
Equipment characteristics along with manufacturer and model, number and operating life	X			X				X					X				
Equipment maintenance							X						X				
Fuel											X						
Operational flexibility and versatility					X						X						
Overhead and ownership costs		X															
Performance equipment				X				X						X			
Economic consideration/ market consideration					X					X				X	X		
Environmental constraint										X							
Experience of the operators	X					X	X			X						X	
Site and work conditions and safety consideration										X			X				

Type of soil & conditions	X	X															
Strategic aspect				X													
Technical specifications /requirement				X				X	X								
Company policies regarding equipment acquisition								X									
Horsepower						X											

2.3 Chapter Summary and Link

After identifying all the factors, an integrated framework for assessing the factors affecting the equipment selection is developed, which contained two main groups of 10 sub-groups and 21 factors. This framework, shown in Figure 2 (Financial Factor) and Figure 3 (Non-Financial Factor) which shall be used for future research work. Table 2.1 shows the list of summary of author who cited about the factors in affecting the acquisition method of construction equipment and machinery.

CHAPTER 3

3.0 Introduction

The previous chapters reviewed the objective and the literature on the need for this research. Unfortunately, the findings of previous studies in the Malaysian construction industry are limited. Furthermore, the secondary data from the literature review needs to be compared with primary data in order to ensure that it is more comprehensive, up-to-date and appropriate for the precise needs of this study. Therefore, the aim of this chapter is to discuss the research design and methodology to be used for the data collection and analysis process to see the justification of previous literature study is still reliable or not to be adopted in Malaysia. This chapter includes the explanation and justification of the decisions that have been made in the selection of a research methodology and design for the framework development and evaluation process.

3.1 Overview of the Research Process

According to Remenyi *et al* (2004), the nature of the research process is often relatively unstructured and frequently unpredictable along its journey, however having an understanding of the philosophical stance of a particular research will at least keep the researcher on the right track and could reduce the risk of uncertainty and room for mistakes. Therefore, it is vital to understand the issue that will be

researched and how the researcher wants to acquire knowledge derived from the issue being studied (Tobi, 2011). The view point of the researcher literally helps to describe whether they are a quantitative or qualitative researcher in nature. Table 3.1 presents detailed features of the two types of research methodology.

Table 3.1 :

Features differences of quantitative and qualitative research methodology

Feature	Quantitative methodology	Qualitative methodology
Nature of reality	Objective; simple; single; tangible sense impressions	Subjective; problematic; holistic; a social construct
Causes and effects	Nomological thinking; cause-effect linkages	Non-deterministic; mutual shaping; no cause-effect linkages
The role of values	Value neutral; value-free inquiry	Normativism; value-bound inquiry
Natural and social sciences	Deductive; model of natural sciences; nomothetic; based on strict rules	Inductive; rejection of the natural sciences model; ideographic; no strict rules; interpretation
Methods	Quantitative, mathematical; extensive use of statistics	Qualitative, with less emphasis on statistics; verbal and qualitative analysis
Researcher's role	Passive; distant from the subject; dualism	Active; equal; both parties are interactive and inseparable
Generalisations	Inductive generalisations; nomothetic statements	Analytic or conceptual generalisations; time-and-context specific

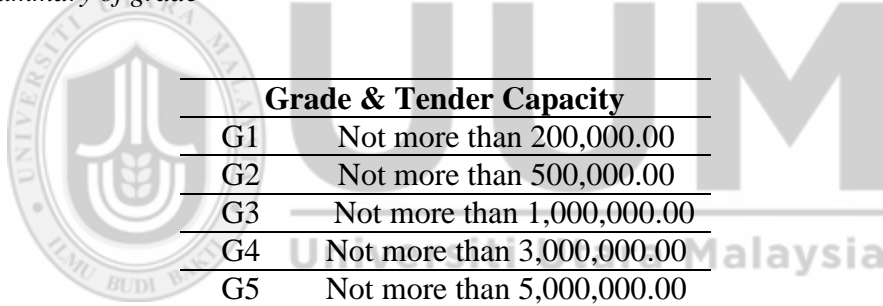
As this research attempts to explore the factors of acquisition method of construction equipment and machinery in Malaysia, the researcher also wants to explore the barriers and the recommendations for the problem. Therefore, the nature of this

research will be more geared towards a qualitative study, which is governed by the qualitative inquiry of “what” and “how” questions in order to achieve the research objectives.

3.2 Participant of the Research

Table 3.2 shows the summary of grade, category and specialization and Table 3.3 shows the criteria for contractor registration:-

Table 3.2:
Summary of grade



Grade & Tender Capacity	
G1	Not more than 200,000.00
G2	Not more than 500,000.00
G3	Not more than 1,000,000.00
G4	Not more than 3,000,000.00
G5	Not more than 5,000,000.00
G6	Not more than 10,000,000.00
G7	No limit

Table 3.3 :
Criteria for Contractor Registration

1	2	3	4	5	6
Grade	Tendering/ Working Capacity	Paid up Capital/Net Capital Worth	Technical Personnel Individual Qualification	Chief Executive Officer/ Representative of Chief Executive Officer	Construction Personnel Registration Card
G7	No limit	750,000.00	Minimum 5 years		

			experience		Chief
G6	Not more than 10 million	500,000.00	Minimum 3 years experience		Executive Officer,
G5	Not more than 5 million	250,000.00	Minimum 5 years experience	2 years of construction related experience	Technical officer and building personnel involved in construction activities at construction site
G4	Not more than 3 million	150,000.00			
G3	Not more than 1 million	50,000.00	Course Certificate Experience		

3.3 Research Approach

Previous researchers define the term research approach in different ways. Easterby-smith (2002) identifies research approaches as organising research activities, including the methods of data collection for achieving the research aims. It has been identified that the knowledge claims, the strategies, and the method contribute to the study (Creswell, 2003). Tobi (2011) views the research approach as the strategy used for data collection and analysis. Gill & Johnson (2002), as well as Sutrisna (2007), in different ways asserted that the research approach can be differentiated and can also be placed along the philosophical continuum depending on the emphasis on deductive or inductive research, degree of structure and the type of data they generate. As highlighted by (Sutrisna, 2009), there are two ways of undertaking the reasoning of the research in the acquisition of new knowledge, namely inductive and deductive research.

The strategy of this study was the inductive research approach. Therefore, this study is to see the justification from previous literature is still reliable or not to be adopted in Malaysia. Additionally, the research environment is not expected to be controlled and simplified with assumptions and hypotheses as the deductive research approach used in positivist studies. Conversely, an inductive research approach is used with the intention of generating rich data to build up theories. There are several researchers who recognize workshops as a highly interactive and experiential method of data collection and validation process in the qualitative research. The same researchers further state that this technique involves an interactive group setting where participants are free to talk and discuss with other group members. For the purpose of this study, based on those criteria, it clearly shows that a workshop is appropriately categorized under the research interview technique which is a subcategory of group interview. By examining the experience of the contractor who had experienced in dealing with buying or renting the equipment, it is possible to explore the relative importance that these contractors attach to. It can be concluded that deductive reasoning is theory testing and goes from the general to the specific while inductive reasoning is theory building and goes from the specific to the general. Inductive research is often associated with interpretive philosophy while deductive research is often associated with positivist philosophy (Sutrisna, 2009; Saunders *et al.*, 2003). Therefore, inductive research will be chosen as the reasoning for this research. However, in order to gather all the information, the researcher

needs to clarify the process of the data collection in an appropriate manner. The next section will discuss the process in more detail under research strategies.

3.4 Research Strategies

Having opted for an inductive approach for conducting the research, this section of the thesis outlines the various frameworks available for the research strategies. According to Saunders *et al* (2009), the research strategy is really important because it will enable the researcher to answer the research questions and meet the objectives. The implementation of a research strategy is guided by the research questions and objectives, the existing knowledge, the amount of time and other resources available, as well as the philosophy underpinning the research. Yin (2009) also points out three conditions which can be used to select the appropriate strategy for the research:

- the type of research question;
- the control of the researcher over behavioural events;
- the degree of focus on contemporary as opposed to historical events.

Robson (1993) suggests that research strategy in a social science and should typically consist of choosing one of three methodologies; a survey, experiment or case study. Blismas (2001) identifies four research strategies that are consistently recommended by researchers as viable options in addressing questions posed in both social science and construction management research. According to him, the main

options and the situations for different designs are experiment, survey, action research and case study. In addition, the literature review revealed that Sexton (2003) categories the research design into five main research strategies which include experiments, surveys, case studies, action research and ethnography. The term “research strategies” used in the “onion” model (Saunders *et al.*, 2008) further identify seven main strategies to indicate ways of conducting research such as experiment, survey, case study, action research, grounded theory, ethnography and archival research. Yin (2009) also lists five different types of research strategies such as experiments, survey, archival analysis, history and case study.

3.5 Research Techniques

Based on the research methodology model adopted for this research (refer Figure 4.1), the research techniques occupy the inner most ring (layer) of the model and are influenced by the other five layers including the research approach and philosophy. Research techniques and procedures in this context refer to the method used for data collection and analysis.

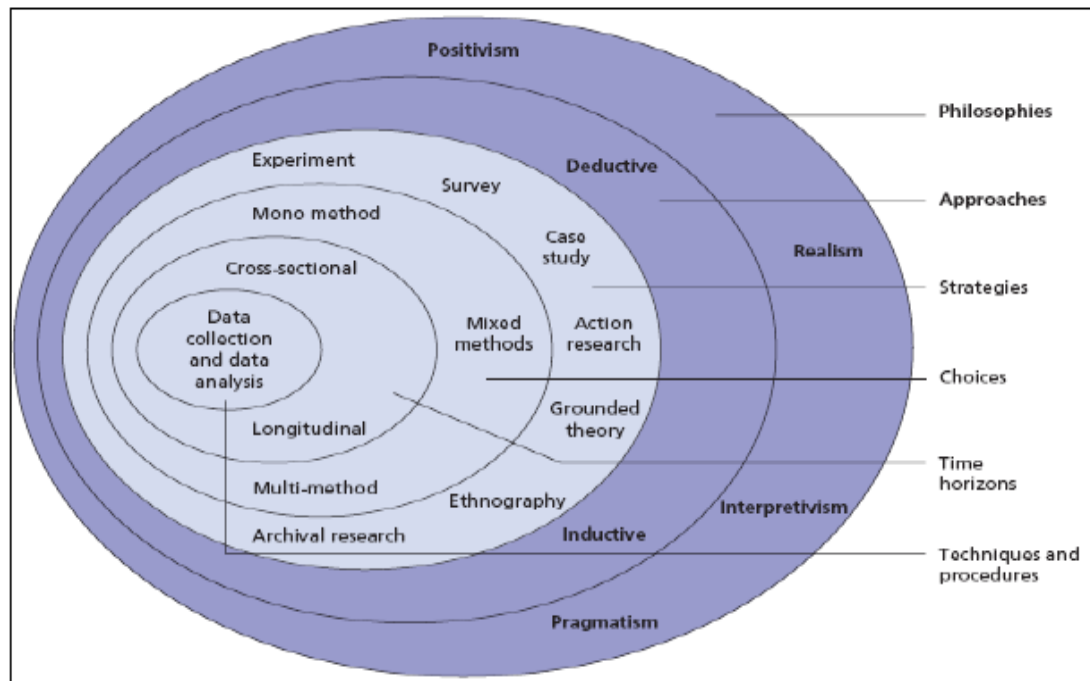


Figure 3.1:

The onion research model for this research (adapted from Saunders et al, 2009)

3.5.1 Method of data sources adopted for this research (Literature Review and Workshop)

Many scholars like Ghauri & Gronhaug (2005) and Churchill (1999) recommend that all researches should start with secondary data sources. This secondary data refers to any information or literature that has been collected and recently published. Saunders *et al* (2009) categorise the data into three main groups; documentary, multiple source and survey (refer figure 3.2). According to them, documentary secondary data is often used in research projects as a primary data collection method. These methods can also be used either on their own or with other sources of secondary data. The examples of documentary secondary data are written material or documents such as

notices, correspondence (including email), minutes of meetings, books, journals, magazine articles, newspapers and dairies (Saunders *et al.*, 2009). On the other hand, primary data is referred to newly collected data (raw data) that has been generated from multiple research techniques of data collection including observations, questionnaires and interviews (Saunders *et al.*, 2009; Sarantakos, 2005; Bryan, 2004).

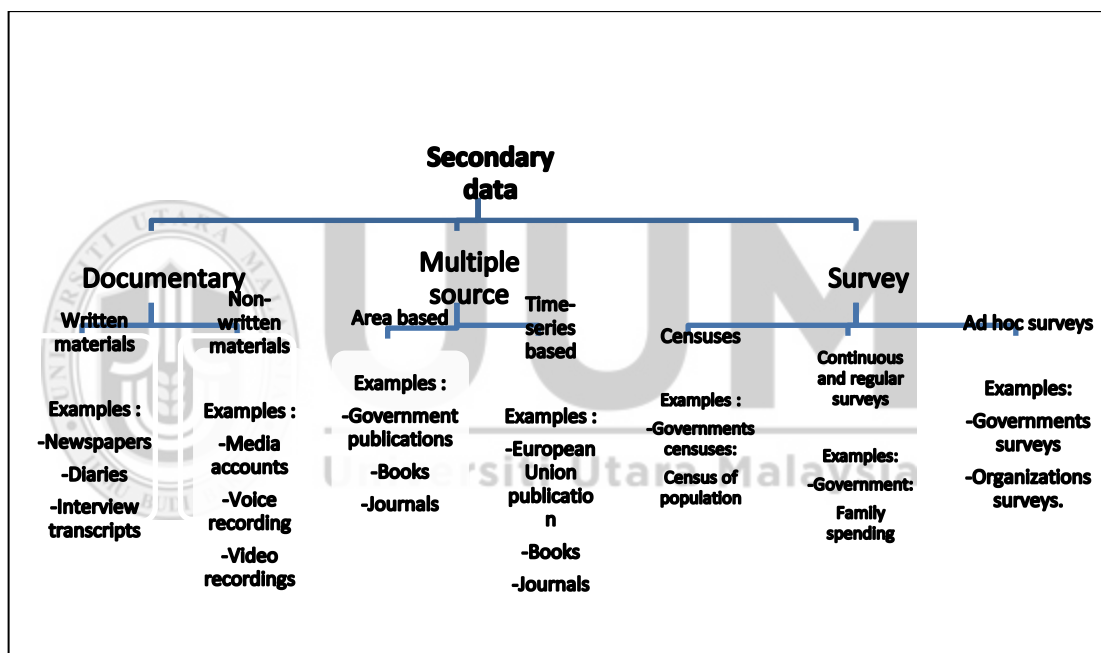


Figure 3.2 :
Types of secondary data (Saunders *et al.*, 2009)

As discussed in section 3.4, this research uses qualitative multi data collection techniques as the main source for primary and secondary data. Based on its strengths and weaknesses (refer table 3.4), an industry workshop is identified as the main method to be used for the primary data.

Table 3.4 :
Relevance of different research strategies

Research Strategies	Advantages	Disadvantages	Form of research question	Requires control of behavioral events?	Focuses on contemporary events?
<i>Experiment</i>	Clear possibility & answer; controlled context, replicable generable; safe time and resources; causal relationship	Requires specific knowledge; artificial; ethical problem due to variable control; quantitative does not really explain	How, why	Yes	Yes
<i>Survey</i>	Widely used; quantitative and qualitative; directive; affordability of large data; high predictability using	Misplace findings; difficult to obtain truthful data; less detail and depth; may be not applicable for phenomenon studies	Who, what, where, how, how many, how much	No	Yes
<i>Case study</i>	In-depth, capture complexities, relationship; multiple data sources and methods; flexible time and space; less artificial	Problem of generalization; focus on natural situation; unpredictable; unacceptable for some course	How, why	No	Yes
<i>Action research</i>	Collaborative; the researchers and context integrity; for practitioner-researchers; professional and personal development; practical	Difficult for new researcher; exclusive; work setting influence; unacceptable for some course	How	Yes	Yes
<i>Grounded theory</i>	Generating theory from a research; flexible	Too specific; ignore the previous knowledge to	„How“, focus on process	No	Yes

Sources: Sarantakos (2005), Robson (2007), Yin (2009), Saunders *et al.*, (2009); Grix (2010) and Setiawan (2011)

3.5.1.1 Literature Review

There is only one objective in conducting the literature review for this study; to gather secondary data for the research (Chapter Two). In identifying the factor of the acquisition method, the literature review is conducted to gain a comprehensive understanding of the research topic – The literature review explored published information and data (reports, statistics, websites, journals, books etc.) about factor of acquisition around the world including the barriers and the recommendation. The information found that there are many factors related to the acquisition method of the construction equipment around the world, but specifically, the lack of information and knowledge among Malaysian contractors make it a problem for the contractors to choose the right method. The discussion of this issue then facilitated an initial understanding of the concept of acquisition method and all the factors that have been found by other previous researchers. Unfortunately, the findings from the literature review, which explored the acquisition method, identified varying advantages and disadvantages, and this has obviously caused some confusion for industry practitioners especially for Malaysian contractor when choosing the best or most appropriate approach for choosing the right method of acquisition. More importantly, previous studies and tangible examples of acquisition method in the Malaysian construction industry are limited.

In addition, Bell (1991) warns that secondary data has the disadvantaged of becoming outdated, as well as not being appropriate for the precise needs of a

particular research problem. Mohammad (2011) also claims that secondary data by itself cannot meet the specific needs of particular situations, problems or settings, and it is essential to obtain primary data to overcome this shortcoming. Therefore, this research needs to generate a study of the industry in order to gather primary data to be compared with secondary data from the literature review.

3.5.1.2 Industry Workshop (Workshop)

As explained in the previous section, the secondary data from the literature review needs to be compared with primary data in order to be comprehensive, up to date and appropriate for the precise needs of particular situations in this study. Accordingly, an industry workshop was conducted to gather primary data (to support the existing current secondary data) for the justification of reliability secondary data whether it can be adopted or not in industry in Malaysia.

There are several researchers (Kamar *et al.*, 2010; Blissmass & Wakefeld, 2008; Haron *et al.*, 2009; Kagioglou *et al.*, 1998) who recognise workshops as a highly interactive and experiential method of data collection and validation process in the qualitative research. However, the literature and information source of this technique, such as definition, criteria and guideline for implementation are limited. A workshop is defined as a form of group interview in which: there are several members (in addition to the moderator/facilitator); there is an emphasis in the questioning of a particular fairly tightly defined topic; and the accent is upon

interaction with the group and the joint construction of meanings Bryman and Bell (2007) (cited from Abukhzam, 2011). Finch (2010) views workshop as a qualitative research technique involving a number of participants to share their experiences, perceptions, opinions, beliefs and attitudes based on topics that are determined by the researcher.

The same researcher states that this technique involves an interactive group setting where participants are free to talk and discuss with other group members. Finally all the findings of the discussions need to be presented and shared in front of other groups. It is fundamental to have moderators / facilitator and a workshop's opening plenary session in order to provide the participants with an overview and better understanding of the subject and issue of discussion (Kamar, 2011). Nelson (2004) also supports that a good moderator / facilitator is vital to derive good results from a workshop. The result or report based on the workshop will feature patterns formed by words, called themes or perspectives, and require specific methods to analyse patterns in spoken language (Creswell, 2007). For the purpose of this study, based on those criteria, it clearly shows that a workshop is appropriately categorised under the research interview technique which is a subcategory of group interview.

An interview is defined as a purposeful discussion between two or more people to gather valid and reliable data that is relevant to the research objective (Kahn & Cannell, 1957 cited from Saunders *et al.*, 2009). Using interviews can help a researcher to gather valid and reliable data relevant to the research questions and

objectives. The interview technique has two main categories (refer Figure 3.3) known as; standardised (structured) and non-standardised (semi-structured and unstructured/in-depth) (Fellows & Liu, 1997; Saunders *et al*, 2009).

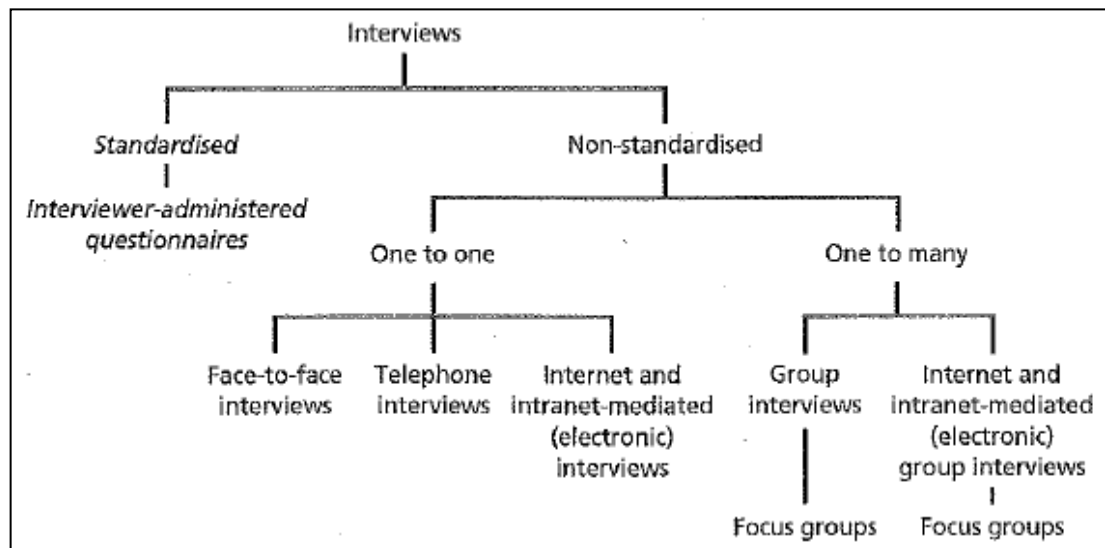


Figure 3.3 :
Forms of interviews (Saunders *et al.*, 2009)

Structured interviews (standardised) are based on a specific predetermined set of techniques, and often the questions are asked in a specific sequence (Keraminitage, 2009). In this type of interview, a standardised set of questions are used with little scope for probing an interviewee's responses by asking supplementary questions to obtain more details about some interesting aspects. Conversely, unstructured interviews (non-standardised) are often conducted within an informal setting with the aim of exploring a general area (broad topic) in depth, without a predetermined list of questions or guidelines, and allowing the interviewee to freely communicate their ideas on the subject (Saunders *et al.*, 2009; Fellows & Liu, 1997). Marshall and

Rossman (1989) state that structured interviews are more suited to use where there is a particular phenomenon with many generalisations, whereas unstructured interviews provide the facility to investigate a problem in more depth.

On the other hand, semi-structured interviews (non-standardised) fill the spectrum between the two approaches (Fellows & Liu, 1997). Within semi-structured interviews, the researcher would have a list of themes and questions to be covered (Saunders *et al.*, 2009), and the area being researched would be more specific than in unstructured interviews. Furthermore, the questions are predetermined and formal interview guidelines are present but the order and wording can be modified when appropriate (Keraminitage, 2009). The interviews are used to clarify and provide more detail on issues that were observed. Other major advantages of semi-structured interviews are their adaptability, as a skilful interviewer can follow up ideas, probe responses and investigate motives and feelings, which is not possible using a questionnaire (Bell, 1991). The high degree of interaction in semi-structured interviews further allows and makes it possible for the interviewer to know “*how*” as well as “*why*” a particular process occurred as it did.

In addition, the types of interview can also be differentiated on the nature of interaction between the researcher and participant involved in the session. Some interviews are “one-to-one” where a single participant is interviewed face to face, by telephone or electronic means. However, “one-to-many” refers to sessions where a researcher conducts non-standardised interviews with several respondents at one

time or namely as group interview (Saunders *et al.*, 2009; Sarantakos, 2005). Although Figure 3.3 shows that focus groups are a form of group interview, Gibbs (1997) noticed that it is important to distinguish between the two. According to her, group interviews involve interviewing a number of people at the same time with the emphasis being on questions and responses between the researcher and the participants. Focus groups, however, rely on interaction within the group, based on topics that are determined by the researcher (Morgan, 1997). There are many definitions of a focus group in the literature that consist of features of organised discussion namely: (Gibbs, 1997; Kitzinger, 1994), collective activity (Powell *et al.*, 1996), social events (Goss & Leinbach, 1996) and interaction (Kitzinger, 1995). The key feature of focus groups that was agreed by many researchers (e.g. Wee & Kevern, 2001; Gibbs, 1997; Kitzinger, 1995) is the active encouragement of group interaction among participants. Interaction in this context means the participants are able to share views and experiences at the same time and allow other individuals to voice differences of opinions as a reflection of their own experiences and thoughts.

A focus group is more commonly referred to as a workshop. As the aims of this research are to obtain several perspectives for factor of acquisition method, workshop is particularly suitable for data collection (primary data) and justification process. Another reason for selecting the workshop technique for this research is to draw upon respondents' experiences and reactions in a way that would not be feasible using other methods, for example observation, one-to-one interviewing, or questionnaire surveys (non-verbal survey). Robson (2004) (cited from Abukhzam,

2011) state that the workshop is considered to be “a highly efficient technique for qualitative data collection since the amount and range of data is increased by collecting it from several people at the same time.” According to Rubin and Missokia (2006), a workshop is usually composed of mixed groups of men and women representing a range of staff positions. The same researcher further explains that this has the advantage of introducing people to those they may not know and encouraging people to learn about the opinions of those they may not interact with regularly. According to the recommendations in the literature, using a group of four to six participants sharing similar backgrounds, attitude and behavioural patterns are suggested in workshop techniques (Krueger and Casey, 2000). Contrast to other research techniques, there is no right or wrong answers in a workshop (Rubin and Missokia, 2006). All opinions are valid because the goal of conducting a workshop is to see which views are more widely held and to clarify their meaning. In addition, the well-guided and thoughtfully conducted workshop also helps to create ownership and engagement among different sections of the organization because they allow participants an opportunity to express their views and to be heard by others (Abukhzam, 2011). That is the main reason why the choice of moderator can have a significant impact on workshop findings. Once a meeting has been arranged, the role of moderator or facilitator becomes critical, especially in terms of providing clear explanations of the purpose of the group, helping people feel at ease, and facilitating interaction between group members. In a sense, the facilitator has to understand the group process as well as the group task. Unlike the study circle or open space technique, a moderator / facilitator leads a workshop in a direct way to promote

debate, perhaps by challenging participants, especially to draw out people's differences, and draw out a diverse range of meanings on the topic under discussion. In a workshop conducted in a permissive environment, the moderator / facilitator is the key person who manages the process, seeks to prevent bias among participants whilst encouraging group members to respond proactively to ideas and comments from other group participants. As highlighted by Larson *et al.*, (2004), a skilled moderator / facilitator is really important in order to provide expertise in selecting participants, motivating them to attend and in interpreting and analyzing the results.

During the data collection stage in this research, the industry workshops are involved in organizing discussions within a selected group of individuals from different company to gain in depth information about their views and reactions to the topic lead by a skilled and experienced moderator/ facilitator. Selecting a well-trained moderator or facilitator helps to ensure optimal group interaction and ensure the desired outcomes with less bias. In an attempt to obtain the most effective environment, at the beginning of the workshop all the participants were briefed about the objectives of the workshop as well as the ethical procedures which would protect the participants' confidentiality and anonymity. Moreover, the moderator / facilitator tries to manage and maintain the situation by ensuring that all contributions to the discussion were treated equally and also encouraged all of the group participants to involve in the discussion of each point raised. According to Gibbs (1997), one way that a moderator / facilitator can convey respect and encourage participation is through the use of an effective introductory statement. The introduction should

communicate the purpose for which the group has been assembled, why the participants were selected, the ground rules for participation, and the opening question. Most importantly, the introduction should make the participants feel comfortable and welcome.

Accordingly, a moderator / facilitator needs to conduct a properly structured workshop that can provide a unique perspective and can produce ideas that lead to innovative programmes as well as programme improvements. The moderator / facilitator has also to keep the session focused and may sometimes have to steer the conversation back on course. The moderator / facilitator must also ensure that everyone participates and gets a chance to speak. At the same time moderators are encouraged not to show too much approval (Kreuger 1988), so as to avoid favouring particular participants. They must avoid giving personal opinions so as not to influence participants towards any particular position or opinion.

For example, throughout the workshop several senior practitioners (e.g. General Manager, Area Manager, and Senior Project Manager) attempted to lead the discussion, thus influencing the thinking of other workshop participants. Concerned about this trend, the experienced moderator / facilitator tried to address this situation by controlling the workshop and not allowing discussions to drift in order to ensure that every participant had a chance to speak. On occasions, the moderator / facilitator used the “probe technique” or moved things forward when the conversation drifted or became difficult. The probe is simply a question or statement which encourages

other group members to add or elaborate on something which was said. According to Gibbs (1997), this technique is a common and effective method used by most moderators / facilitators to elicit responses from participants who may be reluctant to contribute to the workshop's discussion.

Additionally, moderators / facilitators employ the “pause technique” in order to prepare the environment for effective conversation and to manage the conversation so that the delicate balance between outcome and genuine dialogue is maintained. The pause is simply a period of silence after the question is asked. Although a five-second pause may seem awkward to the inexperienced moderator/ facilitator, it is usually successful in encouraging a response from the group and there is usually one group member who is willing to break the silence. All the techniques highlighted above are important in order to ensure that the participants have the competency, particularly in the work discipline, to discuss every issue in the entire workshop session.

The primary data from Workshop has been compared with secondary data based on the literature review in order to see the justification. Several questions are asked in each section of the workshops to check for common views and to explore differences.

3.5.1.3 Objectives of the study and how they are addressed through the data collection method

Table 3.5 shows how the objectives are addressed through the data collection methods. After a thorough discussion on the data collection techniques, the following section tackles the techniques of data analysis.

Table 3.5 :
Objectives of the study and the mode of investigation

Objectives	Method of Investigation	
	Literature Review	Workshop
To identify the factors affecting the acquisition method of construction machinery and equipment among contractors G7	X	X
To discover the main obstacles for acquiring equipment and machinery among contractors G7		X

To identify the strategy for acquisition of equipment and machinery among the contractors G7		X
To justify the factor through an industry-based investigation in Malaysian projects		X

3.5.2 Data analysis

Burns (2000) indicates that the purpose of analysing data is to find meaning, and this is done by systematically arranging and presenting the information. Easterby-Smith *et al* (2002) however, deduces that, in making the data collected to become meaningful to the study, a clear explanation of how the analysis is done and a demonstration of how the raw data is transformed into a meaningful conclusion is required. Although there is no standardised procedure for analysing qualitative data, according to Saunders *et al* (2009) it is still possible to group data into three main processes: summarising (condensation) of meanings; categorisation (grouping) of meanings; and structuring (ordering) of meanings using narrative.

Summarising a qualitative study involves condensing the meaning of large amounts of text into fewer words. On the other hand, categorising involves two activities; developing categories and subsequently, attaching these categories to meaningful

chunks of data; whilst structuring commonly involves the reduction in the amount of interview text and it may also be expanded as the narrative of what happened is developed (Saunders *et al.*, 2009). As aim of this study to identify the factor of acquisition, therefore, categorization (grouping) of meanings is significantly appropriate to be applied in this research. This approach deals with data that involves the creation and application of codes or theme (Gibson, 2006). Coding refers to the creation of categories in relation to data from all kinds of places (e.g. theory, literature, research experience, the data itself); the grouping together of different instances of datum under an umbrella terms that enable them to be regarded as of the same type (Miles & Huberman, 1994). In practice, the coding process of qualitative data can be analyzed using inductively and deductively based analytical procedures (Saunders *et al.*, 2009). Since this research adopts an inductive approach, therefore the discussions of qualitative data collection in this study will focus on inductively based analytical procedures such as data display and analytic approach; grounded theory; discourse analysis; narrative analysis; and template analysis.

According to Miles & Huberman (1994), data display and analytic approaches consists of three concurrent sub-processes; data reduction, data display drawing and verifying conclusions. This approach involves organising and assembling data into summary diagrammatic or visual displays such as matrices and networks. Miles and Huberman (1994) argue that these forms of display are relatively easy to generate and allow the researcher to make comparisons between the elements of the data and to identify any relationships, key themes, patterns and trends that may be evident.

The term grounded theory strategy refers, in particular, to theory building which is helpful for the researcher to predict and explain behaviour, the emphasis being upon developing and building theory through an induction approach (Goulding, 2002). According to Charmaz (2006), in developing theory, this strategy applies simultaneous processes for data collection and analysis. Saunder *et al* (2009) explains that the process of data collection starts without the formation of an initial theoretical framework, whereas theory is developed from data generated by a series of observations. Charmaz (2006) further identifies a two step coding process for analysing data using grounded theory; line by line - open coding (substantive); and theoretical coding. Strauss and Corbin (2008) also elaborate that the disaggregation of data into units is called open coding, whereas the process of recognising relationships between categories is referred to as axial coding, and the integration of categories to produce a theory is labelled selective coding. A three-dimensional analysis is critical for successful analysis using the grounded theory.

Alba-Juez (2009) refers to discourse analysis as the linguistic analysis of naturally occurring connected speech or written discourse. Discourse analysis is a general term that covers an extremely wide variety of approaches to the analysis of language in its own right and is concerned with how and why language is used by individuals in specific social contexts (Saunders *et al.*, 2009). In particular, it explores how language (discourse) in the form of talk and text both constructs and simultaneously reproduces and/or changes the social world rather than using it as a means to reveal the social world as a phenomenon (Phillips & Hardy 2002). Based on the above

discussions, discourse analysis, therefore, focuses on understanding how language is used to construct and change aspects of the world.

According to Saunders *et al* (2009), the implementation of narrative analysis depends on the research questions and objectives, the data collection methods used and the data that is produced, either as the principal means to analyse qualitative data, or as complementary means. From the human science perspective, narrative analysis refers to a family of approaches to diverse kinds of texts, which have in common a storied form (May, 2010). This technique mainly focuses on written or oral texts, but can also be used to analyse photographs, films or even dance performances (Riessman, 2008). Research that focuses on the role of narrative usually involves life story research or oral history such as the sequence of events (Griffin, 2012). The structural elements that are present in narratives may also help the researcher to analyse each narrative account and perhaps to compare the course of events in different narratives where there is likely to be some analytical benefit in their comparison (Saunders *et al.*, 2009). May (2010) also states that most narrative studies limit the number of narratives analysed, and presents the findings in the form of case studies.

In addition, one of the common approaches to analysing qualitative data is called template analysis originated by King (2004). Template analysis refers to the process of organising and analysing textual data according to codebook analysis or thematic coding (Crabtree, 1999). It is a form of thematically organising and analysing textual

data that focuses on using the textual content to describe a phenomenon (King, 2006). Saunders *et al* (2009) further describes that the essence of the approach is that the researcher produces a list of codes or categories (template) that represent the themes or issues revealed from the data that has been collected. This code is very important to the researcher for the interpretive process. As discussed by King (2004), some of the codes will usually be defined as a priori, but they will be modified and added to as the researcher reads and interprets the texts. In contrast to other technique, template analysis is a flexible technique with less specified procedures that permits researchers to tailor it to match their requirements. It works particularly well when the research aim is to compare the perspectives of different groups of staff within a specific context (King, 2006).

As explained, the aim of the workshop however, does not focus on understanding how language is used to construct and change the world or seek to identify relationship between themes or to compare aspects of the findings. This research is not involved with life story research, oral history or case study such as the sequence of events by constructing and testing a set of causal links between events, actions etc. in one case, and the iterative extension of this to further cases. At the same time, this research does not deal with diagrammatic or visual displays such as matrices and networks during the organising and assembling of data. This research has, however, been particularly focused on identifying the factor of acquisition method and has attempted to gain detailed explanations to obtain a deep understanding of the problem. Furthermore, the researcher intends to gather and update the information

(factor of acquisition method) from the multidisciplinary background of Malaysian contractor in order to fill the gap which exists in the current literature. This clearly justifies that template analysis is a significant and most appropriate technique for use in analysing the qualitative data from this research. As highlighted by King (2006), the term template analysis refers to a particular way of thematically analysing qualitative data. The detailed steps of analysing qualitative data by using template analysis in this research are highlighted in the next section.

3.5.2.1 The Analysis Process of this Research

This section will describe the development of the analytical template and illustrate how it aligns with this research. King (2006) develops three analytical stages (refer Figure 3.4) for analysing interviewees' transcripts in a research study; creating the initial template; revising the template; finalising the template. According to the same author, the starting point for creating the initial template is the workshop agenda that includes the set of question areas, probes and prompts used by the researcher. The topic guide is drawn from multi sources that particularly relate to the study such as academic literature, the researcher's own personal experience, anecdotal and informal evidence, and exploratory research. Once the initial template is constructed it must be revised by the researcher in order to reveal any inadequacies that arise within the template. Modifications to the template usually take one or more of the following forms; insertion, deletion, expansion or changing the scope, and changing high-order classification (King, 2006; King 1998). The most difficult decision when

the developing template's process is the final stage usually known as developing the final template. This is because the researcher has only a limited time in which to produce an ideal template (King, 2006). Commonly, the template could be considered final when most or all of the data (transcripts) has been read through at least three or four times and when the researcher is confident that the template is accurate.

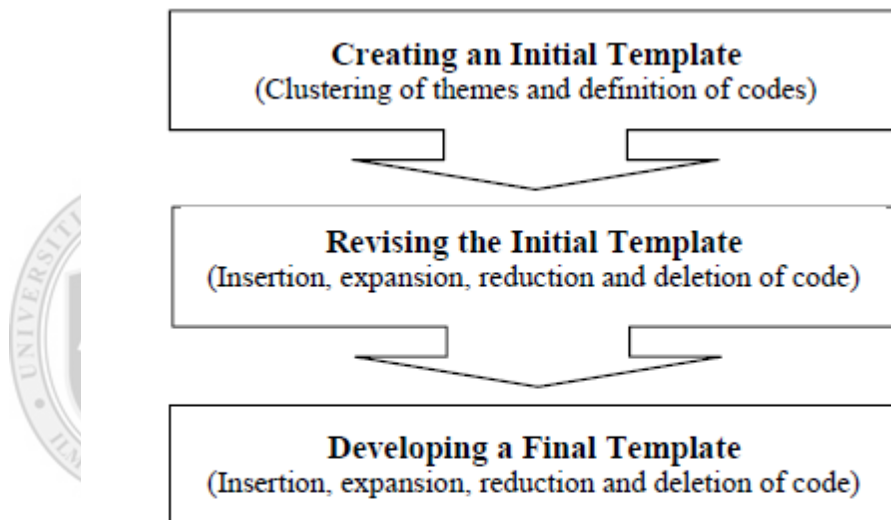


Figure 3.4 :
The steps of template analysis (King, 2006)

Details of processes necessary for creating an initial template, revising the initial template and creating the final template analysis for this research are explained as below;

Preliminary coding:

Defining “themes” and “codes” are as the two main processes in the development of initial template analysis. According to King (2011), *themes* are features of participant’s perceptions or experiences relevant to the research question while *coding* refers to the process of identifying themes in accounts and attaching labels (codes) to index them. In this research, the data analysis process is begun by translating workshop transcript (the workshop was conducted in Malay) from Malay to English. The transcripts are read manually and data has been coded by hand (using colour coding) to help ease the cumbersome process of conventional coding. This kind of collaborative strategy could increase the efficiency of the analysis since the development of the template occurs simultaneously to the coding process (King, 1998). However, according to King (2004), there is a danger during this process of neglecting some aspects of the data. Therefore, all the transcripts were re-read several times to ensure that all the themes relating to this investigation were highlighted and that nothing was omitted.

Clustering of themes and definition of codes:

Template analysis normally starts with some predefined codes or use of priori themes as a guide for the analysis process. King (2004) however, suggests that the use of priori themes should be restricted as far as possible. This is because a large number of priori themes might restrict the effect and prevent the exploration of more

pertinent issues during the analysis process (King, 2011). On the other hand, too many codes may lead to an overwhelming mass of rich and complex data (Mohammed, 2011). Taking this into account, the researcher defines key themes based on the questions and the initial review of the workshop transcript. The process of identifying some themes in advance is common in template analysis and is usually referred as priori themes (King, 2011). It creates an advantage in terms of accelerating the initial coding phase of the analysis, which is normally very time-consuming (King, 2011). The researcher, however, must always be aware that the purpose of developing predefined codes is for use as a guideline and not aimed at influencing the researcher to make a decision (the process should be transparent and not biased towards specific themes or codes) during the analysis of the primary data findings.



Revising the initial template:

According to King (1998), once the initial template is completed, the template needs to be developed until the researcher feels that it gives as good as a representation as possible of the themes identified in the data. This iterative process involves insertion, deletion, changing the scope and changing the higher-order classification of a theme.

Creating the final template:

King (2006) noted that there is no stage where the researcher can say with absolute certainty that the template is finished. This is because there are always other ways of interpreting any set of qualitative data (King, 2011). Abukhzam (2011) states that one of the most difficult decisions faced by the researcher, is when to stop the analysis. Although it is very difficult to finalise the completed template, it is easier to make a decision when the research was conducted by a group. The researcher must make a pragmatic decision about when to stop the development process otherwise the writing up process cannot be started. On the other hand, the template could be considered final when most or all of the data (transcript) has been read thoroughly. According to King (2006), the researcher needs to re-read the template at least three or four times to look for material that was not successfully encompassed in the initial template and change the template, where necessary, and to know when to stop the development of the template.

The themes emerged from the researcher's interpretation of the workshop transcript and are constantly revised until all the relevant sections of the transcript has been scrutinised in the coding process and deemed to be satisfactorily represented in the analysis. It is important, nonetheless, to give a brief explanation as to how the themes were created during the analytical process. The following quotation transcribed from participant P2 (Proalma Manager) is an example of the analysis and the coding process using a portion of the workshop transcript.

'I rarely buy new model because it is difficult to get spare parts and the new parts are often expensive. Spare parts order can only be done through suppliers that sometimes taking a long period of time'

The text contains a number of factors (themes) related to this study. From the researcher's observation of the transcript, participant P2 advocates that spare part machine and cost of the spare part are the key factors for the acquisition method. The researcher vigilantly reads the extract and highlights the themes that are related to the categories identified and assigned each theme to the appropriate category. Themes that are not related to the initial categories are given another category name.

3.5.2.2 The Coding Process of this Research

Previous researchers such as (Abukhzam, 2011; Kvale, 1996) describes coding as a process of breaking down, examining, conceptualising, contextualising and categorising data to yield new concepts, categories and theories from the phenomenon investigated. This process can be conducted either manually (by hand) or with the use of the qualitative research software such as NUD*IST (Non-numerical Unstructured Data: Indexing Searching Theorizing) and NVivo. As highlighted by Gibbs (2002), NVivo is a powerful tool to aid the researcher in examining possible relationships amongst themes.

Smith and Hesse-Biber (1996) point out that software is used mainly as an organising tool and to decide whether to code the data either manually or mechanically. Basit (2003) however believes that since qualitative research involves

a smaller sample and does not deal with large datasets, NVivo is less useful and does not require a great deal of time for analysis like quantitative research. Even though most of the computer-assisted data analysis software that is used to organise data in a systematic way is capable of perceiving a links between theory and data; it still requires the researcher's analytical skills, vision and integrity to produce an analytical and theoretical explanation (Catterall and Maclaran, 1997).

As the number of questionnaires and data sets are relatively small (one workshops), the researcher decides there is no inherent need for NVivo. Therefore, all the data from this research is managed manually by using manual coding techniques in respect of the transcript from the workshop. This involved the manual identification of key research themes and topics that emerged from the workshop transcript as being potentially significant to the phenomena being studied.

3.6 Chapter Summary and Link

This chapter discusses the philosophy that underpins the research and the choices made in the research approach, strategy, and technique. The approaches and strategies available to the researcher were highlighted and clarification of the reasons why those choices are made for the research is discussed. Philosophically, this research adopts the interpretivism epistemological paradigm and the constructivism ontological position. The main differences between the inductive and deductive

research approaches are highlighted and the reasons for choosing an appropriate research strategy are also justified.



CHAPTER 4

The results from the analysis of the interview data will be presented in this chapter. The themes identify within the data include: (a) the factors affecting acquisition method, (b) the problem or barrier for G7 contractors to have equipment and machinery, (c) the recommendation and strategies to get the acquisition of equipment and machinery.

4.1 Findings of question 1- The factors affecting selecting the acquisition method of construction equipment and machinery

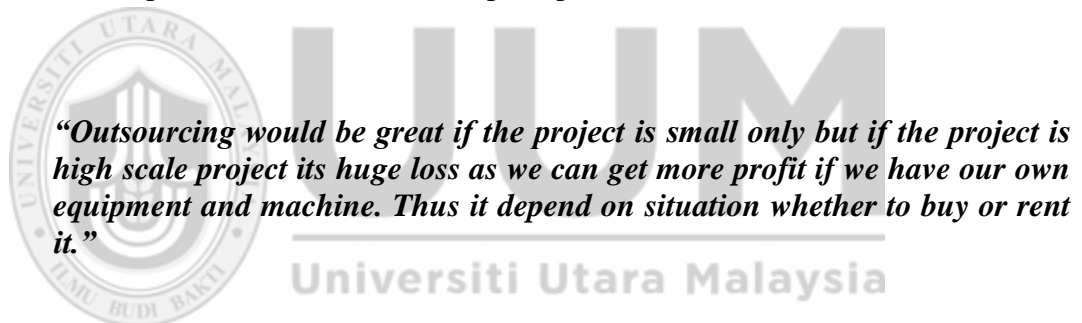
The research question for this study - What the factors affecting the acquisition method of equipment and machinery led the researcher to develop interview questions about participants' experiences during the dealing and how they defined and classified the factor.

For the most part, contractors have similar definitions that encompassed the contractors' perceptions of how they viewed acquisition. These definitions focused on what actually contractors' goal in order to save their budget. For instance, to the question "Does your company are more likely to buy or own construction machinery and equipment compared to renting from a supplier?"

Overall, there is very strong agreement that buying method is the favorite method for all the participants. Finding from the workshop shows that all the participants (except P1) indicate that they would like to have their own machine whether by buying by cash, rental or leasing except participant P1 who likes outsource more. Participant (P1) mentioned that;

“No. It’s because everything we done, we just outsource....I think any time you outsource you will cut more the cost rather than we buy.... I don't know why some people think it’s good to buy all the machine and equipment as we can get profit too by outsourcing the project to others. “

While Participant (P2) made difference perception



“Outsourcing would be great if the project is small only but if the project is high scale project its huge loss as we can get more profit if we have our own equipment and machine. Thus it depend on situation whether to buy or rent it.”

While Participant (P3) defines the concept of definition the most appropriate as:

“I rarely buy new model because it is difficult to get spare parts and the new parts are often expensive. Spare parts order can only be done through suppliers that sometimes taking a long period of time. So, indirectly, this will disturb the planning and work of a project. In addition, the problem to get projects ongoing is also the cause for the contractors to find an alternative method to obtain services through outsourced because it is easier and cheaper. The best way is by purchasing of machinery 'secondhand' as spare parts more cheaply and easily available. While for outsourcing the best time for outsourcing is when we have a high scale project and we want to outsource a several thing to a smaller company that we can cut more cost and time.”

While participant from Participant (P4) believes that in dealing to buy the equipment, it is a natural part of growing up to be a succeed contractor. Participant (P4) views the equipment as an asset that gives benefit in the future so that he prefer to buy all the machine and equipment, when he states,

“I have seen people always see houses and lands is the asset that we should have, but I would consider that machine and equipment as one of the asset as we can give a rent the machine to others . By give a rent we can cover the maintenance or the cost we buy the machine. I mean we don’t have to bare the additional cost like tax and maintenance and maybe in the future we can get also a profit by give rent the equipment. As for example, for roller machine usually the market value if we want rent it around RM8, 000-RM9, 000 in a month and for Excavator the rental could reach to RM16, 000 in a month.”

While Participant (P5) quite agree with participant (P4) but seems to believe that dealing in buying the equipment the contractor must also have knowledge about the market value of the equipment and also they must know the depreciation cost for each types of the equipment. Participant (P5) gives an example case for a company that become bankrupt because cannot absorbed the maintenance cost and thus the company was closed in 2009 due to the high maintenance which costs RM3 million a year (peninsula only). The company's net profit rate last year was £ 14 million. If the company is continuing business machinery and equipment, it will have lost each year 21%. In order to avoid the workers from loss a job, they are absorbed into the Felda Group. Most of the machinery and equipment on tractors purchased through Malaysian tractor. Participant (P5) notes the consequences of buying the equipment the contractor will also bear with the storage, insurance, freight charges and initial unloading and assembly and also the interest from bank.

Others participants like participants (P1), (P2) and (P3) act like they are agree with other participants' statement. When they are asked how they define the concept, (P1) states that,

“I think it can be a variety of meaning if we see with other previous research viewer but the best thing is we choose the method that give the best profit for the company and anything we want to buy or rent we must analysis the pro and contra of the method.”

Indeed, all the participants agree that there is an also indirect cost of factor that must see firstly towards choosing the method. Participant (P2) gives a good example of the advantage and disadvantages of purchasing, which has significantly affected the factor of acquisition method for the past 7 years. As stated;

“From my view and experiences, I find there are several advantages and disadvantages of purchasing equipment compared to renting. Firstly, it is more economical if the equipment is used sufficiently. Secondly, it is more likely to be available for use when needed and no need to search and find when it needed. And lastly if the ownership assures better maintenance and care, purchased equipment will be kept in better mechanical condition and can use to rent to others if they don't have any project. But for the disadvantages I find that by buying the equipment sometimes it may be more expensive than renting. Others that, a contractor may continue using obsolete equipment without notice the equipment should be maintenance due to lack of information during buying the equipment. Besides, purchasing may require a substantial investment of money or credit that may be needed for other purposes. And lastly a contractor may induce to continue doing that type of work, whereas other work requiring different types of equipment might be available at a higher profit due to ownership of equipment designed primarily for a given type of work only.”

The discussion goes continue to ask the perception of the contractor towards the acquisition method of buying, renting and leasing. For instance, to the question participant (P3) states that:-

“I found that most of my friend’s contractor, not interested in selecting buying method because the ability of their company to be the main factor, followed by the factor of future use and also the existing machinery is inadequate. I can conclude here that the financial capability to become an important factor in choosing the method of purchase. Many of my friends buying the equipment by hire purchase thus I can conclude that monetary factors and future use affect the selection of purchase methods.”

The perception was agreed by participant (P4) who gives his own perception:-

“I see that it appears that most of the contractors typically have machinery by renting. To me in my view most the contractor class under D, most of their project is carried out mostly medium and small construction projects and time is short. By rent it maybe cut the cost of project and gives more profit to the company. So, factor size of the project and construction time should be looking first to select the best method”.

For participant (P5), he also agreed but had his own view:-

“I see contractor not aware to lease the equipment and I find this method is much less practiced in the construction industry .For me I assume they don’t have a strong financial and size of the project so small machinery to lease it but for me I think by leasing we can save more money than buy or rent it. So I assumed the factor obsolesce, inflation and improper selection or replacement affecting the choice method”

The findings from the first workshop question identify many factors faced by the contractors in Malaysia. The factors that have been highlighted are summarized below in Table 4.1 :

Table 4.1 :
Factors faced by the contractors

No	Factor	Partisan
1.	Price of machine	Participant (P2) Participant (P3) Participant (P4) Participant (P5)
2.	Cost Consideration	Participant (P1) Participant (P3) Participant (P5) Participant (P3) Participant (P4)
3.	Size of the project	Participant (P2) Participant (P5) Participant (P3) Participant (P4)
4.	Market situation	Participant (P2) Participant (P5)
5.	Availability of spare part	Participant (P3)
6.	Service of suppliers	Participant (P3)
7.	Future used	Participant (P4) Participant (P5)
8.	Storage	Participant (P5)
9.	Freight Charge	Participant (P5)
10.	Initial unloading	Participant (P5)
11.	Interest from bank	Participant (P5)
12.	Equipment productivity	Participant (P2)

13. Equipment maintenance	Participant (P2)
14. Condition of equipment	Participant (P2)
	Participant (P5)
15. Monetary factor	Participant (P3)
16. Construction time	Participant (P4)

For conclusion, this research question that had we concluded; purchasing with cash, financing through a loan, renting and leasing are four most common ways for Construction Equipment Acquiring (CEA). For having the best result in profit for a construction industry, the contractor must choose the best alternative for obtaining the equipment. The optimum acquisition strategy comes from accurate estimates of revenues and cost and also some non-financial factors that effect on choosing acquisition mode. To achieve the research objective, the factors that effect on CEA must been identified firstly in a wide research. Contractors should consider both financial and non-financial factor to make a good decision. The degree of importance for each factor has been specify by experts and experienced construction managers. In order to see the problems related to the factor of acquisition, the following section will focus on identifying the problems.

4.2 Findings of question 2- The Problem or Barrier for G7 Contractors to Have Equipment and Machinery

In the course of the interviews participants recalled their experiences with dealing, whether they feel an obstacle or not during to buy the equipment, so they were asked

to tell about an incident they remembered. For instance, to the question “What is the obstacle you find during you wanted to buy or rent the equipment?”. On many occasions, participants would want to share their experiences, or ones they witnessed, when, where they find any problem that disturb them from being have the equipment. Participant (P4) admitted that lack of finances is the biggest problem facing by most contractors. It was agreed by participant (P2) explained that the biggest problem on contracts was payment. Sometimes when the payment delays meant that a contractor cannot predict cash flow. The difficulty in predicting cash flows means that banks consider contractors as a higher risk, thus the interest on money to construction firms is higher. Thus, the cost of contractors acquiring capital is high. In one incident, a contractor who was doing to buy a machine was just in needed situation and didn’t realize the cost of machine is higher than his expectation. The main reason is because the suppliers are charge high interest rates to them. Several of the participants seemed to be in agreement as to the reasons why contractor cannot afford to buy the machine. Participant (P3) noted,

“Like there was, there was one incident when I want to UMW to buy the bulldozer. I was quite shock when I find the price increased 30% from the previous price and when asked if there were any particular reasons for the increasing price they said that the tax rate to import the machinery is increasing. So, the contractor cannot afford to buy it because the lack of capital to pay the machine.”

Participant (P5) noted the difference as he saw it, saying that,

***“Some contractor, when they found the cost obstacle they should know how to handle the problem. The problem of high purchases equipment is like everywhere .Actually what I found the most problem is like the lack of the latest technology machinery and equipment from the supplier. To get the new technology usually I must wait for the stock because usually a new technology always has been ordered earlier by bigger company.*”**

While other participant from participant (P1) mention among industries, the construction industry has the largest number of firms that have declared bankruptcy. According to the statistics released by LIPM, 6,031 contracting firms have been recorded as inactive or dormant from June 2005 to December 2009. This is due mostly machinery and equipment for the construction work imported from outside. Thus, in consequences the tax rates for equipment ownership will be very high.

Participant (P1) give an example company by added that:-

“This company was established in 1982 and engaged in the G7 contractors civil and civil engineering. Most purchases of machine tools and equipment owned by the company and the capital needed to purchase machinery equipment are very large. Among the most expensive machinery to be purchased is the crawler (crawler tower) and the most expensive component is the controller. It appears that the use of machinery do require very large investments. Maintenance cost of 100 units of machinery is worth RM 1.6 million, while the tax imposed on 100 units of various machinery was worth RM 30,000. This equipment ownership tax must be pay for 5 years on all new and used machinery.”

Others participant like participant (P2) also give act like they are agree with other participants statement which adding also knowledge about the use of machinery and engines as well as the correct methods of operation is also the problem of a

contractor to use it. The participant explained that there was a lack of qualified construction professional with basic knowledge in construction works. There is also a problem with supervision and managerial aspects of construction work in Malaysia. Participant (P2) complained that many workmen lack the necessary training for carrying out their work. Participant (P2) adding more by state that contractor should also view the problem of location of the supplier as if the supplier machinery or equipment are far away from our location thus it will increase the shipping cost.

Participant (P3) talked about contractor getting bankrupt last few years which was mentioned by Participant (P1) statement above. When asked what he thought that led to the bankruptcy:

“I think primarily, firms are considered to fail if the net asset value is negative and firms cannot afford to settle their debt believes that firms are more likely to fail if contractors cannot complete their projects on time and causing project owners to take legal action against the firms. Also if firms cannot pay their debts and cannot return the money they owed to shareholders. Although the economic reason behind the failure of firms; that is, firms have more chances of failing if their income is insufficient to recoup construction cost and if the return on invested capital is smaller than the capital cost...”

Participant (P4) suddenly commented by giving his opinion about the problem. He stated that this problem also had a relation with obtaining bank guarantees for the purchase of machinery and also the time duration of the project. Constraints factors such as cost of spare parts and high operating costs is also the several problems a contractor will deal with. Some contractors complained about no ongoing project.

The volume of construction work has drop in recent years because of lack on capital and sometimes it takes up to a year to get a project.

The perception was agreed by Participant (P5) who gives his own opinion that the main problems expressed by all of the contractors were lack of capital to fund the equipment. Most of them do not have complete machine and equipment and another that most of their own machinery is over 20 years. This will result of breakdown machine which will impact the progress of work. In another cases, they are machines that spare part are not available to find because of machines are too old. Contractor also sometimes meet the problems relating to fake spare parts and equipment. By meaning of lack of funds that means their staffs will not paid well. Thus, the contractors will do not have money to pay wages to their worker. Because of lack of funds also, contractor find it difficult to initiate necessary materials like fuel (gas oil and other lubricants) to carry out works. According to him also, the main reason why there is lack of funds is delays in payment by clients and government.

Participant (P1) also complained about lack of access to get loan from banks. The main reason for this is that contractors often get payment late and it make difficult for the contractor to pay back the loan to bank. Sometimes, it may delayed for several month, contractors not be paid on a job although they are supposed to receive monthly payments for work-in-progress. As the interest rate tends to be very high sometimes by the time a contractor receives the payment interest rates may have

jumped even higher because of the late payment. He also explained that he also tend to rely on overdraft facilities rather than bank loans.

“When I go for bank loans, I often have to provide collateral or guarantee that is difficult for me to provide. Sometimes I have to use my equipment, often times the equipment might even be under collateral already. So I have to use my house sometimes as collateral.”

Participant (P2) seems like agree with participant (P1) but expressed frustration with the contracting environment in Malaysia and the politics that often surrounds it. He complained that the business environment is driven by politics. Each government that comes into power tries to propel its own set of contractors because they realize that contractors are a very good source of raising money for financing political campaigns. In short, most contractors complained that

“Politics is a major problem.”

The discussion goes continue with more hot issue as participant (P3) continue with his statement that complained most Malaysian contractors always have to go and look for credit. But the problem is the cost of credit is high. By that the contractors could not afford equipment. These contractors said that it was government’s duty to create an environment which ensures that businesses construction can thrive and grow. Participant (P2) also complained that the current business environment is not one that is capable of helping them to build their capacity. Other challenges

identified through the interviews included technology and lack of barriers to entry into the market. In the words of Participant (P2),

“This is the only industry in the country where government should set up a school to train the entire contractor but currently what I find they only train their own contractor people and crony for their own satisfaction.”

The findings from this workshop question identified many problems and challenges faced by the contractor during dealing to have the machine and equipment. The problems that have been highlighted are summarized below:

Table 4.2 :
Obstacle faced by the contractors

No	Obstacle	Participant
1.	Prices of machine	Participant (P4) Participant (P3) Participant (P5)
2.	Interest percentage	Participant (P2) Participant (P1) Participant (P3)
3.	Maintenance cost	Participant (P5)
4.	Availability spare part in market	Participant (P5)
5.	Government support	Participant (P2)
6.	New technology equipment	Participant (P5)
7.	Barriers to entry into the market	Participant (P2)
8.	Political environment	Participant (P2)
9.	Lack of funding and access to get loan	Participant (P1)
10.	Obtaining bank guarantee	Participant (P4)
11.	Knowledge about new equipment	Participant (P2)
12.	Tax rate for equipment	Participant (P3)

13.	Payment delays	Participant (P2)
		Participant (P1)
14.	Fake spare part	Participant (P5)

For conclusion for this research question we conclude that to have own machinery and equipment for the construction work, it requires capital or large costs compared with renting or leasing. Overall, from the survey we also found that majority of G7 contractors wants to have heavy equipment. By have own heavy machinery is not only make easier the hard work carried out by human beings, but it also saves time. Purchases of machinery and equipment require quite big amount for initial capital as well as the better efficient planning. Such investments should be calculated in detail so that it can contribute to accelerate the construction process and save time and reduce labor costs. Thus, the purchase of machinery and equipment are more effective when the construction working carried out on large-scale construction so it will allows the use of machine and equipment continued. If the purchase of machinery and equipment burden the financial of the contractors, rental or purchase of secondhand equipment can be done by the company which then the company can provide a service business for construction machinery and equipment rental. In order to overcome the problems related to the lack of integration, the following section will focus on identifying the appropriate solutions.

4.2 Findings of question 3 - The Strategy and Suggestion to the Government Role for Acquisition of Equipment and Machinery among the Contractors G7.

In the previous section, almost half of the interviews, the participants expressed that they felt that government not do so much to help them in helping to buy the equipment. While some participants stated that the contractor should be noticed their own financial limit, others stated that supplier machine should offer credit installment more accessible and also bank should not charge the interest too high. Participant (P1) comments are representative of many of those made by participants regarding the recommendation most appropriate. Participant (P1) notes:

“We are entering into an era of continued growth as we position ourselves into the new millennium when we become an industrialized nation with not only make a buildings and roads but also skills and expertise to sell overseas. In order to fulfill this aspiration the construction industry need to be guided, nurtured and developed to attain the required quality and ingredient. Firstly, you must assess your business reality. It is important to understand your objectives. Secondly, get an external point of view. Depending on the scale of your investment, it may be worth working with an external consultant who can ensure you make the most of your purchase by helping you assess your needs. Third, to become a success contractor you must be innovative. In today's competitive business world, being innovative in everything you do is key to success Next, try to look at your project construction as a whole rather than making isolated purchases, look at the overall needs of your operations. Short-term purchases without long-term plans are costly and may not yield the best results.”

The perception was agreed by participant (P2) who gives his own suggestion:-

“Shop around for supplier’s equipment so that you get best price for the machine you want. The Internet gives you access to a wide range of specialized equipment companies, so take the time to browse... Don't let price alone guide you in your supplier decision. Also consider aspects such as post-sales service and a supplier's reputation, and get references. If you're a loyal customer, you can ask for better warranties or an extended customer service plan. All too often, contractors don't consider the time, money and resources required to train employees on new equipment. You want to avoid the productivity drop that occurs when employees take too much time to adapt to new technology or processes. If the equipment is new or has new features, you can assume employees will face a learning curve. It's important to head off problems by ensuring that you have the financing in place to address the resulting downtime. The most important you must know the financing options. Every method of financing has advantages and disadvantages, so carefully evaluate each option. “

Participants like participant (P3) also gives act like he is agreed with other participants’ statement which give suggestion to think safety first. A healthy and safe work environment means their employees and their company can be more productive, and this rule applies to their equipment and technology purchases as well. Their suppliers are responsible for selling the equipment that can be used safely, but the contractors are responsible for ensuring that their employees follow safety rules. The contractor may also want to ensure that machine such as crane is ergonomically designed to reduce employees' risk of injury and discomfort, while enhancing productivity. Another that when purchasing equipment or technology, be sure that it is energy efficient. Not only the contractor can save the money, but he also contributes to the green earth. Investing in the right equipment is a complex task.

Most participants agreed that there was a connection between the issue that they discussed with the government's role and the supplier machinery itself. Participant (P2) states that if government makes reduction of import duty machinery and equipment as proposed, they should focus on the following to ensure the sustainability of its implementation such as price components and spare parts must be lowered, the import duty components and spare parts must be reduced and also creating a parts supplier industry so that contractor will find more easily the spare part. More than that technology transfer program must be carried out to ensure that the relevant machinery and equipment technology can be developed by local companies in the future. Heavy machinery must be given incentives to increase productivity.

The discussion continues with the issue as Participant (P5) continues with the role of government which suggests that government should focus the development program which focuses on the use of high-tech machinery to increase productivity. The government should also promote the use of machines for the finishing work which carried out nowadays by skilled and semi-skilled workers. And lastly government should restructure the system of training and should emphasize on competency training technical operator of heavy machinery. These accredited operator jobs are usually get expensive wages so it can attract local workers to enter the construction industry.

Participant (P5) also adds the role of government:

“The government should be committed to the implementation of free market policies of economic liberalization through agreements worldwide. The use of machinery and equipment will increase the competitiveness of local contractors to compete for projects at home and abroad. Thus, to promote the use of machinery and equipment by contractors in Malaysia, better incentives such as tax and duty break on machinery and loan facilities should be provided by government. Selection of right incentives is extremely important in order to avoid wrong use”

Participant (P4) adding more CIDB has introduced Industrialized Building System (IBS) and require all government building projects worth RM 10 million with IBS to reduce dependency on the use of foreign workers. IBS Centre (CIDB) and the Construction Research Institute of Malaysia (CREAM) have implemented various programs to encourage the construction industry to use IBS. A reduction in the dependence on foreign workers means the contractor can reduce the wages and use more the utilization of equipment and machinery.

The findings from this workshop question identified many problems and challenges faced by the contractor during dealing to have the machine and equipment. The problems that have been highlighted are summarized in Table 4.1 below:

Table 4.3 :

Recommendation by the Respondent

Participant	Recommendation
Participant (P1)	○ Assess the business reality and understand the construction objective

	<ul style="list-style-type: none"> ○ Get an external point of view depending on the scale of your investment. ○ The contractor must be innovative ○ Look at the project construction as a whole rather than making isolated purchases
Participant (P2)	<ul style="list-style-type: none"> ○ Shop around for suppliers, equipment so that you get the best price for the machine ○ Consider the time, money and resources required to train employees on new equipment ○ Know the financing options
Participant (P3)	<ul style="list-style-type: none"> ○ Think safety first ○ When purchasing equipment or technology, be sure that it's energy efficient
Participant (P4)	<ul style="list-style-type: none"> ○ Government must make a reduction of import duty machinery and equipment ○ Ensure the sustainability of its implementation such as price components and spare parts must be lowered ○ Creating a parts supplier industry so that the contractor will find more easily the spare part ○ Technology transfer program must be carried out to ensure that the relevant machinery and equipment technology can be developed by local companies in the future ○ Heavy machinery must be given incentives to increase productivity

Participant (P5)	<ul style="list-style-type: none"> ○ Government should focus the development program which focuses on the use of high-tech machinery to increase productivity ○ Government should promote the use of machines for the finishing work which carried out nowadays by skilled and semi-skilled workers ○ Government should restructure the system of training and should emphasizes on competency training, technical operator of heavy machinery ○ CIDB must promote the Industrialized Building System (IBS) and require all government building projects worth RM10 million with IBS ○ IBS Centre (CIDB) and the Construction Research Institute of Malaysia (CREAM) must implement more various programs to encourage the construction industry to use IBS
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For conclusion, we can conclude that training and certification system must be provided and comprehensive operator control the machine and equipment through the accreditation program must be recognizes. Other than that, government agencies must facilitate the approval of loans provided by banks such as Bank of Commerce / MIDF / EXIM bank as CIDB should act as a secretariat or a panel for the loan application. Besides that contractor must drafting procedures required each of registered listed machinery and equipment owned by the contractor. In addition contractor must also develop a specific action plan to promote the use of machinery and engines to be more systematic and establishing a computerized registration system and database for machinery and equipment in order to facilitate the process of leasing. For government role, they must encourage contractors to establish a

consortium to raise funds for the purchase of machinery and equipment and lastly they can provide continuous exposure and promotion of the importance of the use of machinery and equipment.

4.3 Chapter Link and Summary

This chapter presents the analysis and discussion of the findings from workshop . It can be summarized that all the workshop participants agreed and confirmed that the optimum acquisition strategy comes from accurate estimates of revenues and cost and also some non-financial factors that effect on choosing acquisition mode in the Malaysian construction industry. The findings from the workshop, therefore, identified the improvements that were needed in terms of the best method in acquisition. Although there is some old factor that they find out is still reliable to affect the acquisition processes, they still need further modification for the previous finding so that it can build a new framework with adding the new primary data.

In addition, the involvement of all contractors was required in order to gain all the experience of them and especially to convince and educate the Malaysian Government or private clients about the new factor that maybe will give a high impact toward the acquisition method. The workshop found that financial cost and non financial cost are the key factors. All the factors identified are shown in 4.1 sections. The next chapter will discuss the conclusion, limitation and suggestion for

future research in Malaysian industry based on the triangulation of the factors that were identified from the literature review and workshop .



CHAPTER 5

5.0 Introduction

This thesis aims to study:

‘An Exploratory Study of Factors Affecting the Acquisition Method of Construction Equipments and Machineries among G7 Contractors’

This final chapter summarizes the research findings from the literature review and the investigations conducted by the researcher as they are presented in this thesis. In doing so, the research’s limitations and contributions to knowledge are presented in the chapter concluding with recommendations for future work. The chapter highlighted how the research aims and objectives (refer section 1.5) of this study are investigated and addressed:-

- To identify the factors affecting the acquisition method of construction machinery and equipment among contractors G7;
- To discover the main obstacles for acquiring equipment and machinery among contractors G7;
- To identify the strategy for acquisition and government role of equipment and machinery among the contractors G7?

5.1 Main findings of literature review

In order to explore the factors affecting the acquisition method in the Malaysian projects, this thesis begins by reviewing literature that related to the Malaysian construction industry. In summary, the research investigates the growth of the Malaysian construction industry, and highlights the groups before recommending the factor which will affect the acquisition method of machine for enhancing the success of construction projects.

Based on the last Malaysia Plan projection (the Ninth Malaysia Plan) alone, Malaysia was struggling to meet the dateline within the framework time that client need. The traditional way to choose the acquisition method, which was commonly practiced, incurred high costs, was unable to respond to this huge demand within a short time, failed to produce acceptable quality construction products and was slow to consider sustainable development strategies. In an attempt to address these issues, the government, through its “caretaker”, the Construction Development Board (CIDB) Malaysia, tried to encourage a paradigm shift in a way to select a proper acquisition method. One of the efforts was to actively make a talk or seminar in order to expose the contractor with a strategy and recommendation that need to choose the best acquisition method.

Despite the well-documented benefits, the take-up for contractor to choose the right method not as high as anticipated. One of the main barriers is the environment

constraint such as market and political factor in the Malaysian construction industry is related to poor economy management control. This central issue can, specifically, affect the various stakeholders in the project with also the client and the contractor itself. As construction becomes more innovative, competitive and complex, more participants are involved in this study, a radical improvement in the procurement system and supply chain process is required for a more integrated practice, especially during the dealing phase.

Malaysian project is rely only on the historical data and experience of the similar project to guide them in constructing the strategy to choose the best method for the machine selection; mostly rely on myriad factors. This traditional method process is however, unsuited to new development project nowadays and poses many problems that could affect the success of the construction. Since the construction industry character is a concept project based, thus, contractor is having trouble to choose which type of acquisition can give more profit to them so that the machine and equipment they buy will not be wasted. If not tackled, this will lead to the additional costs and time because of rework stemming from errors, quality issues and inefficiency of project delivery, poor performance and client dissatisfaction of product delivery.

Many industry-led reports have all called on the industry to change from its traditional modus operandi and increase performance through a right way to choose the right method of acquisition. Based on the above discussion, the need for greater

collaboration with government and supplier in industry is paramount. Previous researchers around the world suggested that this collaboration is still lacking particularly during the dealing process. Even though there are many related studies concentrating on the factors of selecting the acquisition method to improve construction project, they do not provide whether it suitable in Malaysia construction industry itself. The findings from the literature review, which explored all the concept factor, identified that there were varying advantages and disadvantages between all the method, and this has obviously caused some confusion for industry practitioners especially for contractor, as to which approach to choose for improved the success of the project. Accordingly, research into a right method acquisition for each barrier and problem is necessary in order to avoid more problem occurred despite the contractor cannot avoid the problem due to many constraint factor.

As a response to that challenge, and consistent with the needs of the construction industry, therefore, this research is focused first on justification of the previous literature on the factor whether it is suitable or not to be adopted in Malaysian construction projects. By doing so, this research involved a comprehensive literature review of secondary source data includes current and previous reports, tools, concepts and approaches that particularly related to factor of acquisition method. After looking thoroughly the previous researches, there are 20 factors that affecting acquisition method of construction equipment which can be separated into two main groups; financial and non financial factor. All the factors have been grouped into seven key elements: fixed cost, equipment revenue, indirect cost, adaptability,

operating cost, risk and organization. Unfortunately, as highlighted earlier, the findings of previous studies especially in the Malaysian construction industry, are limited in Malaysia and it is not to be sure whether it reliable to be adopted in Malaysia or not. As a result, the researcher undertook to address this gap using the following methodology.

5.2 Methodology analysis and key findings

The main aim of this research is to explore the primary data about the real situation and environment in Malaysia industry construction, therefore this study requires the researcher to understand, explore, and elicit opinions and perceptions based on those experienced by Malaysian construction practitioners which was governed by the qualitative inquiry of what (to explore the context of a number of variables associated with factor of acquisition method) and how questions (to investigate in-depth information and explanation of the data to be collected – problems) thus, this research fell within the interpretivist paradigm. Accordingly, a series of industry workshops was chosen as the mode of data collection because of the capability to obtain data based on multidisciplinary Malaysian stakeholders' perspectives.

The data collection process began with workshop with the aim of enhancing the current literature review of factor of selecting the acquisition method for a Malaysian project context. The key findings of this research can be summarized that all workshop participants agreed and confirmed that the financial problem and lack of

government support during the dealing stage of buying the machine significantly affects successful project in the Malaysian construction industry. The findings from the workshop further identified that most of previous research was unsuited to Malaysia project and thus posed a substantial barrier to its adoption. It was suggested that improvements framework were needed in terms of the factor in selecting the acquisition method in current Malaysian practice in order to achieve the success in the Malaysian construction industry. According to the workshop's participants, contractor need to ensure that all the basic of the factors, such as price of machine, cost consideration, size of the project, market situation, availability of spare part, service of suppliers, future used, storage, freight charge, initial unloading, interest from bank, equipment productivity, equipment maintenance, condition of equipment, monetary factor and construction time are taken this into account before proceeding to buy or rent or lease the equipment.

By doing so, the participants strongly agreed that an appropriate framework for this study needs to be developed to detail how the right method (including buy, rent and lease) should be selected depend on the factor , problem and situation happened. The participants believed that a lot of benefits will be gained from the implementation of this approach such as bringing together various skills and knowledge, enhancement of the level of trust and respect among each other, ensuring good and reliable flows of information, and establishing mechanisms for problem resolution through a collaborative decision making process for effective and efficient delivery of the project.

The analysis of data from the workshop then has been compared with the information identified from the literature review in order to see the justification between them.

The overall findings from the workshop confirmed that not all the factors (20 main factors) are suitable and have a robust applicability to achieve effective success in Malaysian industry projects. The final frameworks need to be presented in the next study due to several limitation and constraint.

5.3 Research Limitations

In the course of conducting this research, the following obstacles were encountered:

- Having a limited number and time of appropriate workshops for data collection framework due to only 18 weeks given for this project study.
- Participants sometimes talked to each other, asked questions and expressed doubts and opinions on personal or unrelated issues rather than focusing on the topic given.
- Difficulties in obtaining and accessing information directly from the participants because most of the participants in the workshop had not known each other.
- A few of the workshop's participants already knew each other, and tried to play safe by using passive involvement during the workshop's activities in order to avoid any confrontation or argument with their current client or future partner.

5.4 Contribution to Knowledge

Despite the above limitations, the contribution of knowledge of this research came from both practical and academic perspectives. From the practical perspective, on Malaysian construction industry most of them did not provide any specific guidelines to be followed by practitioners on how to select the right method of acquisition. According to previous researchers, there has been a lack of attention paid to right acquisition, which is why most of the contractor still select the wrong method although they have studied the history of the others experience contractor. The researcher hopes that this study can be helpful to guide the contractor to select the acquisition method of construction equipment based on the factor that suitable with their objective project. Most of the firm have their own strength to persuade their worker to have the intention to complete the project with success and give full effort into their project without delayed, but it is still a lack of guidance on the particular issue regarding on the how to show the real situation that the contractor always get involved. Therefore, this research was generated to justify the previous research with the workshop finding in order to develop a new framework of critical factors to selecting the acquisition method for the Malaysian industry which will be explore in the next study.

The researcher hopes that this study will help the firm to investigate whether the factors affecting the acquisition method of construction equipment and machinery can bring positive impact towards the success of the project. Meanwhile, the firm can

also identify the main obstacles for G7 contractors to have equipment and machinery and to discover the recommendation and strategies to get the acquisition. Thus, from this study it can help the contractor to determine the best action for the firm to achieve the target for the construction project and to prevent from being delayed.

The researcher believes that this study will be used as a term of reference for the next studies which to develop a new framework. In addition, highlighting the critical success factors which had been identified during the workshop also will help to standardise the benchmarking for selecting the method. Benchmarking is the one of a good practices that the managements must apply to their operation in order to sustain their level of performance. By creating the ISO benchmark such as the government must start to make obligation which required all the contractors to attend a course that helps the contractor to choose the right method. Then, the contractor will know all the possibility that could happened to each of the method that they have selected. Therefore, government agencies must ensure all contractors be aware with the barrier and problem surrounding because each of that will have significant towards the efficiency of the operation. Government is the main person that will influence the ways of contractors strategic in aspects of setting their mission and vision and also their objective. In order to build the progressive contractors the government must know how to tackle the problem may arise with apply the practice from previous research.

Last but not least, the outcomes of this study could also be used for appropriate education and training either for academic programmed or professional hands-on practical purposes. This would improve students and practitioners' understanding of factor of selecting the acquisition, barriers and strategies for the problem. Once academia and industry have gained an in-depth knowledge and understanding of this matter, it will indirectly help in the enhance the success in future Malaysian construction projects

5.5 Recommendations for Future Work

This section suggests related areas of research where additional investigations may be valuable or would further enhance this study. In the entire process of this research, there were various issues that were uncovered and highlighted. Therefore, the following are some recommendations for the further improvement:

- Further research on developing a framework for new factor of selecting of acquisition method of equipment and machinery in Malaysia industry would be helpful to validate this study. Additionally, it might be useful to consider a comparative study with other outside countries that are at a different stage of development (UK and US) compared to Malaysia industry in order to see whether this framework is applicable for implementation.

- Since the method of acquisition have their own advantage and disadvantage a further research to discover the best choice to choose the method for selecting the acquisition for construction machinery for each situation and barrier could be study.
- Further study is required in terms of investigation and validation processes among contractor project in southern region so that it might be useful to consider a comparative study with other countries in Malaysia.
- A future study should also focus on the readiness aspect. It is really important to know whether the current local contractor well prepared or have enough knowledge in terms of dealing skill and know the incentives and support from agencies that can help them with the financing loan.

5.6 Chapter Summary and End Note

This chapter has presented a summary of this research's key findings, contribution, limitations and the recommendation for the research. In spite of some of the limitations highlighted in section 5.5, the researcher remains confident in the results, which have successfully explore the factor of acquisition method for selecting the method for equipment and machinery among G7 contractor in Malaysia project. But the value of this study was still not confirmed and considered to be valid until a new framework and validating workshop is done.

Despite the difficulties and limitations faced throughout this study in gaining access to the research subject, the fact that this study engaged with different data collection

techniques should be indicative of the worth of the results. However, although the interpretation of the data for the purpose of this thesis has concluded, the significance of the findings could be refined in future for dissemination purposes. To date, several academic refereed journal publications, book chapters, and academic conference publications have been undertaken as a consequence of this research. It is believed that the output of this research will meet the current academic (trainer, facilitator, researcher, policy maker and lecturer) and practitioner (e.g. government body, client and contractor) needs for those who have an interest in achieving the success of effective construction projects. Finally, a new framework of factor of selecting the acquisition method in Malaysian construction industry will be developed in the next study.



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