THE STUDY OF CONTRACTOR &
SUBCONTRACTOR SELECTION CRITERIA IN
MALAYSIAN CONSTRUCTION INDUSTRY

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The Study on Contractor & Sub-contractor Selection Criteria in Malaysia Construction Industry

by

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Dissertation submitted in partial fulfilment of

the requirements for the

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CERTIFICATION OF APPROVAL

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Approved by,

_____
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TRONOH, PERAK

January 2009

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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MUHAMMAD AFEQ BIN AMRAN

ABSTRACT

This report basically discusses the preliminary research done and basic understanding of the chosen topic, which is The Study on Contractor Selection Criteria in Peninsular Malaysia Construction Industry. The objective of the project is to identify criteria on selection of contractor and sub-contractor from literature review and from current practice by clients group and general contractor company in Peninsular Malaysia focusing on private sector. The challenge of this project is to conduct surveys among the clients group and general contractor company in Peninsular Malaysia. The respondents that we will choose will represent the whole private sector in Peninsular Malaysia. The surveys will be done by distributing the questionnaires to clients group and general contractor company in Peninsular Malaysia. Once the questionnaires have been replied, it will be used to do descriptive statistic. Any criteria that been used in current practice but not mentioned in literature review will be added up. The criteria also will be prioritizing from the most popular to the less popular. The research aim to help organization such a clients group and general contractor company from construction industry to select criteria to choose a contractor and subcontractor and provide a guideline as well to construction industry. The research also serves as source of information for main contractor and sub-contractor to win the contract. Besides, it can be a platform to client and main contractor to make appropriate decision on the choice of main contractor and subcontractor.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Construction industry consists of many important phases and one of the most important phases is bidding process. During the bidding process, selecting the most appropriate contractors to conduct the project is very difficult. Contractor and sub-contractor selection actually plays a vital role in overall success of any construction project. Most of the clients and main contractor need a best method to select contractor and sub-contractor so that they can get best results in term of cost, time, and quality for their project. Historically, client and main contractor usually will choose the lowest bidder to get the contract during tender been issued.

Few Guidelines existed in those early days in Malaysia on how main contractor and sub-contractor been selected by the client and main contractor and what are the criteria that they used for selecting the contractor and sub-contractor. The problem is, sometimes clients and main contractor do make mistakes in their decision. There are only few studies regarding the performance for selection contractor and sub-contractor in Malaysia so a lot of improvement can be done for this matter.

1.2 Problem statement

Various researches had been done in Malaysia regarding performance selection criteria to choose contractor and sub-contractor. From those researches, it has been proved that the method implement by every client and general contractor company in Malaysia is different. Some of the client and general contractor company reveal about the criteria that they are looking for but it just general because some of it still confidential for them to publish it, so what is actually the criteria for contractor selection by clients group (current practiced) and sub-contractor selection by main contractor in Peninsular

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Malaysia and also how far those criteria different with criteria for selection contractor and sub-contractor from literature review.

Therefore, this project will aim to identify and describe the selection criteria that already been used by several client and main contractor in Malaysia so that a better guideline can be achieve in the future.

1.3 Objectives

The main objectives of this research are:

- To investigate criteria for selecting contractor by client and sub-contractor by main contractor from literature review
- To investigate criteria for selecting contractor by clients from current practice in Peninsular Malaysia
- To investigate criteria for selecting sub-contractor by main contractor from current practice in Peninsular Malaysia

1.4 Significance of research

- To help organization such as clients group and general contractor company from construction industry to select criteria to choose a contractor and sub-contractor and provide a guideline as well to construction industry.

1.5 Scope of Study

- The study shall focus on the criteria to choose main contractor and sub-contractor that being implement by current practice in Malaysia construction industry. The study will use survey research method to collect data which using questionnaires and interviews as to validate the data obtained from survey method.
- It is assumed that criteria to choose main contractor and subcontractor in Peninsular Malaysia are different compare with West Malaysia. So the questionnaire will be distributed to companies in Peninsular Malaysia only.

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CHAPTER 2
LITERATURE REVIEW

2.1 Previous Study

There are already some researches that had been done all over the world by experts. They take several years to finish their work and some of the researches as below: From the research of Y. Ilker Topcu (2003), he indicates that there is a multi-criteria decision model for construction contractor in Turkish sector. There are three main factors been focused which are cost, time, and quality. On the other study by Zedan Hatush (1997), it is found that when dealing with selection of contractor, client have to focus on utilise information concerning client objective and contractor capabilities as well as bid price as objectively and transparently as possible as means of achieving the best value for money. He also concludes that utility analysis is one of the best ways for evaluation suited to contractor selection.

Journal by Ekambaram Palaneewaran (2001) emphasis on prequalification of contractor by some major public clients in Hong Kong, Australia and USA. He highlights some strength and weaknesses of the contractor selection process. The paper also mention about aims or objectives of pre-tender exercise of contractor prequalification to make sure that all contractors sufficiently responsive, responsible and competent to undertake the contract. There are also paper entitle a review of contractor selection practice in the U.K by Gary D. Holt (1995) that have done some researches in the U.K construction industry especially. The author reveals that choice of contractor should be made on a value for money basis rather than automatically accepting the lowest bid because the main objective is to identify best tender not lowest bidder. While, the journalist R.M Skitmore (1998) study about the difficulties for clients to set decision criteria in able to see capabilities of contractors. He also investigates the divergence of decision criteria used by different client through large empirical survey conducted in the U.K. He also identify that there are two possible factors affecting criteria selection which are client objectives and decision-maker perceptions.

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Table 1: Criteria for selection main contractor from literature review

Criteria of main contractor selection	Previous Study			
	Skitmore (1999)	Topcu (2004)	Kumaraswamy (2001)	Holt (1995)
Financial Stability	√	√	√	
Background of company	√	√	√	
Technical Capacity		√	√	
Cost	√	√	√	√
Performance	√			
Standard of Quality	√	√	√	√
Occupational Health & Safety	√	√	√	
Time performance	√	√	√	√
Management capability	√			
Failed contract	√			
Progress of Work	√			
Human Resource Management			√	
Level of technology	√			
Relationship with client		√	√	
Relationship with sub-contractors	√			
Fraudulent activity	√			
Competitiveness	√			

Table 2: Criteria for selection sub-contractor from literature review

Criteria of sub-contractor selection		Previous Study	
	Arslan,G,Kivrak,S,Birgonul,M.T,Dikmen,I. (2007)	Yan,C.S,Tsung,P.T,Miao,L.H (2004)	Manoharan (2005)
Cost	√	√	√
• Financial capacity	√	√	√
• Timely payment to labourers		√	√
• Completion of job within budget	√	√	√
Quality	√	√	√
• Quality of production	√	√	√
• Standard of workmanship	√	√	√
• Team efficiency	√	√	√
Quality of materials used	√	√	√
• Experience in similar projects	√		
• Experience in the construction industry	√		
• Job safety		√	√
• Personnel training	√		
Time			√
• Accessibility to the firm	√		
• Time accuracy in submitting bids	√		
• Completion of job within the time	√	√	
Adequacy	√		
• Proposal accuracy	√		
• Adequacy of experienced site super,staff	√		
• Adequacy of labor resources	√		√

Table 3: Criteria for selection sub-contractor from literature review

Criteria			
• Adequacy of material resources	√		√
• Adequacy of equipment	√		
• Compliance with site safety requirements		√	√
• Reputation		√	√
• Track record		√	√
• Relationship with client			√
• Previous work experience		√	√
• Type of project			
• Failed contract			√
• Competitiveness			√
• Technical expertise			√
• Management capability		√	√

Yan, Tsung, Wen and Miao from Chung Hua University in Taiwan stressed on a common style of selecting subcontractor in Taiwan's construction industry. They mention about their method of distributing questionnaire to survey about 400 construction companies and from that, they obtained subcontractor selection factors and their weights. Three system mention by them which are Quotation System, Appraisal System and Subcontractor selection system. Quotation System is useful for subcontractor to fill available price for specific items. Then, appraisal system will integrate and calculate related data to determine total grade for all factories. The third is the Subcontractor selection system that can be used to compile all information about special area. With the help of this system, construction Company can use internet to do procurement, collect factory quotation and perform subcontractor selection. This result on a fair procurement process, getting right partners, increase competition and create profit for company. The study also discovers the shortcomings of the current procurement operations and proposes feasible management strategies. The developed aided system provides the function of the maintenance of subcontractor's data, quotation module, report preparation and maintenance of relevant data, which capable of provide services such as the system sets the task for selected project and create unit price analysis. The system also can select appropriate subcontractors based on the results of the evaluations. Then, it successfully combines the procurement operations with the budget control. The system able to provides the progress control function for the procurement operation so that the decision makers may investigate the progress. The objectivity of the evaluation criteria and their weights is confirmed by the industry. Both the evaluation item and the weights can be adjusted depending on the demand of each project.

Another important study is conducted by Gokhan, Serkan, M.Talat and Irem from Civil Engineering Department (Anadolu University), Ankara, Turkey (2007). They mention about the role of the general contractor to know all financial, technical and general information about the subcontractor in order to get the best subcontractor for the project. General contractors should also consider several factors in the selection process. These may include the quality of production, efficiency, employment of qualified members, reputation of the company, accessibility to the company and ability to complete

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the work within the time given. This paper proposes a web –based sub-contractor evaluation system called Web-based sub-contractor evaluation system(WEBSES) by which the subcontractors can be evaluated based on a combined criterion. This system actually helps general contractors to select the best subcontractor for their subworks, speed up selection process, gain time and cost savings during bidding process. They describe how subcontractor selection in construction projects is very crucial. The selection will affect the quality of work as well as the construction progress. As construction projects and sub-contract works become more complex, a combined assessment of various criteria should be considered by the general contractor in order to select the most suitable one. Previous practice is like general contractor usually will deal with subcontractor that they have worked together before. This can lead to inefficiencies in projects. Here, WEBSES can help to improve the selection of subcontractor. This system is developed for the use of general contractor. It eliminates the dependency to the factor of lowest bid where it also considering other criteria. WEBSES can speed up the sub-contracting process and improve the decision quality and may help to solve the problems that arise from previous practices They conclude that overall benefit of selecting the most suitable subcontractor can be the improvement of the general contractor overall performance.

There is one method of classifying construction contractors using unsupervised-learning neural works (Elazouni). Contractor prequalification involves the monitoring of contractors by client to determine their competence. Factors that client looking for are ability of contractors to complete the project on time, within budget, and meet the quality standards. A neural network model was applied to aid in the prequalification process by classifying contractors into groups based on similarity in performance using the financial ratios, activity, profitability and leverage. Contractors are represented in this model by patterns in four-dimensional space. Pattern of similar performance tend to form clusters intercepting regions of low pattern density in between. A neuron with weights is used as a classifier to set a decision boundary between clusters. The method basically iterates the neuron weights to move the decision boundary to a place of low pattern density. Then, the statistical hypothesis testing of the mean difference of two independent samples was

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used to validate the classification of the parent class to the two child classes considering the four ratios separately. The method was used hierarchically to classify a group of 245 contractors into classes of small numbers. Then, the inferred procedure of classification proves that the neutral network model classified the four-dimension pattern representing contractors efficiently. This technique divides the given contractors into a number of classes based on the similarity in performance. This method gives a means to evaluate performance of a contractor relatively to the other contractors working under the same conditions in a particular country. Thus, this method negates the need to evaluate contractor based on international standard values of the financial ratios.

The famous method to select subcontractor is Analytic Hierarchy Process (AHP) introduced by Manoharan,R.(2005). The author emphasized that majority of selection process depend on bid cost rather than trade-off between other parameter such as quality, safety and environmental commitments. The main objective of this study was to identify the criteria used for selection process. The finding from the research indicated that the common criteria considered by contractor during selection are the cost, past performance, financial stability, technical capability, management capability, subcontractor workload, previous work experience and track record. The study also recommended Analytic Hierarchy Process (AHP) to be used as decision support system. This paper too provides information for subcontractor to win the bid and prepare group of main contractors so that they can choice the best subcontractor for their project. Reputation of company can be describes as a standing of the company. Level of technology defines as contractor's experience to handle the level of technology as required in the present project.

2.2 Theory

A book called Building Profits in the construction company (published by McGraw Hill) defines contractor as a person or company that accepts responsibility to perform the obligations of a contract; a term usually applied to one who engages in contract execution as regular employment. Another term is Client that may be defines as the owner of the contract that give tender to the contractor to do their project. Clients group consist of many party such as developer, architect firm and quantity surveyor firm. Developer defines as an entrepreneur who invests in land and buildings and who sometimes manages the construction involved in those investments. The term of Architect firm defines as firm qualified, and usually certified as such by statue , to analyze construction projects, create and develop designs compatible with project and properties of materials to be used in project's completion, prepare detailed drawings and specification, and administer execution of project by a book named Construction Contractors' Survival Guide(published by A Wiley-Interscience Publication).The performance defines as performance of recently completed projects. Fraudulent activity means history of convictions in professional conduct, default of deceive, non- payment of social security and non-payment of tax. Financial stability defines as previous, present and future financial status of the contractor. Meanwhile, management capability defines availability of experienced management staff to monitor and co-ordinate the work. Standard of quality in construction management defines as quality of workmanship and material in previous projects. Then, failed contract can be describes as whether the contractor has failed to complete a contract or recently has his contract terminated by client or main contractor.

CHAPTER 3
METHODOLOGY

3.1 Research Methodology

3.1.1 Population and sample of population

The project is concentrate on the criteria that been used by client/consultant and general contractor company in Malaysia. There is only few study were conducted in this country, so the aim of this project is to provide a guideline to help clients group and general contractor company in Malaysia when they want to choose main contractor and sub-contractor. The research methodology would be conducted by survey. Sample unit that will be conducted is simple random sampling where there will be 30 samples. These 30 samples will represent the whole population of study. To be able to get 30 samples, the questionnaire to be distributed will at least 300 and more because some of the survey might get a good feedback and some of it may not. After that, descriptive analysis will be performed to find the value such as mean and variant in order to compare both criteria selection to choose contractor from literature review and as in practice. Minimum of 30 samples is needed because according to Central Limit Theorem, when sample size approaches 30, the sampling distribution approaches normality. Then, this normal distribution will have the same mean as the parent distribution and variance equal to the variance of the parent divided by the sample size (David and Sutton, 2004).

Population=Client group and general contractor in Peninsular Malaysia

Sample minimu
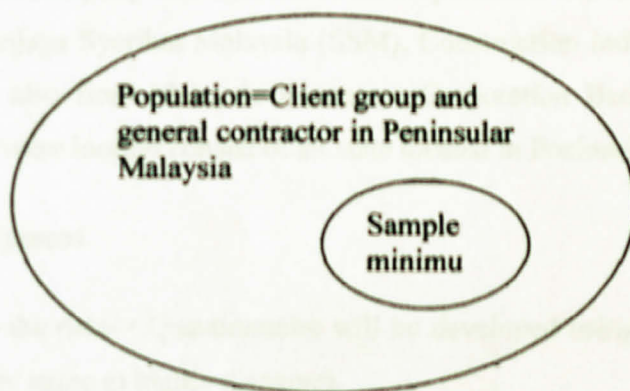
Figure 1: Random sample method for population of private sector in Peninsular Malaysia

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Analysis of data will be conducted using a descriptive analysis and the methodology of the objectives can be concluded as below:

Table 4: Methodology of research

Task	Method	Result
Identifying criteria selection main contractor and sub-contractor from literature	Literature review	Criteria
Identifying criteria of main contractor selection from practice	Survey using questionnaire	Criteria
Identifying criteria of sub-contractor selection from practice	Survey using questionnaire	Criteria

3.1.2 Respondents of Study

The population of study would be in Peninsular Malaysia so the respondents for this study shall be the general manager, project manager and engineers in clients group and general contractor company in Peninsular Malaysia focusing on private sector such as Developer, Construction contractor company, Quantity Surveyor firm, Architectural Firm and Engineering Firm. In choosing respondents, random sampling method will be used. Sample unit that will be conducted is simple random sampling where there will be 30 samples. These 30 samples will represent the whole population of study which is Peninsular Malaysia. To be able to get 30 samples, the questionnaires will be distributed at least to 300 private company and. The list of the respondents will be obtained from list provided by Suruhanjaya Syarikat Malaysia (SSM), Construction Industry Development Board (CIDB) and also from Malaysia Resources Corporation Berhad (MRCB). The sample respondents were located consist of all state located in Peninsular Malaysia.

3.2 Tools and Equipment

1. To compile the data-> Questionnaire will be developed using the 5 point Likert scale (Highly agree to highly disagree).

2. To analyze the data-> Statistical tools(Descriptive Statistic, e.g : mean,varians & severity index)

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3.3 Flow chart of the research
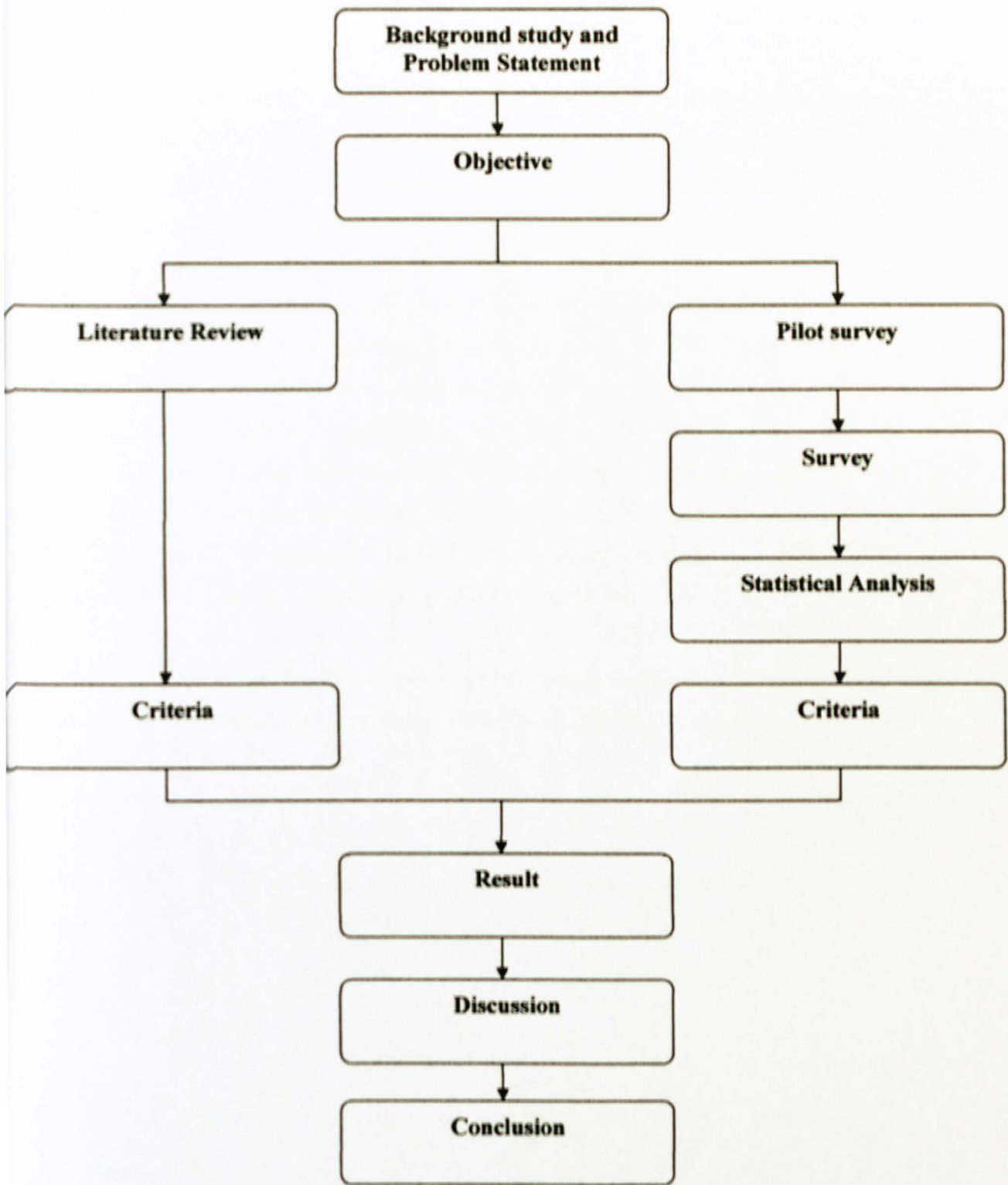
Figure 2: Flow chart of final year project

3.5 Pilot Survey

<u>Definition</u>

A survey, usually on a small scale, carried out prior to the main survey, primarily to gain information to improve the efficiency of the main survey. For example, it may be used to test a questionnaire, to ascertain the time taken by field procedure or to determine the most effective size of sampling unit.

During week 11, Pilot survey has been conducted in order to test before going for real survey. 3 questionnaires have been distributed to lecturers, 1 to client/developer and 1 to main contractors. The purpose of the pilot survey is not concentrating on the content or result of the survey but it focusing more on comment on how the survey questionnaire can be improved. It is important to prepare a good questionnaire so that respondent will feel easy and comfortable to fill the questionnaire. The questionnaire also should be attractive, simple and complete. The meaning of complete is later when questionnaire been replied; it should give a good result after been analyzed.

For pilot survey, it is better to meet the respondent face to face so that easy for the respondent to comment on weaknesses of the questionnaire as well thing that can be improved.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Comment on the questionnaire from pilot survey

Table 5: Comment on questionnaire

No.	Comment on the questionnaire	Suggestion	Example of Suggestion
1.	Include only important question related to the research because later graph and chart will be construct from the result	Reconsider to put the question	Eliminate question on estimating annual turnover of company
2.	Some criteria term on section B should be describes to help respondent understand because different respondent will have different perspective	Describes every term that might difficult to understand	Criteria (Technical capacity) – ability of the company in term of technical, the skills and expertise they have
3.	Respondent feel that all criteria is mostly importance and very importance. So they just concentrate to thick on column importance and very importance	It may be better to 'rank' the criteria according to importance where the upper one is the most respondent will thick and the lowest one is the least respondent	If bid price is the most importance, rank the criteria 1st and if political reason is the least importance, rank the criteria to be the last one

		thick	
4.	The question about the designation of the respondent should cover all possible designation that responsible to a project. It may cause problem later when constructing pie chart if many of the respondent choose 'other'.	Avoid 'other' designation by providing more possible designation in construction industry.	
5.	For section C, it is not good to put 'Please feel free' because it might not encourage respondent to fill that column.	Make the question straight forward	Please feel free to add further information regarding the criteria for selection of main contractor or sub-contractor and any other matters related to the topic
6.	For section E, the question asking if respondent prefers to know result of the research. But how the result will be send is not stated.	Change the pattern of the question	Change to question like 'How do prefer to know result of the research' And change the answers to be a) By e-mail [ ] b) By mail [ ] c) No, thank you [ ]
7.	Avoid grammatical error in questionnaire because some of the respondent concern about that	Spent some times to check the grammar	After finalized the questionnaire for real survey, submit to supervisor for grammar checking.

CHAPTER 4
RESULTS AND DISCUSSIONS

4.2 Data Compilation & Presentation

4.2.1 <u>Section A: General / Background Information</u>

Company Information

1. Type of business

Table 6: Type of business and number of respondent

Type of business	Number of respondent	%
a) Client for residential projects	29	31%
b) Client for commercial projects	18	19%
c) Client for industrial projects	7	8%
d) Client for infrastructure projects	8	9%
e) Construction contractor	30	32%
f) Quantity Surveyor Firm	0	0%
g) Engineering consultant	0	0%
h) Architect Firm	0	0%
i) Other	1	1%
Total	93	100%

Percentage for type of business

- a) Client for residential projects
- b) Client for commercial projects
- c) Client for industrial projects
- d) Client for infrastructure projects
- e) Construction contractor
- f) Quantity Surveyor Firm
- g) Engineering consultant
- h) Architect Firm
- i) Other
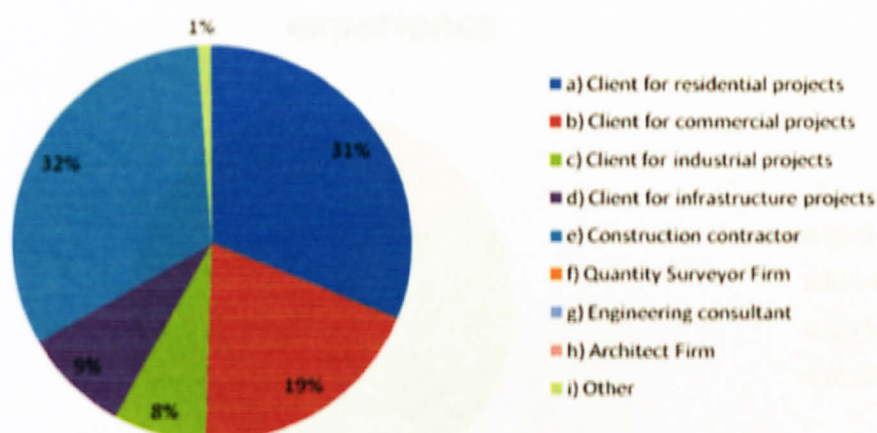
FIGURE 3: Percentage for type of business

Figure 3 shows the type of business that the respondent companies are involved in. A total of 54 company replied the questionnaire and some of the company involved in more than one sector. From the pie chart, it is shown that the biggest type of business is client for residential projects while the lowest is other type of business. Construction contractor also have higher percentage because this research involves two sides which are client and main contractor.

2. Years of company experienced in construction

Table 7: Years of company experienced in construction

Years of company experience	Number of respondent	%
a) <5	2	4%
b) 5-10	6	11%
c) 11-20	25	44%
d) >20	23	41%
Total	56	100%

Percentage for years of company experience

- a) <5 — 4%
- b) 5-10 — 11%
- c) 11-20 — 44%
- d) >20 — 41%
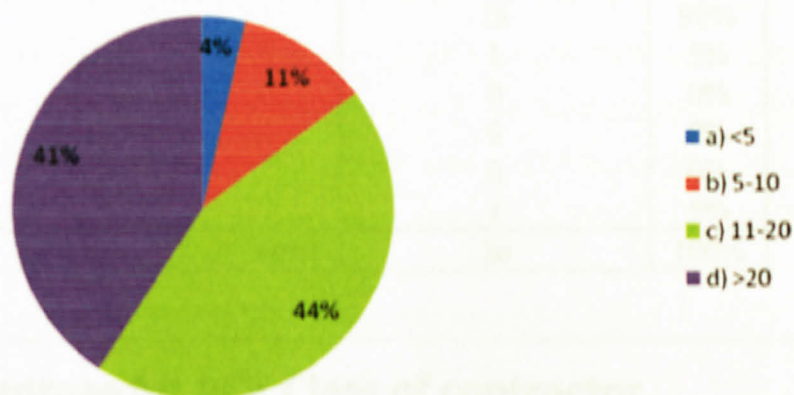
FIGURE 4: Percentage for years of company experience

Figure 4 shows percentage of companies that are experienced in construction projects. Most of the companes that replied the questionnaire have more than 10 years experience in construction projects. Thus, it can be verified that overall answers for the questionnaire is good because the period of the company involved in construction is quite long. There is a low percentage of companies that have experience in construction for less that 5 years. It is not very good to have many companies that have short experience because they might not be very familiar with the criteria that client and main contractor in Malaysia usually consider in order for them to choose the respective main contractor and sub contractor for their proejct.

3. Class of contractor

Table 8: PKK Class of contractor

PKK Class of contractor	Number of respondent	%
a) A	18	90%
b) B	1	5%
c) C	0	0%
d) D	0	0%
e) E	0	0%
f) F	1	5%
Total	20	100%

Percentage for PKK Class of contractor

- a) Class A
- b) Class B
- c) Class C
- d) Class D
- e) Class E
- f) Class F
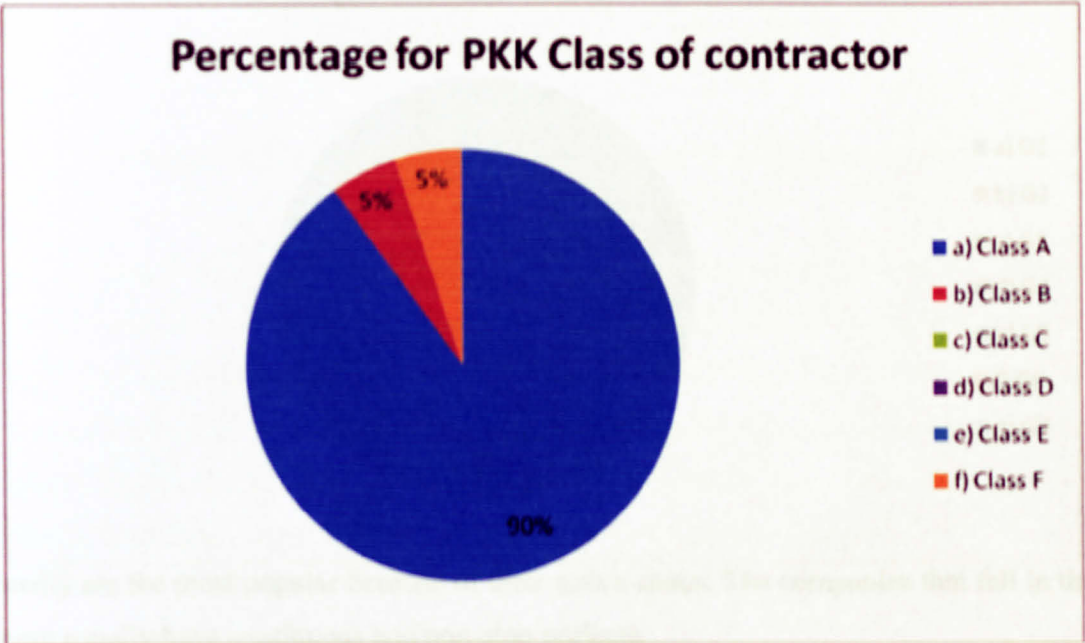
FIGURE 5: Percentage for PKK Class of contractor

Table 9: CIDB Class of contractor

CIDB Class of contractor	Number of respondent	%
a) G1	0	0%
b) G2	0	0%
c) G3	0	0%
d) G4	0	0%
e) G5	0	0%
f) G6	0	0%
g) G7	24	100%
Total	24	100%

Figure 5 and 6 show the percentages of PKK Class of contractor and CIDB Class of contractor. For the PKK class, the highest percentage which is 90% is in class A because class A usually will be the most active group involved in construction projects. The remaining two respondents are from class B and class F. For the CIDB group, all respondents are in group G7 which is the most active group in CIDB. The G7 members

Percentage for CIDB Class of contractor

- a) G1
- b) G2
- c) G3
- d) G4
- e) G5
- f) G6
- g) G7

100%
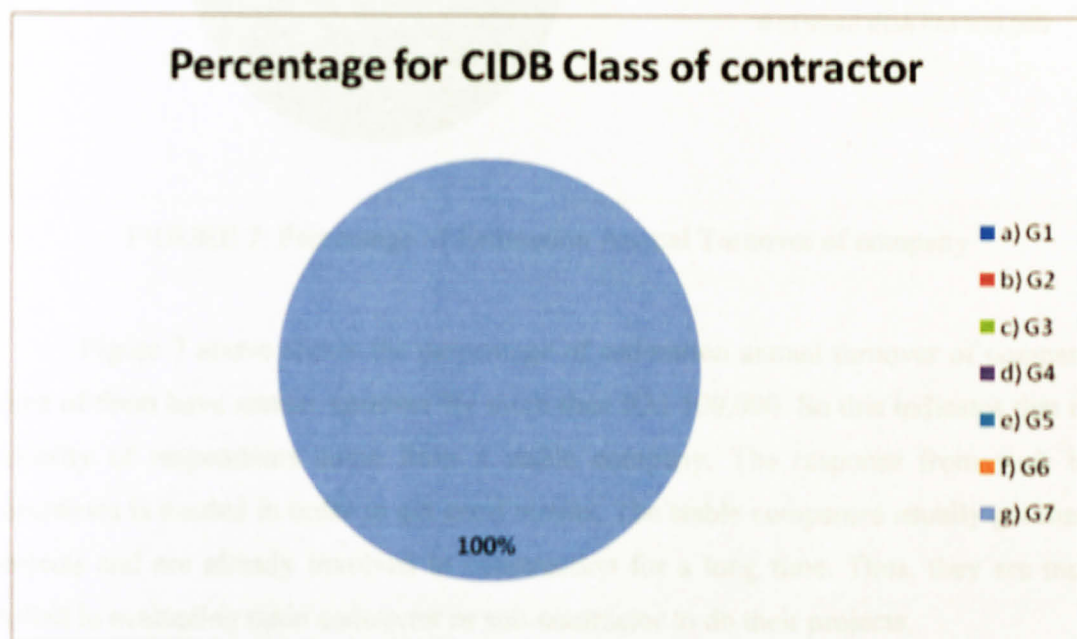
usually are the most popular because of their active status. The companies that fall in this group usually have continuous and non-stop projects.

4. Estimating annual turnover of company

Table 10: Estimating annual turnover of company

Estimating annual turnover of company	Number of respondent	%
a) Less than RM 50,000	1	2%
b) RM 50,000-RM 100,000	1	2%
c) RM 100,000-RM 500,000	5	9%
d) More than RM 500,000	49	88%
Total	56	100%

Percentage of Estimation Annual Turnover of company

- a) Less than RM 50,000
- b) RM 50,000-RM 100,000
- c) RM 100,000-RM 500,000
- d) More than RM 500,000

2% 2%
8%
88%
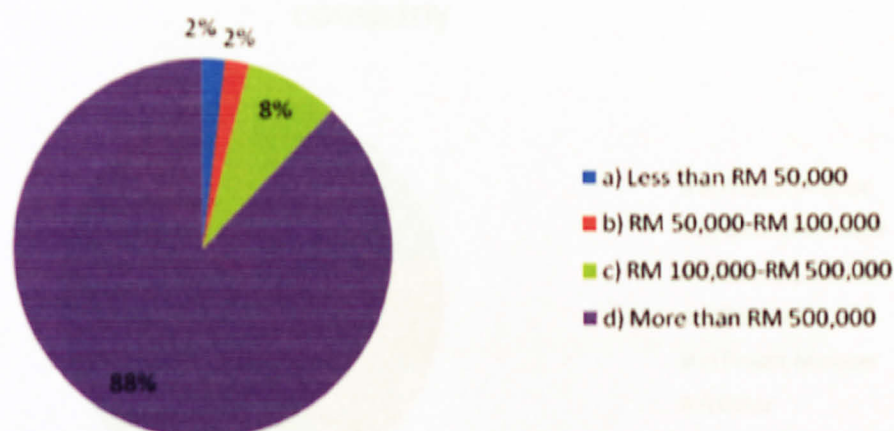
FIGURE 7: Percentage of Estimation Annual Turnover of company

Figure 7 above shows the percentage of estimation annual turnover of company. Most of them have annual turnover for more than RM 500,000. So this indicates that the majority of respondents come from a stable company. The response from such big companies is needed in order to get good results. The stable companies usually get many projects and are already involved in construction for a long time. Thus, they are more skilled in evaluating main contractor or sub-contractor to do their projects.

Respondent's Information

1. Present designation in the company

Table 11: Present Designation in the company

Present Designation in the company	Number of respondent	%
a) Project Director	12	22%
b) General Manager	12	22%
c) Quantity Surveyor	2	4%
d) Engineer	3	6%
e) Project Manager	20	35%
f) Other	7	11%
Total	56	100%

Percentage of Present Designation in the company

- a) Project Director
- b) General Manager
- c) Quantity Surveyor
- d) Engineer
- e) Project Manager
- f) Other
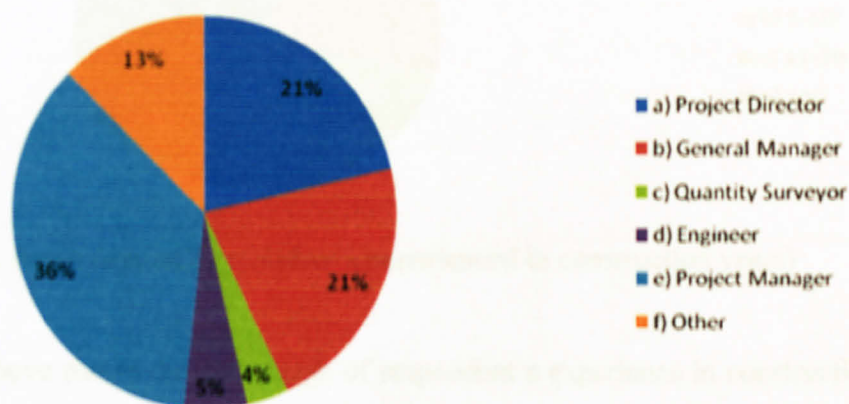
FIGURE 8: Percentage of Present Designation in the company

Figure 8 above shows the percentage for present designation of respondent in the company. It shows that the highest percentage is project manager while the lowest is quantity surveyor. It is good to have people in the organization such as project director, general manager and project manager to be the respondent because they are usually given the task as the evaluator to choose the main contractor and sub-contractor to do their projects.

2. Respondent's experienced in construction(years)

Table 12: Respondent's experienced in construction (years)

Respondent's experienced in construction(years)	Number of respondent	%
a) <5	4	7%
b) 5-10	12	21%
c) 11-20	20	36%
d) >20	20	36%
Total	56	100%

Percentage of Respondent's experienced in construction (years)
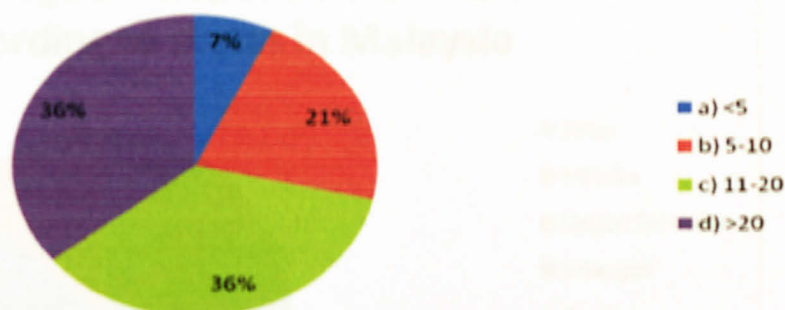
FIGURE 9: Percentage of Respondent's experienced in construction years)

Figure 9 above shows the percentage of respondent's experience in construction. The highest percentage falls on the respondent that has experience between 11 to 20 years. The second one comes from respondent that have experience in construction for more than 20 years. So, it can be summarized here that the majority of the respondents involved in construction for more than 10 years and looking at that period, it can be concluded that they have a lot of experience regarding the construction projects.

Table 13: Respondent's location according to states in Malaysia

State	Number of respondent	%
Johor	6	11%
Melaka	3	5%
Negeri Sembilan	3	5%
Selangor	12	21%
Perak	5	9%
Pulau Pinang	2	4%
Kedah	5	9%
Perlis	1	2%
Kelantan	3	5%
Terengganu	4	7%
Pahang	4	7%
Kuala Lumpur	8	14%
Total	56	100%

Percentage of Respondent's location according to states in Malaysia

Legend:
- Johor
- Melaka
- Negeri Sembilan
- Selangor
- Perak
- Pulau Pinang
- Kedah
- Perlis
- Kelantan

Pie chart values: 11%, 5%, 5%, 21%, 9%, 4%, 9%, 2%, 5%, 7%, 7%, 14%
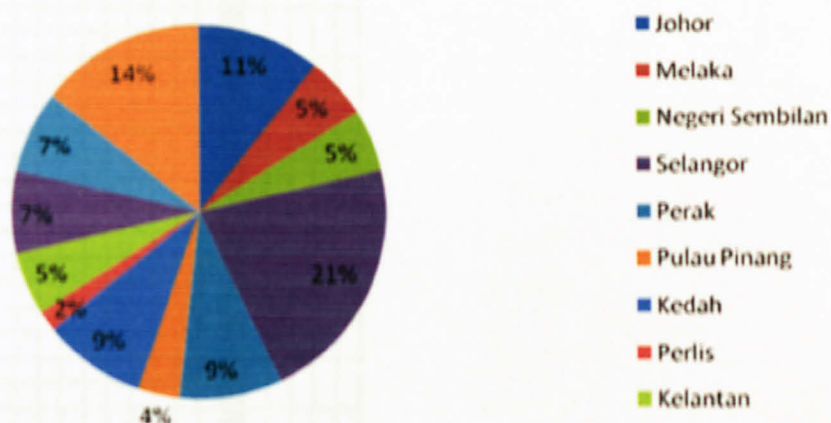
FIGURE 10: Percentage of Respondent's location according to states in Malaysia

Figure 10 above shows percentage of respondent's location according to states in Malaysia. There are many factors contribute to this results. Firstly, it is obvious that most developing states which are Selangor and Kuala Lumpur have the higher percentage due to many clients and contractor focusing on those places whereas states like Kelantan which less developed only contributes 5% each although the geographical size of that state is large. Respondent that comes from Negeri Sembilan and Melaka only 5% each due to geographical size is small and many of the respondent's company based in Kuala Lumpur. Lastly, number of respondents (client and main contractor) is not balance in every state due to different size of each state for example there is only 2% respondent come from Perlis due to size of Perlis that are smallest. From the research also, it is found that the three states which are Kedah, Pulau Pinang and Perlis are sharing the same contractors because the distance between the three states is quiet close.

Table 14 : Criteria for selection of main contractor

No.	Criteria	Respondent																															Σ Sum	Mean	Variance
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
1	Financial capacity	4	4	5	4	5	5	5	5	5	5	5	5	4	5	4	5	3	5	5	3	4	4	4	4	3	5	4	5	4	5	5	140	4.5161	0.391397805
2	Technical capacity	4	4	5	4	5	5	5	5	5	5	5	5	5	5	4	4	4	4	5	4	4	5	4	4	1	5	4	5	5	5	5	136	4.3871	0.711827196
3	Bid price	4	5	5	4	4	4	5	4	5	5	5	5	5	5	5	4	5	4	4	5	3	4	5	4	4	5	5	4	4	5	4	138	4.4516	0.389247731
4	Performance	4	4	5	5	4	4	4	5	5	5	5	3	5	5	5	4	5	5	4	5	4	3	5	4	5	5	5	5	142	4.5806	0.384946824
5	Occupational Health & Safety	4	4	3	4	4	5	3	4	5	3	2	4	3	5	3	3	4	2	4	3	3	5	5	4	4	4	5	3	118	3.8065	0.827965199
6	Management efficiency	4	5	4	5	4	4	4	4	5	5	5	4	5	4	4	4	4	4	4	5	5	5	4	5	5	5	133	4.2903	0.412903225
7	No. of projects in hand	4	4	4	4	4	3	3	4	4	3	4	2	3	3	4	2	3	5	1	3	4	2	1	3	3	4	5	3	3	106	3.4194	1.0516129
8	Progress of existing project	4	4	4	4	4	4	3	4	4	4	3	3	3	4	5	4	3	5	3	4	5	3	1	3	3	4	5	3	3	118	3.8065	0.761290322
9	Level of technology	4	5	4	4	4	4	3	4	5	1	4	1	5	4	2	5	3	2	4	3	3	2	5	3	4	4	4	4	104	3.3548	0.969892247
10	Time of completion quoted	4	4	4	5	4	5	4	5	3	3	5	5	4	4	3	4	4	5	4	3	5	4	4	4	3	5	4	128	4.129	0.516129032
11	Friendship	4	2	4	3	2	4	2	3	3	1	4	1	5	3	4	2	4	1	3	4	3	2	4	4	2	4	3	4	2	2	97	3.129	1.1827957
12	Political or other reason	3	2	3	3	3	4	1	3	3	1	4	5	3	2	2	3	1	4	3	1	3	3	3	2	4	4	3	2	3	2	86	2.7742	0.98064516
13	Experience in similar projects	4	2	5	4	4	4	5	3	4	5	3	5	5	5	5	5	4	5	4	4	5	4	5	5	4	5	5	5	135	4.3548	0.503225581
14	Relationship with client	4	3	4	4	4	4	3	3	4	1	4	1	4	3	4	5	1	5	4	3	3	4	4	0	5	5	4	3	4	5	0	105	3.3871	1.97849462
15																																			
16	Other: Image integrity																				5						5								
17	Other: Value eng proposal																						5												
18	Other: Labour resources																							5												
19	Other: Equipment resources																							5												
20	Other: Workmanship quality																													5						

Table 15 : Criteria for selection of sub-contractor

No.	Criteria	Respondent																														Σ Sum	Mean	Variance
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
1	Financial capacity	3	5	5	5	5	3	4	3	4	5	5	5	3	5	5	5	4	4	4	3	4	5	5	5	4	4	4	4	127	4.2333333	0.740827419
2	Technical capacity	5	5	5	5	5	3	5	4	5	4	5	4	5	3	5	4	4	4	4	4	5	5	5	4	5	4	5	4	141	4.7	0.37800241
3	Bid price	4	4	5	5	5	4	5	4	5	5	4	0	4	3	3	5	4	3	4	5	4	5	5	5	5	5	5	4	136	4.5333	1.032258065
4	Performance	4	4	5	5	5	5	5	4	5	5	5	5	5	5	5	4	4	5	4	4	5	5	3	4	5	5	4	5	140	4.6667	0.5
5	Occupational Health & Safety	3	3	3	5	4	5	5	3	5	3	5	3	3	5	3	5	4	4	4	2	5	4	4	5	4	4	4	0	112	3.7333	1.612903226
6	Management efficiency	5	5	5	5	4	3	5	4	5	3	4	3	5	4	5	5	4	5	4	2	5	4	4	4	5	4	135	4.5	0.62802419
7	No. of projects in hand	3	4	3	5	4	5	4	5	4	2	4	3	4	3	3	2	3	5	2	1	5	5	4	3	4	4	2	112	3.7333	1.612903226
8	Progress of existing project	4	5	3	5	5	4	5	4	3	5	4	4	4	5	3	4	4	5	2	5	5	4	5	4	4	5	4	128	4.2667	0.905225806
9	Level of technology	3	4	3	5	4	3	5	3	4	3	4	3	2	5	3	2	3	4	3	5	3	5	5	3	5	4	115	3.8333	1.216728671
10	Time of completion quoted	3	5	4	5	4	5	5	3	5	4	4	3	4	4	4	4	4	5	4	5	5	5	5	5	5	132	4.4	0.5
11	Friendship	3	3	3	3	5	4	3	4	3	3	3	4	2	5	4	4	4	4	1	2	5	3	4	4	4	1	109	3.6333333	0.959669355
12	Political or other reason	4	3	3	3	5	3	3	3	1	3	2	4	3	3	2	4	3	4	3	4	2	4	3	3	1	91	3.0333	0.974965287
13	Experience in similar projects	5	5	5	5	4	4	4	4	2	3	5	5	5	5	4	4	5	4	5	5	5	0	4	5	5	3	122	4.0666667	1.576961290
14	Relationship with main contractor	3	4	4	3	4	5	4	4	2	3	3	5	3	3	5	3	4	3	3	4	5	0	4	4	5	3	115	3.8333	1.345766129
15																																			
16	Other Labour resources				5																														
17	Other Responsiveness				5																														
18	Other Safety conscious							5																											
19	Other Planning capability							5																											
20	Other Image & integrity														5																				
21	Other Honesty record																	5																	
22	Other Relationship with bank																			5															
24	Other QMS 9000																																		
25	Other OHSAS 18000																																		

4.3 Data Analysis

Severity Index been used as analysis tools for this research instead of mean and varians because 2 main reason which are:

1. Type of data for this research is ordinal and
2. Inconsistent of value mean and varians (mean is good but smaller varians is needed to show every respondent agree with the result)

Severity Index also useful to prioritize the criteria after the analysis has been finished where criteria with high severity index(%) will rank at top and criteria with low severity index(%) will rank at bottom. Severity index was calculated based on the response of the survey to reflect the level of severity effect. This index was calculated as follow (Al-Hammad, 2000):

Severity Index (I) = [$\sum a_i \cdot x_i$] / [4 $\sum x_i$] x 100%

constant expressing the weight given to i

x_i = variable expressing the frequency of the response for i ;

i = 0,1,2,3,4 and illustrate as follow ;

x_0 = frequency of the 'very high extend' response and corresponding to a_0 = 4

x_1 = frequency of the 'high extend' response and corresponding to a_1 = 3

x_2 = frequency of the 'moderate' response and corresponding to a_2 = 2

x_3 = frequency of the 'small extend' response and corresponding to a_3 = 1

x_4 = frequency of the 'very small extend' response and corresponding to a_4 = 0

Table 16 : Criteria for selection of main contractor (SEVERITY INDEX)

No.	Criteria	0 very low	1 low	2 moderate	3 high	4 very high	total	mean	Category	Severity Index for ranking (%)	Ranking
1	Financial capacity	0	0	2	11	18	31	3.5161290322	Very High	87.90	2
2	Technical capacity	0	1	1	13	16	31	3.4193548389	Very High	85.48	4
3	Bid price	0	0	2	13	16	31	3.4516129003	Very High	86.29	3
4	Performance	0	0	2	9	20	31	3.5806451161	Very High	89.52	1
5	Occupational Health & Safety	0	2	10	11	8	31	2.8064516113	High	70.16	8
6	Management efficiency	0	0	3	16	12	31	3.2903225581	Very High	82.26	6
7	No. of projects in hand	2	3	9	14	3	31	2.4193548389	High	60.48	11
8	Progress of existing project	1	0	9	15	6	31	2.8064516113	High	70.16	8
9	Level of technology	2	3	10	14	2	31	2.3548838871	High	58.87	12
10	Time of completion quoted	0	0	6	15	10	31	3.1290322258	Very High	78.23	7
11	Friendship	2	8	7	12	2	31	2.1290322258	Average	53.23	13
12	Political or other reason	4	6	15	5	1	31	1.7741933548	Average	44.35	14
13	Experience in similar projects	0	1	1	15	14	31	3.3548838871	High	83.87	5
14	Relationship with client	3	0	7	14	5	29	2.6206689655	High	65.52	10
15											
16	Other: Image integrity										
17	Other: Value eng proposal										
18	Other: Labour resources										
19	Other: Equipment resources										
20	Other: Workmanship quality										

	Total	14	24	84	177	133
		0	1	2	3	4
	Mean	1	1.7142857	6	12.642857	9.5
	Variance	1.8461538	6.3736264	18.461538	8.5549451	42.730769

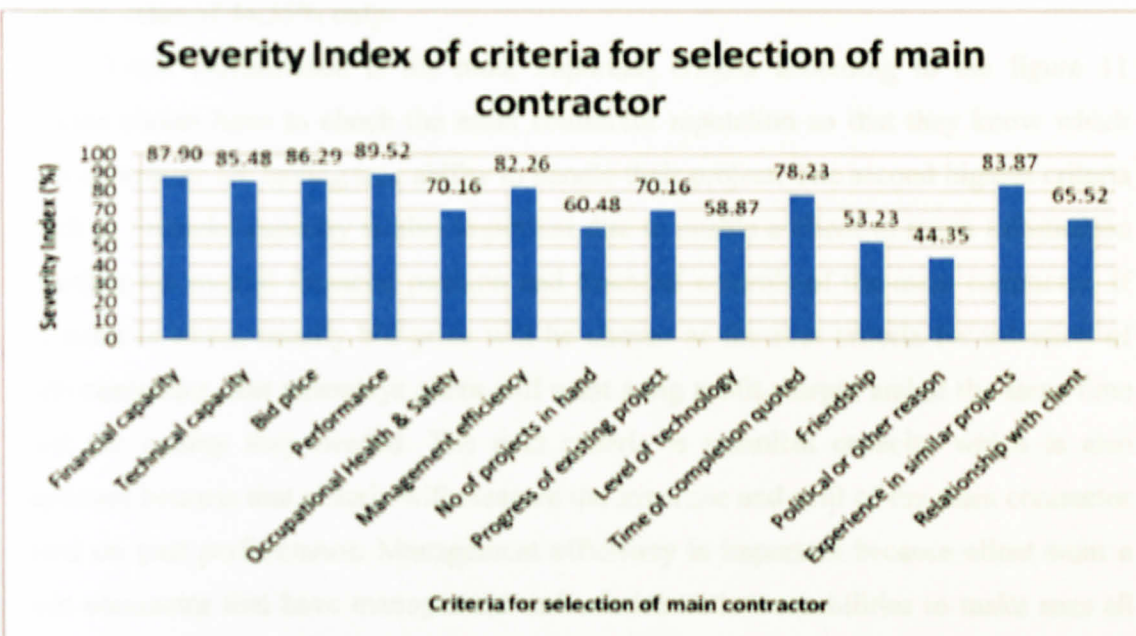**4.3.1 Analysis of selection criteria for main contractor**

FIGURE 11: Severity index (%) of criteria for selection of main contractor

As can be seen from table 14, there are 14 criteria for selection main contractor listed based on literature review and additional of 5 more criteria based on comment from respondent. A total of 31 respondents take place which is enough for the minimum requirement to get normal distribution based on central limit theorem. According to the figure 11, the highest ranking is track performance record of company which is 89.52%, followed by financial capacity which is 87.90%. The criteria with third highest ranking are bid price which is 86.29%. Then, nearly followed by technical capacity with percentage of 85.48%. After that experience similar project with percentage of 83.87%. Then, management efficiency ranked at sixth with percentage of 82.26%. Next, criteria in seventh ranking are time completion quoted with sum of 78.23%. From the figure also, it can be seen that 2 criteria shared the eight ranking which are occupational health & safety and progress of existing project with 70.16%. Meanwhile, criteria called relationship with client fall on ninth with percentage of 65.52% followed by number of project in hand with percentage of 60.48%. Then, most of the respondent are not familiar with criteria called level of technology thus it fall on eleventh ranking with 58.87%. The second

lowest criteria is friendship with percentage of 52.23% and the last one is political reason with the value of 44.35% only.

Track performance is the most important criteria according to the figure 11 because clients have to check the main contractor reputation so that they know which main contractor are having true ability to handle their project. The second highest criteria which is financial capacity is also important due to enable a client to reach information regarding the overall financial position and financial controls of the main contractor. If old trend is taken, usually bid price will be chosen as the first criteria for selection of main contractor. But nowadays client still want a big profit margin and at the same time meet the quality they needed. The next criteria is technical capacity which is also important because that criteria will measure the expertise and skill of the main contractor based on past performance. Management efficiency is important because client want a main contractor that have management and administration capabilities to make sure all the work in office or on site been organized well. Then, time of completion quoted also very important due to client prefer main contractor who can finished the project earlier without any additional cost of project. The following criteria which is occupational safety and health is considered as moderate due to most of main contractor in Malaysia are really concern about that. Construction Industry Development Board (CIDB) are really stress on occupational health & safety, so for sure every main contractor are well prepared about that. The criteria called as progress of existing project is also categorized as moderate because client want to know the performance of existing project that main contractor have done. Relationship with client also play an important role because client will choose main contractor that they are more familiar so that they know the capability of the main contractor. After that, client also considering about the number of project in hands because if main contractor hold too many project at one time, there might be a problem occur such as insufficient time to finish all projects within the time given and insufficient of labour to do the project. Level of technology also is not familiar criteria for client to select their main contractor because mainly the main contractor in Malaysia are having the same level of technology. The criteria called as friendship and political placed at the lowest ranking because client believe when business mix-up with political and

friendship, profit will not be gain much in fact a lot of other problem will occur and contribute to undesired quality of project when the project is finished.

Additional Criteria for selection main contractor

A total of 5 additional criteria given by a few respondents from client side. For the first additional criteria which is integrity and business ethics are important according to respondent 18 due to main contractor image in the market will reflect their level of professionalism in the construction field. Respondent 25 also give the same criteria with different opinion where he gives suggestion on how to maintain the integrity is by efficient management of money. The second additional criteria mentioned by respondent 22 which is value engineering proposal is also important due to quality of the project that later can decide whether the project is success or not. After that, respondent 23 stressed on for each main contractor should must have adequate labour resources and have proper management especially with foreign workers in order for the message from upper class to lower class can be pass on smoothly. Equipment resources also very important because preferably owned rather than rented. The last additional criteria given by respondent 28 which is workmanship quality where contractor's performance usually evaluated by visiting contractor's previous projects as well as referring to the projects client's consultants.

Table 17 : Criteria for selection of main contractor (SEVERITY INDEX)

No.	Criteria		very low(x1)	low(x2)	moderate(x3)	high(x4)	very high(x5)	total(∑xi)	mean	Category	Severity Index for ranking (%)	Ranking
			0	1	2	3	4					
1	Financial capacity		0	0	11	8	11	30	3	Very High	75	6
2	Technical capacity		0	0	2	14	14	30	3.4	Very High	85	1
3	Bid price		0	0	3	12	14	29	3.37931103	Very High	84.48	2
4	Performance		0	0	4	12	14	30	3.33333333	Very High	83.33	3
5	Occupational Health & Safety		2	2	8	11	6	29	2.58620069	High	64.66	9
6	Management efficiency		0	1	4	13	12	30	3.2	Very High	80	4
7	No. of projects in hand		3	4	7	9	7	30	2.43333333	High	60.83	11
8	Progress of existing project		1	1	5	14	9	30	2.96666667	High	74.17	10
9	Level of technology		2	3	10	14	2	31	2.35483887	High	58.87	13
10	Time of completion quoted		0	0	6	15	9	30	3.1	Very High	77.5	5
11	Friendship		2	2	11	12	3	30	2.4	Average	60	12
12	Political or other reason		5	3	14	8	0	30	1.83333333	Average	45.83	14
13	Experience in similar projects		1	2	6	9	11	29	2.93103445	High	73.28	7
14	Relationship with main con		1	1	11	10	6	29	2.6551724	High	66.38	8
15												
16	Other:	Labour resources			5							
17	Other:	Responsiveness			5							
18	Other:	Safety conscious							5			
19	Other:	Planning capability							5			
20	Other:	Image & integrity										
21	Other:	Honesty record										
23	Other:	Relationship with bank										
24	Other:	QMS 9001										
25	Other:	OHSAS 18001										

			0	1	2	3	4
		Total	17	19	102	161	118
			0	1	2	3	4
		Mean	1.214285714	1.3571429	7.285714286	11.5	8.428571429
		Variance	2.181318681	1.7857143	13.14285714	5.6538462	21.18681319

4.3.2 Analysis of selection criteria for sub-contractor

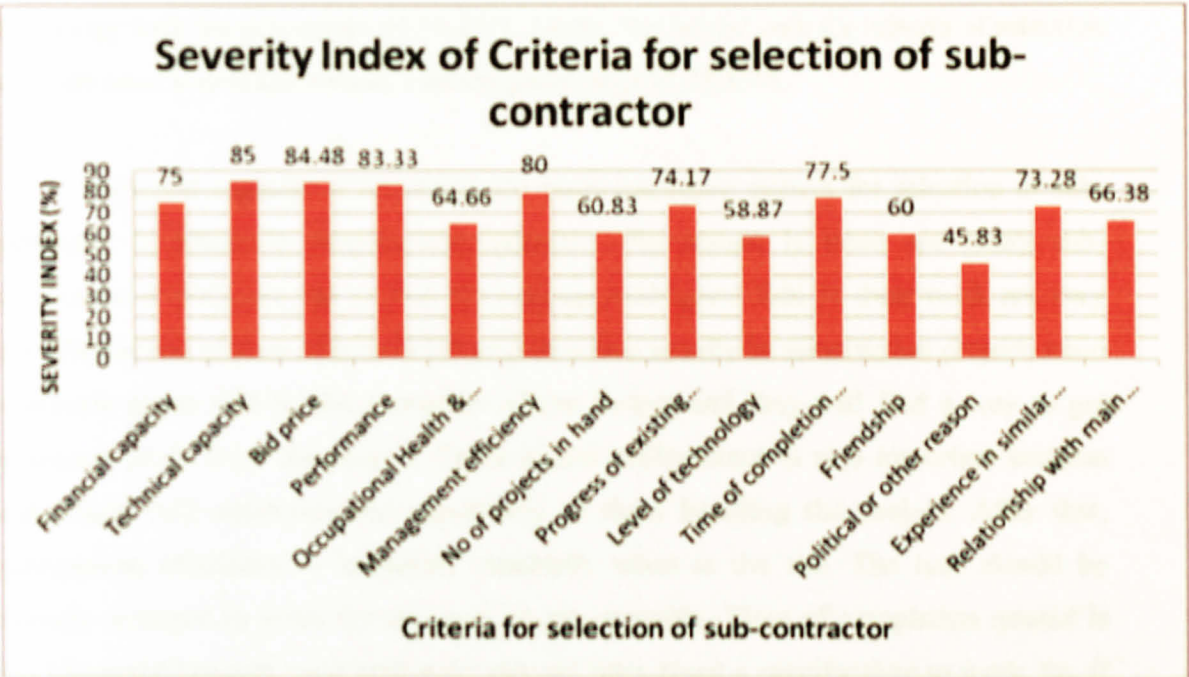**Severity Index of Criteria for selection of sub-contractor**

FIGURE 12: Severity Index (%) of criteria for selection of sub-contractor

From the table 15 shows that there are 14 criteria for selection sub-contractor listed based from literature review and additional of 7 more criteria given by the respondent. A total of 30 respondent taking places. The highest criteria are technical capacity with the percentage of 85%. Then, followed by bid price criteria at second highest ranking with 84.48%. After that, the third highest ranking is track performanc1.e record of company with the percentage of 83.33%. Next, the fourth highest is management efficiency which the percentage of 80%. and then followed by criteria with percentage of 77.5% which is time of completion quoted. According to the figure, financial capacity falls on sixth ranking with the percentage of 75%. Then, the criteria in seventh ranking is progress of existing project with the percentage of 74.17%. After that, the following criteria is experience in similar projects that placed at eighth with the percentage of 73.28%.

As indicates in the figure, relationship with main contractor is at ninth ranking with the percentage of 66.38%. The criteria at tenth ranking with the percentage of 64.66% is occupational health and safety. Meanwhile, criteria called as number of

projects falls at eleventh ranking with the percentage of 60.83% followed by friendship at twelfth ranking with the percentage of 60%. The second lowest criteria is level of technology with the percentage of 58.87%. Lastly, the lowest rank for criteria of selection sub-contractor is political reason with the percentage of 45.83%.

Technical capacity is becoming the most important criteria for selection of sub-contractor in Malaysia construction industry. The reason is there are many sub-contractors in Malaysia but to find the package with good skill in their work are very rare. The second highest criteria is bid price because usually in construction project, main contractor group will be the controller of the budget and they will find a way to get maximum profit from the project. Track record performance is also important because background will determine the experience of them handling the project. After that, management efficiency is important especially when at the site. The task should be properly arranged in order for the work to go smoothly. Time of completion quoted is also important because main contractor already been given a specific time to work. So, if they choose the sub-contractor that proposes too long duration of time to work, later they are the one will be suffer. The financial capacity will be the indicator for the stability of the sub-contractor. Main contractor tend to choose sub-contractor that good in their financial control because that will make sure over budget not happen. The criterion called progress of existing project is also taken as consideration for some main contractor because they want to see the performance of sub-contractor in previous projects. Meanwhile, experience in similar projects is also important because this criteria will indicate whether the sub-contractor have the ability to do to project. Relationship with main contractor also important because main contractor will give more priority those sub-contractor they already familiar. This way can help main contractor to shorten the selection time because they already know capability of the sub-contractor. Occupational Safety & Health is important but the ranking is too low because nowadays, the implementation of safety act and rule is compulsory to every construction company in Malaysia. Next, criteria called as friendship is also not familiar due to certain reason such as main contractor want to make high profit margin and it difficult to be strict with people that they have outside relationship. Most of main contractor also agree that level of

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technology is not important because majority of sub-contractors come from lower class of contractor, so for sure the overall level of technology that each sub-contractor got is just the same. Lastly the least criteria chosen by main contractor for selection sub-contractor is political because they are more prefer clean business that can guarantee a more profit and better quality of the future project.

Additional Criteria for selection sub-contractor

A total of 7 additional criteria given by a few respondents where the first one is labour resources mentioned by respondent 5. He suggests sub-contractor should have a high level of labour resources, especially in house rather than outsourced. This is to ensure that control and direct management is prevented. The second additional criteria were also mentioned by respondent 5 which is responsiveness. As with individuals, sub-contractor must also demonstrate high levels of responsiveness to the main contractor needs and requirements and have to be able to do these expeditiously. Then, respondent come up with two criteria which are safety conscious and planning. Safety in term of able to comply strictly to site safety and Occupational Safety & Health Act (OSHA) requirement to reduce unnecessary site accidents, set to right example for other to follow to improve site safety and health environment. For the planning is able to meet the program schedules and work in correct sequence. This will actually avoid defective and rework during construction projects. The fifth criteria , integrity and business ethics important criteria in selection of sub-contractor because their image in the market will reflect their level of professionalism in the construction field. Then, respondent 20 stressed on the importance of honesty record of the person doing the job, especially the sub-contractor appointed. If the sub-contractor have no previous record of cheating, misusing payment and default payment to workers under him, he will get better chance. The last additional criterion for selection of sub-contractor is relationship with bank that was mentioned by respondent 22. It is important due to construction projects that play with big amount of money. A stable company usually has a good relationship with bank in order to back-up if anything like unexpected loss.

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4.3.3 Comparison between criteria for selection main contractor and sub-contractor

From the selecting main contractor by client from current practice in Peninsular Malaysia, it is found that the most important criteria is track performance. Meanwhile, the most important criteria for selecting sub-contractor by main contractor from current practice in Peninsular Malaysia is technical capacity. Overall from the analysis there is not much different between criteria for selecting main contractor compare with criteria for selecting subcontractor. Coincidently, both of the group shared the least criteria which is political reason and it show both client and main contractor in Peninsular Malaysia are very honest and give same chances to all main contractor and sub-contractor who interested to do the project.

Problem facing

During the phase of sending questionnaire, there are some questionnaire been replied very fast but with no fill. It is because some of the company already change their office address and close their business. This caused by the source of those address were not updated. During collecting data, the normal problem occur where only 10% of questionnaire been replied. So, a lot of effort been done to make sure a minimum of 30 questionnaire been obtained. The cost of posting the questionnaire which include the envelope, paper and stamp are quiet expensive. Thus, sometimes the plan to send the questionnaire have to be reschedule because of limited budget of money.

There are also lacks of info which is email of respondent who want to know the result is not given, thus the result have to be sent through mail. Fortunately only few of the respondents want to know the result.

During the research, there are only a few of respondents that give an additional criterion that their company used to select main contractor and sub-contractor. Although the prepared criteria in the table is the most familiar one but it will be more interesting if

a new criteria been listed. The new criteria will be so much helpful for those who are having inexperience in construction project.

4.3.4 Interview

Interview had been conducted twice, one with the client and one with the main contractor. The objective of the interview is to find any additional criteria for selection of main contractor and sub-contractor. The truth is both of the side client and main contractor were giving the criteria that already listed in the table such as financial capacity, technical capacity, bid price, and track performance record. From the figure 11 and figure 12, it is also shown that these 4 criteria are placed at the top five in the chart. Thus, it shows the validity of the survey that have been done where the result is nearly accurate compare with the current practice. There is also comment from interviewee where they tend to change pattern of criteria when they get older. This can be summarize that, as client and main contractor grow older and having a bunch of experience, they will know the right criteria for selecting the main contractor or sub-contractor to do their project. It also proves that nowadays there are more criteria important than bid price.

4.3.5 Number of respondents

From 350 questionnaires sent, only 56 questionnaires are answered which is 16% from the total questionnaires. The reasons that lead to such number of respondents could be explained by:

- Some of the respondents change their based office.
- The downturn economy that happened now causing people are more concentrating on work that is important ignored something that probably they think not beneficial to them.
- The questionnaire is very easy to be filling without much effort to think. Majority of the question only require respondent to thick without putting any number.
- The questionnaires just consist of 2 pages where it took a little time only to fill it.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The first objectives of the research is obtained from the literature review where the experts have conclude their preference criteria for selection with identification 17 criteria for selection main contractor and sub-contractor such as financial capacity, track performance and time of completion quoted.

Finding for the second objectives of the research which is investigation of criteria for selecting main contractor from current practice in Peninsular Malaysia has reveal that there are several criteria that client choose in order for them to select main contractor such as technical capacity, bid price and experience in similar projects. It is also found that the most important criteria for selecting main contractor from current practice in Malaysia construction industry is track performance record while the least criteria is political reason.

The most popular criteria been used by main contractor in Malaysia to choose their sub-contractor is technical capacity whereas the least popular criteria is political reason. With that, it finalized the third objectives of the research which is to investigate the criteria for selecting sub-contractor by main contractor from current practice in Peninsular Malaysia.

As a result from the discussion, it can be summarize that top five of criteria according to severity index ranking for selection of main contractor which is track performance record that placed at first. Secondly, financial capacity and then bid price dominate in third place. Next, the fourth criteria is technical capacity and the fifth one is experience in similar projects.

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In the other hand, top 5 criteria according to severity index ranking for selection of sub-contractor lead by technical capacity. Then, bid price falls on second place. After that, track performance record placed at third. The fourth criteria is management efficiency and the fifth one is financial capacity.

There is not much difference between criteria for selection of main contractor and sub-contractor and looking at the top 5 criteria, the difference is only experience in similar projects been included in the top five of criteria for selection of main contractor where else management efficiency been included in the top five of criteria for selection of sub-contractor.

It can be concluded from the above, that the three objectives of the research have been achieved.

5.2 Recommendation

There is no restriction in improvement for this research. The recommendation for better advancement will benefit the construction industry as well as the researchers. Thus, the recommendations are as follows:

- To improve and reassure about the data that been obtained, a short interview should be conducted with one of the respondent to make sure validity of the data.
- To improve the quality of the research, it is recommended to do comparative analysis where criteria obtained for selection of main contractor and sub-contractor been compared using comparative analysis. But, to be able to conduct the analysis which take a quite a long time to do it, the researcher need to be patient

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Appendix

Questionnaire Form

List of Pilot Survey participants

Version 1   **SURVEY QUESTIONNAIRE**

<u>Decision criteria for selection main contractor in Malaysia Construction Industry.</u>

During the bidding process phase, selecting the most appropriate contractors to conduct the project is very difficult. There are many criteria that can be found from literature review but in current practice, clients use to have different guideline. Therefore a research is made to find out the exact ways that clients and general contractors used in determining the criteria for selection contractor in Malaysia construction industries.

The questionnaire below is divided into 3 sections which are A, B and C. Please answer the questionnaire by referring to every section's instructions. To simplify and save time, point forms are encouraged.

Section A: General / Background Information

Please fill in the blanks and tick in [ ] provided. Respondents can thick more than one [ ]

I.   **Company Information:**

1. Name of Company: _____

2. Type of Construction Projects :
    [ ] Building   [ ] Roads   [ ] Bridge   [ ] Drainage   [ ] Other: _____

3. Company experienced in construction (years) :
    [ ] < 5   [ ] 5-10   [ ] 11-20   [ ] > 20

4. Type of business :
    [ ] Consultant   [ ] Architect Firm
    [ ] Developer Property   [ ] Quantity Surveyor Firm

5. No. of Construction Projects in progress:
    [ ] 1   [ ] 2   [ ] 3   [ ] 4   [ ] More than 5

6. No. of projects completed within 2 years back:
    [ ] < 5   [ ] 5-10   [ ] 11-20   [ ] > 20

7. Estimating annual turnover of company:
    [ ] Less than RM 50,000   [ ] RM 50, 000- RM 100, 000
    [ ] RM 100,000-RM 500,000   [ ] More than RM 500,000

   II. Respondent's Information

1. What is your designation with the company?
    [ ] Project Director   [ ] Architect   [ ] Project Manager
    [ ] General Manager   [ ] Engineer   [ ] Other: _____
2. Respondent's experienced in construction(years):
    [ ] < 5   [ ] 5-10   [ ] 11-20   [ ] > 20

3. No. of Projects Respondent Involved:
    [ ] 1   [ ] 2   [ ] 3   [ ] 4   [ ] More than 5

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Section B: Criteria for selection main contractor
Please give you opinion in 5 point Lickert scales on important criteria for selecting sub-contractor

No.	Criteria for selection of main contractor	Scale				
		1 Not importance	2 Less importance	3 Importance	4 Very importance	5 Most importance
1	Financial Stability					
2	Background of company					
3	Technical Capacity					
4	Cost					
5	Performance					
6	Standard of Quality					
7	Occupational Health & Safety					
8	Time performance					
9	Management capability					
10	Failed contract					
11	Progress of Work					
12	Human Resource Management					
13	Level of technology					
14	Relationship with client					
15	Fraudulent activity					
16	Competitiveness					
17	Method of procurement					
18	Length of time in business					
19	Working capital					
20	Bid price					
21	Others					
22	Other					

Section C: Decision maker for contractor selection

1. Who are the decision maker for selecting main contractor in your company
    (You can thick more than one)

No.	Designation	
1.	Project Director	
2.	General Manager	
3.	Project Manager	
4.	Architect	
5.	Engineer	
6.	Other: .... (please state)	

Section D: Feedback

1. Do you prefer to know result of research?
    [ ] Yes   [ ] No

2. Would you willing to be contacted to provide additional information to support this research?
    [ ] Yes, my contact telephone number is _____ ext : _____
    [ ] No.

Thank you for your time and cooperation in completing the questionnaire. Your response will be used for research purpose only. It would be appreciated if you could return this questionnaire as soon as possible, latest by ....

<u>**Decision criteria for selecting main contractors and sub-contractors in Malaysia Construction Industry.**</u>

During the tendering phase of a project, selecting the most appropriate main contractor and sub-contractor to implement the project can be difficult. There are many criteria that can be found from literature review but in current practice, clients and main contactors may have different guidelines. Therefore a research is conducted to investigate the criteria used by clients and main contractors in selecting respectively their contactors and sub-contractors in Malaysia construction industry.

The questionnaire below is divided into 5 sections which are A, B, C and E. Please answer the questionnaire by referring to every section's instructions.

Section A: General / Background Information

Please fill in the blanks and tick in [ ] provided. Respondents may tick in more than one [√]

I.   Company Information:

7. Name of Company: _____

8. Type of business :
    a) [   ] Client for residential projects   e) [   ] Construction contractor
    b) [   ] Client for commercial projects   f) [   ] Quantity Surveyor Firm
    c) [   ] Client for industrial projects   g) [   ] Engineering consultant
    d) [   ] Client for infrastructure projects   h) [   ] Architect Firm
    i) [   ] Other: _____

9. Years of company experienced in construction:
    [   ] < 5   [   ] 5-10   [   ] 11-20   [   ] > 20

10. Class of contractor (to be fill by construction contractor only)
    a) PKK   [ ]A [ ]B [ ]C [ ]D [ ]E [ ]F
    b) CIDB   [ ]G1 [ ]G2 [ ]G3 [ ]G4 [ ]G5 [ ]G6 [ ]G7

5. Estimating annual turnover of company:
    [   ] Less than RM 50,000   [   ] RM 50, 000- RM 100, 000
    [   ] RM 100,000-RM 500,000   [   ] More than RM 500,000

II. Respondent's Information

4. Your present designation in the company?
    [   ] Project Director   [   ] Architect   [   ] Project Manager
    [   ] General Manager   [   ] Engineer   [   ] Other: _____

5. Respondent's experienced in construction(years):
    [   ] < 5   [   ] 5-10   [   ] 11-20   [   ] > 20

Section B: Criteria for selection main contractor or sub-contractor

Please give your opinion using a 5- point Lickert scale as shown below on the importance of criteria used for selecting main contractors or sub-contractors for your project.
Those respondents who have selected item a) to d) in question 2(Section A), please respond in Table A and for those respondent who have selected item e) to h), please respond in Table B.

No.	Criteria for selection of main contractor/sub-contractor	A Selection main contractor (To be fill by client) Level of importance					B Selection sub-contractor (To be fill by main contractor) Level of importance				
		1	2	3	4	5	1	2	3	4	5
1	**Financial capacity** eg: working capital										
2	**Technical capacity** eg: skill of workers, machinery & methods used										
3	**Bid price**										
4	**Performance** eg: track record of performance										
5	**Occupational Health & Safety record**										
6	**Management efficiency** eg: availability of experienced management staffs to monitor the work										
7	**No of projects in hand**										
8	**Progress of existing project**										
9	**Level of technology** eg: Contractor's method statement proposed and to be used in the project										
10	**Time of completion quoted**										
11	**Friendship**										
12	**Political or other reason**										
13	**Experience in similar project**										
14	**Relationship with client** eg: contractor is subsidiary of client										
15	**Relationship with main contractor** eg: sub-contractor is subsidiary of main contactor										
16	Other: _____										
17	Other: _____										

LEVEL OF IMPORTANCE *

1	2	3	4	5
Very low	Low	Moderate	High	Very High

Section C: Other information

1. For those respondents who have added additional criteria in item **16 and 17(Section B)**, please explain each of those criteria.

_____
_____
_____
_____
_____
_____
_____

Section D: Decision maker for main contractor/sub-contractor selection

2. Who decide in selecting main contractor or subcontractor in your company
    (You may tick more than one)

No.	Designation	Tick[√]
1.	Project Director	
2.	General Manager	
3.	Project Manager	
4.	Architect	
5.	Engineer	
6.	Other: _____ (please state)	

Section E: Feedback

3. How do you prefer to know result of the research?
    [ ] Via email   [ ] Via mail   [ ] No,thank you

4. Would you willing to be contacted to provide additional information to support this research?
    [ ] Yes, my contact telephone number is _____ ext : _____
    [ ] No.

Thank you for your time and cooperation in completing the questionnaire. Your response will be used for research purpose only. It would be appreciated if you could return this questionnaire as soon as possible, latest by 6 February 2009 using the self-address enveloped. Alternatively you may send by fax to 05-3656716 with attention to Assoc Prof. Ir. Dr. Arazi Idrus/Muhammad Afeq B. Amran

Section C: Other information

1. For those respondents who have added additional criteria in item **16 and 17(Section B)**, please explain each of those criteria.

_____
_____
_____
_____
_____
_____
_____

Section D: Decision maker for main contractor/sub-contractor selection

2. Who decide in selecting main contractor or subcontractor in your company (You may tick more than one)

No.	Designation	Tick[√]
1.	Project Director	
2.	General Manager	
3.	Project Manager	
4.	Architect	
5.	Engineer	
6.	Other: _____ (please state)	

Section E: Feedback

3. How do you prefer to know result of the research?
   [ ] Via email   [ ] Via mail   [ ] No,thank you

4. Would you willing to be contacted to provide additional information to support this research?
   [ ] Yes, my contact telephone number is _____ ext : _____
   [ ] No.

Thank you for your time and cooperation in completing the questionnaire. Your response will be used for research purpose only. It would be appreciated if you could return this questionnaire as soon as possible, latest by 6 February 2009 using the self-address enveloped. Alternatively you may send by fax to 05-3656716 with attention to Assoc Prof. Ir. Dr. Arazi Idrus/Muhammad Afeq B. Amran

Version 1

Date:

Dear Sir/Madam,

Decision criteria for selecting main contractors and sub-contractors in Malaysian Construction Industry.

We seek your help in a university research survey on the decision criteria for choosing main contractors and sub-contractors in Malaysian Construction Industry.

Much has been written in the literature regarding performance or decision criteria for choosing main contractors and sub-contractors. There are criteria such as bidding price offered by the bidder, time of completion quoted and financial stability of the company. However, criteria used by clients in choosing main contractors may vary from clients to clients. Likewise, those used by main contractors in choosing sub-contractors may vary among the contractors. On the other hand, criteria used by clients may also differ significantly from criteria used by main contractors in choosing the main contractors and the sub-contractors respectively.

Therefore, the objectives of this survey are to investigate criteria used by clients for selecting main contractors from their current practice and those used by main contractors in choosing sub-contractors from their current practice in Malaysia. This major significance of this research hopes to be able to help organizations such as client groups and main contracting companies from the construction industry in prioritizing select criteria for selecting main contractors and sub-contractors respectively and perhaps providing also some guidelines with regard to this.

In relation to the above issues, we have devised a questionnaire which we would like you to complete and return and which will only take not more than 15 minutes of your time. With your cooperation, we should be able to collect as many data as possible regarding the decision criteria for selecting main contractors and sub-contractors in Malaysia Construction Industry. It would help us very much if you could complete and return the questionnaire before............... As an enclosure to this letter, please find a self-addressed and stamped envelope to return the questionnaire. Alternatively, you could also return it by fax on 05-3656716 (Attn: Assoc. Prof. Ir. Dr. Arazi Idrus). Please contact Mr. Muhammad Afeq B Amran, (0162679787) or email afeq.apek @yahoo.com) if you have any question regarding to survey.

Yours truly Sincerely,

(Assoc. Prof. Ir. Dr. Hj. Muhd Fadhil Nuruddin)
Head of Civil Engineering Department,
Universiti Teknologi PETRONAS

Cc: Assoc. Prof. Ir. Dr. Arazi Idrus
Mr. Muhammad Afeq B. Amran

Version 2

UNIVERSITI
TEKNOLOGI
PETRONAS

Date: ....

Project Director,

....

....

....

Dear Sir/Madam,

Decision criteria for selecting main contractors and sub-contractors in Malaysian Construction Industry.

We seek your help in a university research survey on the decision criteria for choosing main contractors and sub-contractors in Malaysian Construction Industry.

Much has been written in the literature regarding performance or decision criteria for choosing main contractors and sub-contractors. There are criteria such as bidding price offered by the bidder, time of completion quoted and financial stability of the company. However, criteria used by clients in choosing main contractors may vary from clients to clients. Likewise, those used by main contractors in choosing sub-contractors may vary among the contractors. On the other hand, criteria used by clients may also differ significantly from criteria used by main contractors in choosing the main contractors and the sub-contractors respectively.

Therefore, the objectives of this survey are to investigate criteria used by clients for selecting main contractors from their current practice and those used by main contractors in choosing sub-contractors from their current practice in Malaysia. This research hopes to be able to help organizations such as client groups and main contracting companies in prioritizing criteria for selecting main contractors and sub-contractors respectively and perhaps providing also some guidelines with regard to this.

In relation to the above, we have devised a questionnaire which we would like you to complete and return and which will only take not more than 15 minutes of your time. With your cooperation, we should be able to collect as many data as possible regarding the decision criteria for selecting main contractors and sub-contractors in Malaysia Construction Industry. It would help us very much if you could complete and return the questionnaire before 30 December 2008. As an enclosure to this letter, please find a self-addressed and stamped envelope to return the questionnaire. Alternatively, you could also return it by fax on 05-3656716 (Attn: Assoc. Prof. Ir. Dr. Arazi Idrus). Please contact Mr. Muhammad Afeq B Amran, (016-2679787) or email afeq.apek@yahoo.com) if you have any question regarding to survey.

Yours faithfully,

_____

(Assoc. Prof. Ir. Dr. Arazi Idrus)
Head of Structure and Construction Cluster of Civil Engineering Department
Universiti Teknologi PETRONAS

Cc: Mr. Muhammad Afeq B. Amran

List names of pilot survey participants

- **Lecturers**

1. **Assoc. Prof. Dr Madzlan Napiah**

   Doctor of Philosophy, University of Leeds

   Masters of Science (Engineering) , University of Leeds

   Bachelor of Science ,Michigan State University

   Areas of Specialisation: Highway and Transport Planning Engineering

2. **Assoc Prof. Dr. Narayanan Sambu Potty**

   Doctor of Philosophy, Building Technology and Construction Management IIT

   Madras India

   Masters of Technology (Structural Engineering) NIT Calicut India,

   Bachelor of Engineering, Kerala University, India

   Areas of specialization: Structural Engineering

3. **Dr Mohd Faris bin Khamidi**

   PhD. Eng., Kyushu University, Japan

   M.Eng., Kyushu University, Japan

   Bachelor of Architecture, Universiti Sains Malaysia

   Bachelor of Science of Housing, Building and Planning, Universiti Sains

   Malaysia

   Areas of specialization: Sustainable Building and Construction, Green Building

   Assessment Tool and Rating

4. **Assoc. Prof. Dr Abdul Nasir Matori**

   Doctor of Philosophy, University of Newcastle Upon Tyne

   Bachelor of Science (Honours) in Nuclear Science, Universiti Kebangsaan

   Malaysia

   Areas of specialization: Offshore Position Satellite

- **Client and main contractor**

1. **Saiful Bukhari**

   Project Manager,

   KLCC Project Sdn Bhd

   Currently representative for KLCC for project in University Technology Petronas

2. **En. Nasri**

   Contractor,

   Kamosa Sdn Bhd

   Currently managing Futsal sport complex project in University Technology
   Petronas

3. **Abdul Halim bin Abdul Rahman**

   Building Engineer,

   Dewan Bandaraya Ipoh(DBI)

List of Respondents

No.	Name of Company	Status
1	IJM LAND BERHAD	CLIENT
2	KUMPULAN HARTANAH SELANGOR BERHAD	CLIENT
3	MODAL EHSAN SDB BHD	CLIENT
4	DARULAMAN REALTY SDN BHD	CLIENT
5	BERTAM DEVELOPMENT SDN BHD	CLIENT
6	MUTIARA RINI SDN BHD	CLIENT
7	AMBANGAN HEIGHTS SDN BHD	CLIENT
8	PLEASANT-VILLE DEVELOPEMNT SDN BHD	CLIENT
9	BINAKAYA PKINK SDN BHD	CLIENT
10	NAGA SAKTI SDN BHD	CLIENT
11	SYARIKAT MAJUPERAK BERHAD	CLIENT
12	GLOMAC BERHAD	CLIENT
13	BENTUK CEMERLANG DEVELOPMENT SDN BHD	CLIENT
14	ADMIRAL LOVE DEVELOPMENT SDN BHD	CLIENT
15	DC AVENUE SDN BHD	CLIENT
16	MALTON BHD	CLIENT
17	PERMAS JAYA SDN BHD	CLIENT
18	UDA HOLDINGS BERHAD	CLIENT
19	JLAND BHD	CLIENT
20	DIAMOND BAY DEV. CO. SDN BHD	CLIENT
21	ALIRAN MURNI SDN BHD	CLIENT
22	BERTAM PROPERTIES SDN BHD	CLIENT
23	RAYHAR PROPERTIES SDN BHD	CLIENT
24	IDEAL HEIGHTS PROPERTIES SDN BHD	CLIENT
25	FRANKY DEVELOPMENT SDN BHD	CLIENT
26	GLOMAC ENTERPRISE SDN BHD	CLIENT
27	AQEEL ENG. & CONSTRUCTION SDN BHD	CLIENT
28	DAYA PRESTASI SDN BHD	CLIENT
29	MAKA CORPORATION SDN BHD	CLIENT
30	BINA DARULAMAN BERHAD	CLIENT
31	HOMEWISE CONSTRUCTION SDN BHD	CLIENT

<u>List of Respondents</u>

No.	Name of Company	Status
1	HAZUMI ENTERPRISE SDN BHD	CONTRACTOR
2	KONSORTIUM KONTRAKTOR MELAYU(MELAKA)	CONTRACTOR
3	FRANKY CONSTRUCTION SDN BHD	CONTRACTOR
4	ICM CONSTRUCTION SDN BHD	CONTRACTOR
5	RN CONST & DEVELOPMENT SDN BHD	CONTRACTOR
6	METRIO CONSRUCTION SDN BHD	CONTRACTOR
7	SUNRISE BERHAD	CONTRACTOR
8	JAMIL GHANI CONSTRUCTION SDN BHD	CONTRACTOR
9	AHMAD ZAKI RESOURCES BERHAD	CONTRACTOR
10	GLOMAC ENTERPRISE SDN BHD	CONTRACTOR
11	AQEEL ENG. & CONSTRUCTION SDN BHD	CONTRACTOR
12	BINAAN SENTOSA	CONTRACTOR
13	BINA MEKAR SDN BHD	CONTRACTOR
14	CEMARA BINAJAYA SDN BHD	CONTRACTOR
15	HOMEWISE CONSTRUCTION SDN BHD	CONTRACTOR
16	AKED UTARA SDN BHD	CONTRACTOR
17	DUTA ALAM CONSTRUCTION SDN BHD	CONTRACTOR
18	DAYA PRESTASI SDN BHD	CONTRACTOR
19	FBS BINA SDN BHD	CONTRACTOR
20	BINA DARULAMAN BERHAD	CONTRACTOR
21	ZABIMA ENG. & CONSTRUCTION SDN BHD	CONTRACTOR
22	NS CONSTRUCTION SDN BHD	CONTRACTOR
23	KONSORTIUM INDERA SDN BHD	CONTRACTOR
24	BA URUS BINA (M) SDN BHD	CONTRACTOR
25	PUTRA PERDANA CONSTRUCTION SDN BHD	CONTRACTOR
26	KLCC PROJECT SDN BHD	CONTRACTOR
27	KONSORTIUM KONTRAKTOR MELAYU(N.S)	CONTRACTOR
28	JERAI CONSTRUCTION (M) SDN BHD	CONTRACTOR
29	SHAZAS BUILDERS SDN BHD	CONTRACTOR
30	NUSAJAZA CONSTRUCTION SDN BHD	CONTRACTOR