PRIORITIZING CONTRACTOR PERFORMANCE CRITERIA IN CONSTRUCTION PROJECT WITHIN CLIENT PERSPECTIVE

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CERTIFICATION OF APPROVAL

Prioritizing Contractor Performance Criteria in Construction Project within Client Perspective

by

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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.

MOHD HAQ BIN HUSIN

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ABSTRACT

The objective of this study is to develop prioritize criteria in evaluating the performance of contractor in a construction project based on client perspective. Currently there is not any standard approach or agreement to evaluate contractor performance in construction project as project success carries different definition to different management. The focus on this study is on the private sector which different company has different type of management to measure the construction project performance. The study will involve collection of criteria to measure construction project performance from available source e.g. journal, magazine and book. Survey research methodology is chosen to be the technique to get the performance criteria used in current practice. The require information will be received from the questionnaires which are distributed to specific private company (respondent). Descriptive analysis method will be used to analyze the performance criteria and then prioritize criteria will be generated base on the analysis.

The significant of the research will helps the client in current practice to ensure success in construction project as it provide better understanding on the most important criteria which should be applied by their contractor during construction stage. This finding would also directly help the contractor to be attentive and focus on every criteria that emphasized by the client. For contractor to gain client's satisfaction is vital as it would help them to gain more future project from the same client. It is hoped that by this findings will give benefits to all levels of professional levels related to this field and to the societies as well.

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INTRODUCTION

1.1 Background Study

The construction industry is one of the huge industrial in Malaysia. The concept of a construction project to success has wide in scope and the project success means different things to different people. Project management is about the process of planning, organizing and controlling of company resources to achieve a specific goals and objectives. While some project management consider on time of the completion, the cost of total expenditure of a project as well as the quality of the construction, others suggest that success is something which is more complex and more than that three aspects.

Project planning is one of the project management's major activities. It is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks.

Project is considered as a process or activities that has a specific objective, consumes resources and operates with respect to time, cost and quality constraints. In every construction project, project management cannot succeed unless the project manager is willing to employ a good effective system approach to project management by analyzing those variables that lead to success and failure in a project.

Today, the concept of project performance is being developed in many ways of criteria to evaluate and assess the successful of a project. Different type of project management would come out with different type of outcomes and it depends on the project organization to choose what would be the most excellent for their construction business to survive and perform in the future. Therefore it is necessary to understand how private sectors evaluate their project which will be important results for all parties to improve project performance to achieve a successful project construction.

1.2 Problem Statement

Client satisfaction is one of the most important criteria for achieving a good performance in any construction project. Client's interest would be the vital concern for consultant or contractor to provide the best services in order to maintain and improve their reputation which are important for future project. The quality of construction as well as legal claim and environment issue are those major criteria to assess performance of construction. Therefore, contractors not only supplying products but actually giving a service to the customer requirement through delivery of completed projects. On the fundamental, the client has a wide choice in which they can select the best contractor to implement the project with good quality services. The problem is what criteria are used from client perspective to evaluate contractor performance in construction in private sector which covers in Peninsular Malaysia.

1.3 Objective and scope study

The main objectives of this research are:

- To identify what are the criteria used in evaluating contractor performance between public sector and private sector by literature review
- To identify the contractor performance criteria during construction stage as well as upon completion for private sector in current practice by survey (questionnaire) method.
- To analyze and prioritize criteria for evaluating contractor performance in private sector.

1.4 Significant of research

To help contractor to understand what criteria is used and stressed more in client perspective to measure performance in a construction project and to help client to understand what should be the most priority criteria in general practice.

LITERATURE REVIEW

2.1 Previous Study

Base on the previous study that has been made by the researchers, there are various type of criteria which are considered in evaluating the construction project performance. Every research has their own perspective and they come out with different type of criteria which base on literature review or case study. Generally, there is no standard approach or guideline to evaluate construction performance project and people continue to enrich every research by time to time. In the early 1990s, at project level, success was measured by the project duration, monetary cost and project performance. Time, cost and quality are the basic criteria to project success and it is called these three criteria as the 'iron triangle' as it always included in any project performance evaluation.

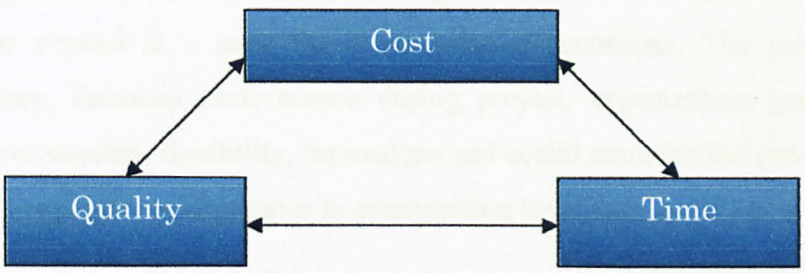


Figure 1: Basic criteria to measure project performance in construction project

From the research on Construction Business Performance Measurement by Love and Holt [1], explain criteria to measure the construction performance in United Kingdom (UK) construction sector. The author has discussed on the differences measurement performance of construction between Stakeholder Perspective Measurement (SPM) and Business Performance Measurement (BPM). In the journal, the focus is on why the construction organization should reject BPM thinking.

BPM is a myopic thinking (narrow-minded) that should be rejected as it is focusing in short term, being project-specific, profit-oriented and neglecting broader 'stakeholder' problems. It is predominately project specific and profit oriented which failing to take account of the broader 'stakeholder' issues. This method of measurement only meet client objective and goals without considering the nature of their business environment, structure of organization and level of technology employed.

To compare with SPM practice, it is selected as it consider the three perspectives of the firm which are as a stakeholder entity where they take account on interest of customers and shareholders, it is a goal-oriented (profit center) and as a system that involved in resource garnering, conversion and exchange with environment. In SPM, construction organizations use various methods to measure their performance and hold the specialists in organization to evaluate result, comparison, planning for improvement and then the implementation of strategy. The desires and values of their organization's stakeholders also being taken into account for the manager to achieve their interests. This will help the project to expend at a pace far beyond the expectations. The product and service performance, financial performance during project, organization goals and objective, competitive success, flexibility, innovation and social contribution are criteria of SPM to evaluate any project performance in construction business.

Next, the journal entitles Key Performance Indicators (KPI) for measuring construction success written by chan and chan [2], explain on the development of Key Performance Indicator (KPI) to develop a benchmark for measuring the performance of a construction

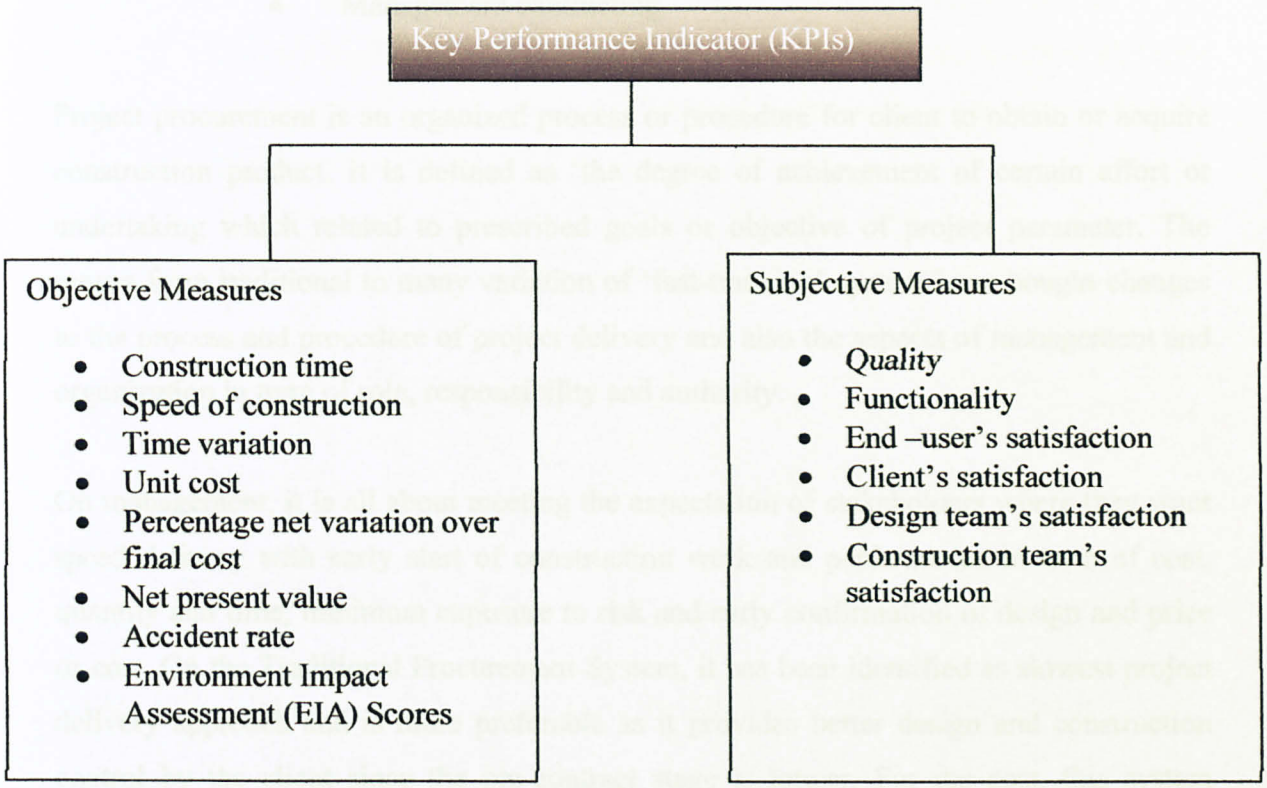
project .According to the journal, it stated that there is no general agreement has been achieved as project success carries different meaning or objective to different people. The criteria of project success are constantly been improved by the researches.

In KPI, the calculation methods are divided it to two groups which are mathematical formulae and subjective opinion of the stakeholder. For the mathematical formulae, it is

used to calculate the respective values and for subjective opinion is to measure the quality, functionality and satisfaction level of stakeholders and others.

Below is a graphical representation of the Key Performance Indicator (KPIs) which propose by the author [2].

Table 1: KPI for project success



From the journal of KPI, the criteria to measure a project performance are covered with qualitatively and quantitatively. It is useful framework to measure and to compare project performance for future study as it provides useful information on managers, client and stakeholder to implement a project excellently compare to other journals which review more on the three basic success performance indicator which are time, cost and quantity.

In the other research, Effect of Procurement Systems on The Performance of Construction Project is written by Rashid and Mat Taib from Department of Quantity

Surveying, University Teknologi Malaysia (UTM) [3]. The Journal discusses on the different procurement system available and the effect of the different procurement systems on the project performance .Generally there are there type of procurement system available which are as follows.

- Traditional system
- Design and build
- Management contracting.

Project procurement is an organized process or procedure for client to obtain or acquire construction product. It is defined as 'the degree of achievement of certain effort or undertaking which related to prescribed goals or objective of project parameter. The ranges from traditional to many variation of 'fast-tracking' system have bought changes to the process and procedure of project delivery and also the aspects of management and organization in term of role, responsibility and authority.

On management, it is all about meeting the expectation of stakeholders where they want speed delivery with early start of construction work and performance in term of cost, quantity and time, minimum exposure to risk and early confirmation of design and price or cost. On the Traditional Procurement System, it has been identified as slowest project delivery approach and is more preferable as it provides better design and construction control by the client since the pre-contract stage is longer. For the cost, this system provides more price certainty to the client as the design and the complete working drawing is fully developed prior to tendering. In term of quality, it provides high degree of quality and functional standard as it allow the building owner to combine best design management between contractors and consultant.

For the Design and Build and Turnkey Procurement systems, it is a fast-tracking where design and construction are integrated. The detail design and construction run in parallel and concurrently to each other. For the cost, it is fixed at the tender stage and is subject to

design changes. Cost saving may be made as contractor applies his knowledge to simplify both design and work. The quality is much compacted and coherent work program as contractor utilize integration of design and construction knowledge.

For Management Contracting and Professional Construction Management Systems, the time is shorter than other system as it allows for more efficient and effective coordination of work, material, manpower and plants. The cost to be lower than other as it is the sum of prices quoted by the package contractor. In term of quality, it is more proficient and effective in ensuring high quality of works. Therefore, this information tells that all factor should be consider before selecting the most appropriate procurement system to meet the objective and target of the project.

[8] Below is the simplified of the process for every type of procurement systems

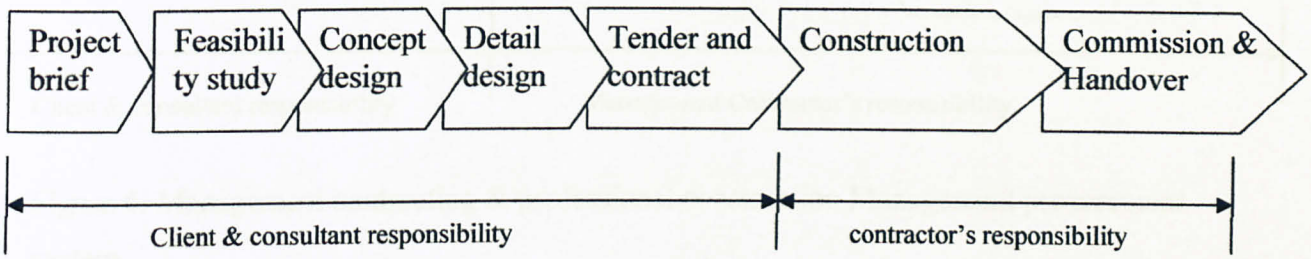


Figure 2: The linear or sequential process of the Traditional Procurement System

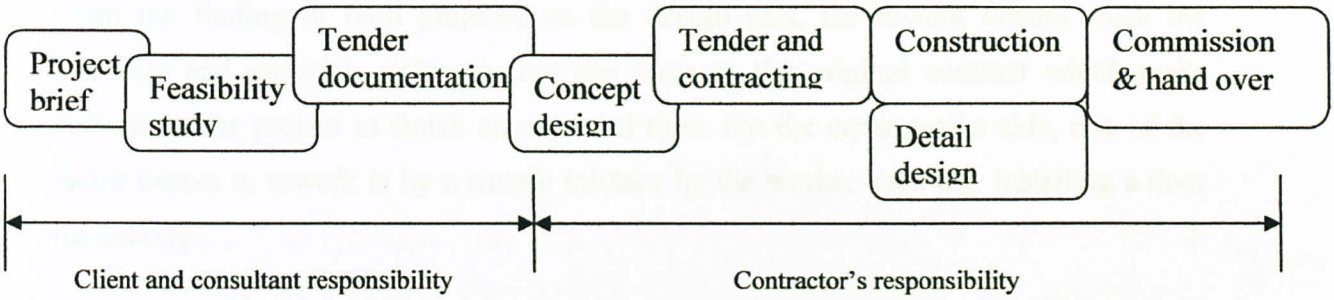


Figure 3: The integrated Process of Project Designing and Construction in Design and Build Procurement System

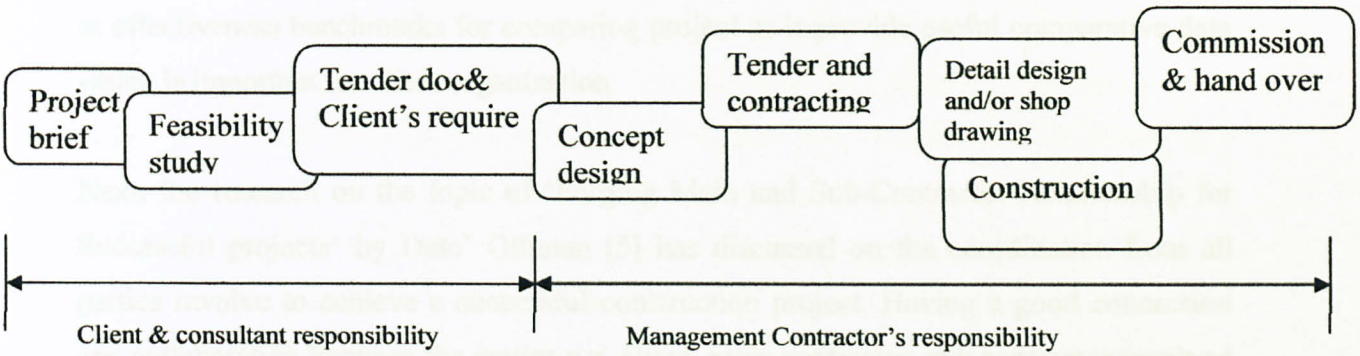


Figure 4: Management contracting & professional construction Management procurement system

In the other study, research entitled the propagation of rework benchmark metrics for construction has written by Love and Smith [4]. The journal is to develop a series of benchmark metrics for the causes and cots of rework. Base on the research, it is suggested that most organizations should learnt to accept the rework as part of their operation as they have not realized the rework will affect the performance of a successful project.

In his paperwork, he has used a case study approach to develop a series of benchmark metrics for the causes and cots of rework. The result is obtained from two construction project which done by same contractor but using different type of procurement methods.

From the finding of both projects, on the design part, the rework occurs when the activities and materials order are not the same to the original contract which make difficulties for project to finish on expected time. On the construction side, one of the factor causes to rework is by a simple mistake by the worker such e.g. installing a door incorrectly.

Lack of standardization during the painting, tilting and concrete placing also cause rework activities to overcome the poor quality of project. Recognizing the benchmark metrics for the cost of rework can be potential goal for the construction industry but there is a limitation application to the project types presented. An initial measure can be used as effectiveness benchmarks for comparing project as it provide useful comparative data which is important for client organization.

Next, the research on the topic of 'Forging Main and Sub-Contractor Relationship for Successful projects' by Dato' Othman [5] has discussed on the coordination from all parties involve to achieve a successful construction project. Having a good connection and collaboration between the parties e.g. client, main contractor, sub contractor involved is the essential in order to accomplish the project objectives and avoid disputes escalate into legal actions.

Those aspects can be achieved by having a good communication channels, instilling a paradigm shift in main contractor and sub-contractor relationship and a creation of good managing system. In the Public Work Department (PWD), two type of contract which is as follows:

- Conventional contract
- Design and Build contract

In conventional contract, the project will basically design by consultant or by in-house. PWD will hire a main contractor who then will choose their own supplier and sub-

contractor. In project which required specialized input, PWD will choose the sub-contractor to do the work. However, the main contractor is still responsible on performance of sub-contractor.

For design and built (D& B) contract, the main contractor will select it own consultant to work on the detailed design of the project. The main contractor is also responsible to select the sub- contractor or specialized contractor and is responsible for the design and execution of the project. Tension between main and sub-contractor may cause due to poor communication, lack of information on site, poor supervision, master and slave syndrome and lack of management systems.

Not balance flow of communication also will affect the smoothness of execution work where instruction and requirement from client does not transfer well or share with subcontractor. Poorly communication information by the main contractor to sub contractor also lead to incorrect pricing where difficulties happen when endorsement of the budget to buy necessary equipment/tool.

The other issue that effect the project performance is 'master and slave' relationship where will create a tense situation during the project implementation which results the product not finishing in time and of good quality. From the research, the contractor is not just supplying product but actually giving a good service to the user/client. Building a good relationship between all parties is the very important aspect to achieve the objective of the construction. Good procurement flow, management system and team work will make the objective successful.

2.2 Evaluation Criteria from Previous Study

Base on the literature review, every people has different perspective and opinion towards the evaluation of performance project in construction industry. Below is an example of

list of criteria which set by the researches with respect to their own perspective to measure the construction performance.

Table 2: List of criteria to measure project performance base on previous study

Criteria to measure project performance	Previous Study			
	Songer and Molenaar (1997)	Kumaraswany and Thorpe (1996)	Lim and Mohammed (1999)	Chan and chan (2001)
1.Cost/financial performance	√	√	√	√
2.Project duration	√	√	√	√
3.Quality	√	√	√	√
4.Client and project manager satisfaction		√		√
5.User expectation and satisfaction	√		√	√
6.Friendliness of environment		√	√	√
7.Health and safety		√	√	√
8.Quality of workmanship	√	√		
9.Utility/ Functionality			√	√
10. Meet specification	√			
11. Minimize construction aggravation	√			
12. Commercial profitable				√
13. Transfer of technology		√		
14. Speed of construction				√

2.3 Terminology

- Project Management – The appliance of knowledge, skills, tools and technique to the project activities to achieve the project objective mainly on planning and tracking on the project tasks and leadership of the project team to bring success and customer satisfaction [6]
- Project – A fix of time process with a defined of start and end date, with the purposed to deliver a unique product , service or other result , and composed of interrelated and interdependent tasks.[6]
- Criteria – standard of judgement of principle by which something is measured for value [7]
- Success – occurs only when the customers is satisfied with the results of the product which the customer allow the contractor to use the customer's name as a reference [8]
- Criteria of a project success – As set of principle or standards by which favorable outcomes can be completed within a set specification [2]

METHODOLOGY

3.1 Literature Review

A comprehensive literature review is an important process in the project, as it helps to understand the background or concept of construction performance as well as to widen the knowledge and idea which related to research topic. The methodologies involved in this process are mainly research from websites, books and discussion with supervisor and graduate assistant.

3.2 Questionnaire Design

Generally, for designing questionnaire, it can be divided into three major steps, which are as follows:

1- Comprehensive literature review
2- Pilot survey
3- Questionnaire revision

3.2.1 Comprehensive literature review

The questionnaire design is based on the literature review and research which the criteria consider to measure project performance in construction project has been consider and used in the research .The criteria that is being used to do this research was based from previous studies, journals and other related books

3.2.2. Pilot survey

Pilot survey is one of the major processes in the project and it could be included as one of the steps in the designing process. It serves as a tool to support in the questionnaire modifications. The purpose to have a pilot survey is to observe weather the understanding of respondent towards the question is same with what the author aim for. From the pilot

survey, the respondent had answered and commented on the structure of the questionnaire whether the question that includes is relevant and applicable upon the research topic. Please refer to appendix A for pilot survey questionnaire.

For this study, pilot survey is conducted after the completion of draft questionnaire. The pilot survey has been conducted for both internally and externally which include lecturers and client companies. Three internal respondents (UTP's lecturer) and two external respondents (clients) have been chosen randomly for the survey. The respondents are given some period of time to complete the questionnaire. The questionnaires from respective people have been collected to be analyzed. Please refer to appendix B for respondent's information for pilot survey.

3.2.3. Questionnaire revision

It is a process to revise the questionnaire from pilot survey .The process involved in modification or changes based on the comment from the respondent. This is carried out to further enhance and improve the questionnaires from various aspects. This questionnaire revision is done after the pilot survey process.

3.3 Population and sample

The population of the research is focusing in Peninsular Malaysia area. The sample or questionnaire is conducted by simple random sample which have been distributed using a survey method via email or interview. The questionnaire is distributed for at least 300 companies and minimum number of feedback is expected to be received is 30 respondents. For the respondent party, it is focused on client which mainly the developer company from residential, industrial, commercial and infrastructure project.

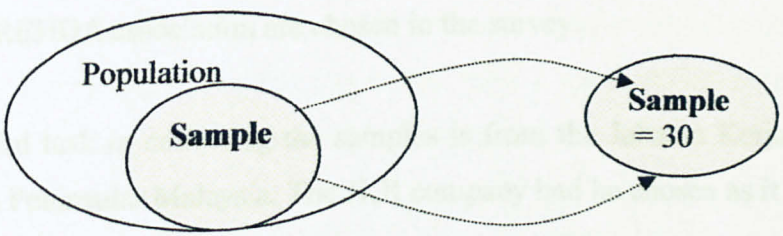


Figure 5: Population and sample

3.4 Sampling Method

Sampling is defined as gathering data from a representative sample of the target population. In this research, the random sampling method is applied as the population is too large for the author to attempt to survey all of target population. The sampling methods are classified as either probability or nonprobability. For probability samples, each member of the population has a known non-zero probability of being selected which this ensure there is an equal and known chance for each member in a sample population to be selected. In nonprobability sampling, members are selected from the population in some nonrandom manner where it target specific members.
The research shall implement a probability sampling methods in order to avoid biases in the results with an area covering respective states in peninsular Malaysia. Client from respective states will be divided into each area, and shall be selected randomly in order to provide better distribution of results.

The process of random sampling conducted for this project consists of 3 main tasks. The first task is to search the developer company name which serves as a client involved in developer business in private sector. This is done by browsing from the reliable websites. The clients interested to be surveyed in this study are clients from respective states covering peninsular Malaysia.

The second task in collecting the samples is from the available directory book published for property project in Malaysia, from landed properties, high-rise commercial/residential buildings, to hotel/resorts which published in market. The author has used REHDA (Real Estate & Housing Developers' Association Malaysia) Directory [12] book as a medium to collect samples for this research to choose clients for the research. A number of clients under REHDA association are chosen in the survey.

The third task in collecting the samples is from the Jabatan Kerja Raya (JKR) of each state in Peninsular Malaysia. The JKR company had be chosen as it representing eveloper

of infrastructure for private sector as most of infrastructure project in state is control and manage by JKR.

After finalizing the name list, the author then rearrange the name list according to alphabets (from A-Z), and choose the clients in incremental order. For this study, the author has decided to choose the clients from the name list in increment of two, as the total sample of clients which are six hundreds divided by two will results three hundreds as respondents. However the starting point where the author decided to choose is decided randomly. The author shall take ten small pieces of paper, and numbered them from one to ten, fold and place it into an empty box. Randomly, the author shall pick one of papers in order to decide what number shall be the starting point in choosing the clients incrementally to avoid biases as normally the first name list will be chosen. Through these steps, twenty five clients shall be selected for each state in peninsular Malaysia which from Johor, Negeri Sembilan, Melaka, Perak, Selangor, Penang, Kedah, Perlis, Kelantan, Terengganu, Pahang, and Kuala Lumpur.

3.5 Questionnaire Distribution

The questionnaire distribution had been made in two different periods. The period of distributions is determined by the latest reply date which is set by the author to the respondents before 28th December 2008 for first stage and 23rd February 2009 for second stage. For each phase of distribution, 150 of questionnaires is posted to respective company. Please refer to appendix C and D for questionnaire cover letter and appendix E for the questionnaire.

For this research, the distribution is done through mails and household drop-off. Questionnaires are mailed to the companies located around Peninsular Malaysia. For companies nearer to UTP, the questionnaire is distributed personally to the companies' offices. Every questionnaire is included with a cover letter within the questionnaire's envelope, in order to introduce the research to the respondents.

3.6 Follow Up

The follow up process is done to higher the chances of the respondents to respond on the questionnaire sent to them. This process takes place when the expected reply dates for the respondents which on 28th December 2009 and 23rd February 2009 have passed. The author would contact the respondents by means of telephone or email. The follow up process shall be done in one week duration. The author shall call or email the respondents in order to check the respondents whether they received the questionnaire and also to remind respondents about the feedback of questionnaire.

3.7 Interview

For the process of interview, commonly there are two methods to interview respondent namely individual interview (face to face) and telephone interview. The individual interview gives the author a chance to find out about the client on a more personal level of managing contractor based on their experiences. Besides the opportunity to ask respondent on the questionnaire, the respondent can clarify the points of opinion and elaborate the significant of criteria more deeply. Personal interview requires the author to go to the respondents' place, and conduct a direct interview with the person. However, respondents are most likely to welcome the interviewee once they agreed to be interview.

Telephone interview is easier and quicker to be conducted as the author is not required to travel a lot. Comparatively, it is cheaper than personal interview as personal interview required the author to move to respondent place. However, most of the time, telephone interview could not establish a good relationship from both of the parties (the interviewee and the respondents) as they are no direct communication from both of them. Therefore, some of the questionnaire may not be answered correctly as respondents may answer it without full commitment.

For this research, the author has applied direct interview method, as the feedback and answer from the respondents is more accurate and truthful. Rationally, it is difficult to

make the respondents understand the desired answer needed by only talking in the telephone. Besides, the respondents would probably try to answer the questions asked by the author as fast as he/she can in order to end the conversation. Therefore, personal interview is very most advantageous in this research as compared to telephone interviews.

3.8 Method of analysis

Analysis of data is conducted using a descriptive analysis to compare both criteria from literature review and as in practice. Below is the methodology of the research which has been used to get the respective results.

Table 3: Methodology method

Task	Method and Tools	Result
Identifying construction performance criteria from literature review	Literature review	Criteria
Identifying construction performance criteria from current practice	Survey using questionnaire	Criteria
Prioritize the construction performance criteria in private sector	Analysis by descriptive analysis using means and variance, standard deviation and others.	Prioritizing criteria

3.9 Tools

Table 4: Tools of research

Equipment	Description
A4 Paper	To be used for survey purpose where questionnaire and cover letter is printed and to be send to respondent
Stamps and envelopes	For sending the questionnaire via post
Microsoft word and Microsoft Excel	Software to present the results (feedback) e.g. Pie chart and results calculation

3.10 Flow chart of research process methodology

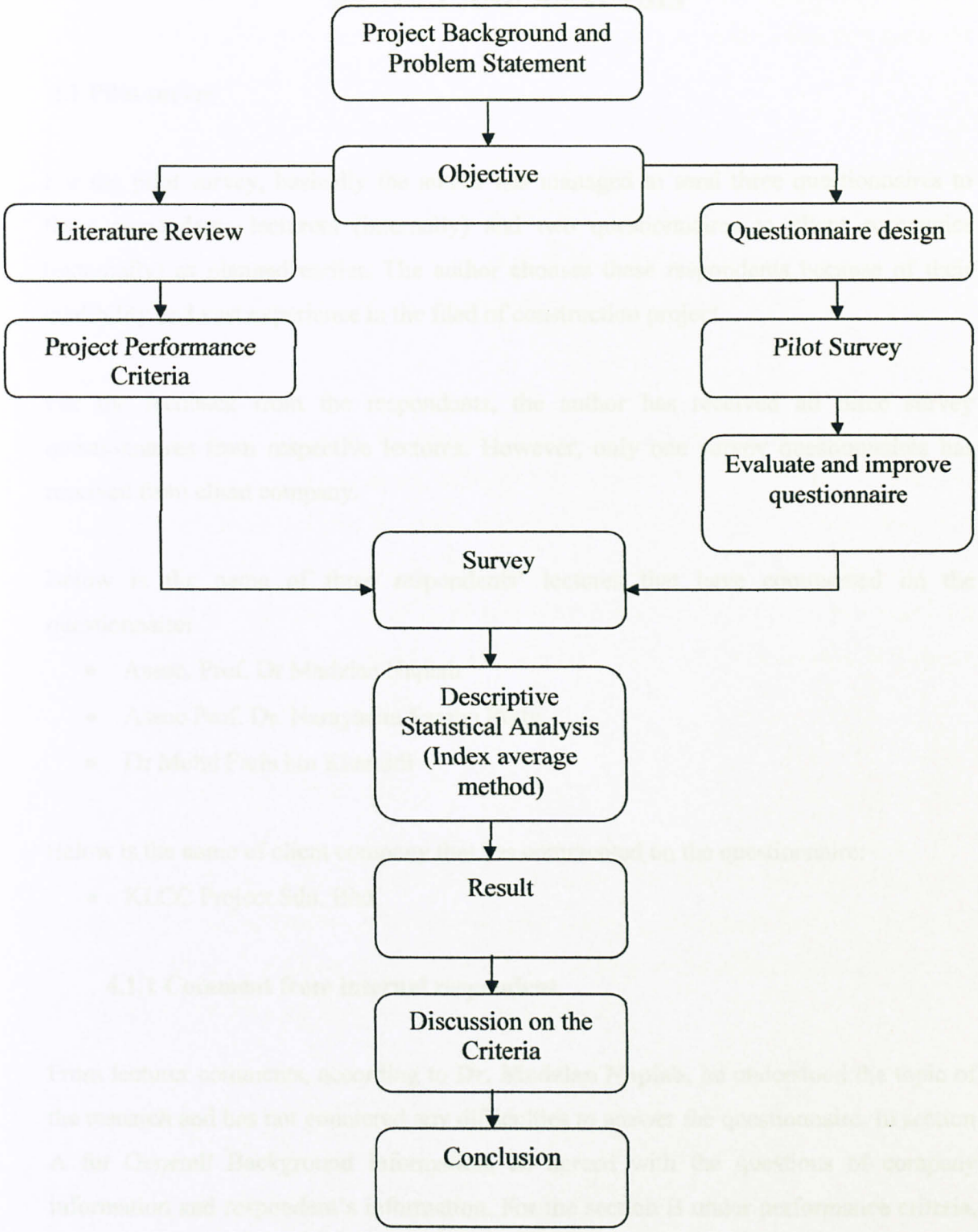


Figure 6: Flow chart of research process

RESULT AND ANALYSIS

4.1 Pilot survey

For the pilot survey, basically the author has managed to send three questionnaires to three respondents lecturers (internally) and two questionnaires to client companies (externally) as planned earlier. The author chooses these respondents because of their credibility and vast experience in the filed of construction project.

For the feedback from the respondents, the author has received all three survey questionnaires from respective lectures. However, only one survey questionnaires has received from client company.

Below is the name of three respondents' lectures that have commented on the questionnaire:

- Assoc. Prof. Dr Madzlan Napiah
- Assoc Prof. Dr. Narayanan Sambu Potty
- Dr Mohd Faris bin Khamidi

Below is the name of client company that has commented on the questionnaire:

- KLCC Project Sdn. Bhd.

4.1.1 Comment from internal respondent

From lecturer comments, according to **Dr. Madzlan Napiah**, he understood the topic of the research and has not countered any difficulties to answer the questionnaire. In section A for General/ Background information, he agreed with the questions of company information and respondent's information. For the section B under performance criteria, he has managed to understand and prioritize all criteria to measure the project performance without any comment. Next, in section C and section D, he has no

comment and agreed with the questionnaire. For the last section which is section E, on the suggestion to improve the questionnaire, he suggested to include a question on the client's experience (bad or good) with regards to the quality of product that they received from the contractor after number of years.

Next for **Dr.Narayanan** comment, he does not have any comment on section A. However for the section B, he strongly suggested to give some short description on the criteria listed in order to make sure the respondent has a same thinking or idea to what the question is ask for. For other sections which are section C, D and E, there is no comment on respective section.

The last internal responded is **Dr Mohd Faris** and he major concern is on section B which to the prioritize performance criteria. The criteria listed should be not wide in scope. He has mentioned that by some description, it would helps to narrow down the scope for every criteria and easy for respondent to rank it toward the current practice. There is no comment for section A, C and D. For section E, he has commented on feedback if the respondent prefers to know the result. He suggested via email and phone call would be a good way to convey survey result.

4.1.2 Comment from external respondent

The feedback for pilot survey from **KLCC Project Sdn. Bhd.** is done by the project manager, **Mr. Saiful Bahari**. He understood the survey questionnaire well and has given ranking to the criteria based on his experience over 20 years in construction project. For the comment, he does not have any regarding the survey.

4.1.3 Summary of comment from pilot survey

Below is the summary of comment from the respective respondent:

Table 5: summary of comment from respondent

Name /company	Respondent	Comment section	Explanation
Dr. Madzlan Napiah	Internal	E	1. Suggestion to ask question on respondent experience (client) on quality of product after several years of hand over project.
Dr. Narayanan	Internal	B	1. Provide some short description on criteria listed
Dr Mohd Faris	Internal	B	1. Narrow down the scope by some description and example
		E	2. To convey results of survey via email or phone call
KLCC Project Sdn. Bhd	External	None	None

4.2 Data Compilation and Presentation:

For the questionnaire distribution, the author has managed to distribute questionnaire to selected companies in Peninsular Malaysia. The author has received 38 feedbacks via post and fax. Respondent from Selangor state is the highest with 8 feedbacks. Second highest respondent is from Johor state with 6 feedbacks. The lowest feedbacks received are from two states which are from Kelantan and Kedah with 1 respondent for respectively. For this research, the author is not able to receive any respondent from Perlis state .Below is the number of feedbacks from respondents with respect to their state in Peninsular Malaysia.

Table 6: Number of respondents for each state in Peninsular Malaysia

No.	State	No of Respondents	Percentage (%)
1	Selangor	8	21
2	Johor	6	16
3	Penang	5	13
4	Melaka	5	13
5	Kuala Lumpur	3	8
6	Pahang	3	8
7	Negeri Sembilan	2	5
8	Terengganu	2	5
9	Perak	2	5
10	Kelantan	1	3
11	Kedah	1	3
12	Perlis	0	0
	Total	38	100

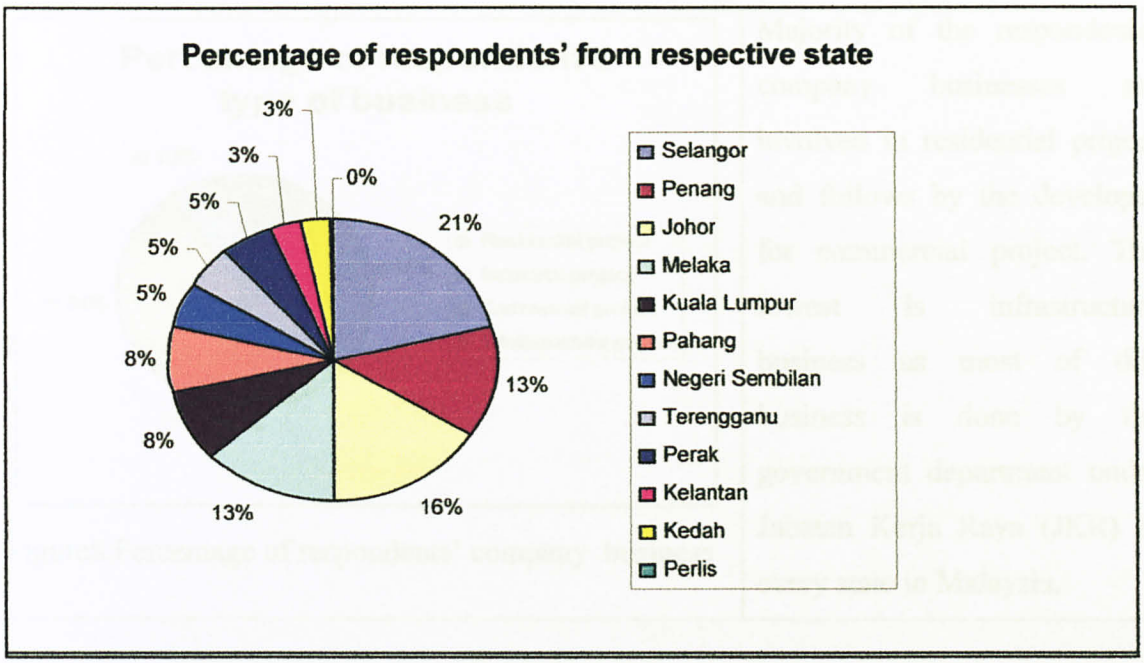


Figure 7: Percentage of respondents for respective state

4.2.1 Company Information:

4.2.1.1 Type of Business:

Table 7: Type of business

No.	Type of Business	No. of Respondent	Percentage (%)
1	Developer for residential project	36	45
2	Developer for industrial project	9	11
3	Developer for commercial project	27	34
4	Developer for infrastructure project	8	10
Total :		80	100

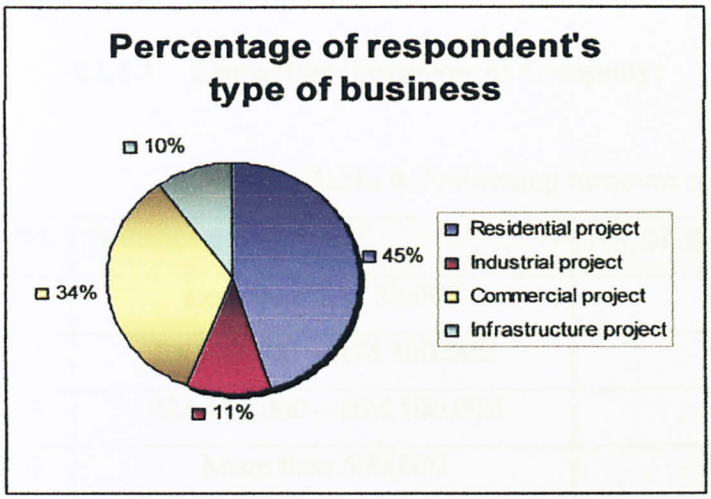


Figure8:Percentage of respondents' company business

Majority of the respondents' company businesses are involved in residential project and follows by the developer for commercial project. The lowest is infrastructure business as most of this business is done by the government department under Jabatan Kerja Raya (JKR) in every state in Malaysia.

4.2.1.2 Company Experience in Construction (years):

Table 8: Company experienced in construction (years)

No.	Company experience (Years)	No. of Respondent	Percentage (%)
1	Less than 5	2	5
2	5-10	3	8
3	11-20	13	34
4	More than 20	20	53
Total :		38	100

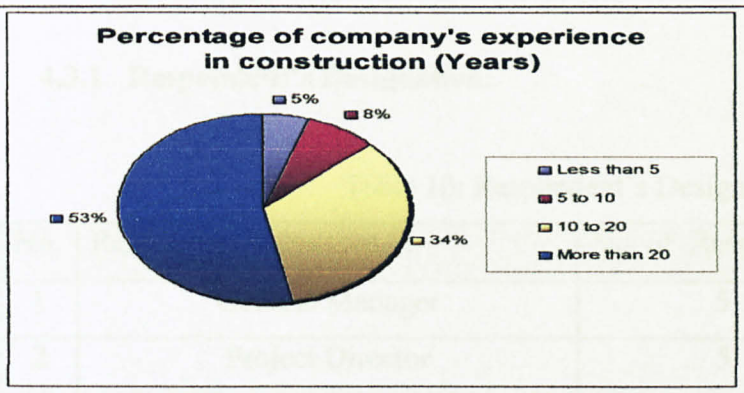


Figure 9: Percentage of company's experience in construction

Most of the respondents' company's have experiences more than 20 years in construction project. This indicates that the companies background have solid knowledge on dealing with contractor performance.

4.2.1.3 Estimating Turnover of Company:

Table 9: Estimating turnover of company

No.	Annual turnover	No. of Respondent	Percentage (%)
1	Less than RM 50,000	0	0
2	RM 50,000 – RM 100,000	0	0
3	RM 100,000 – RM 500,000	1	3
4	*More than 500,000*	37	97
Total :		38	100

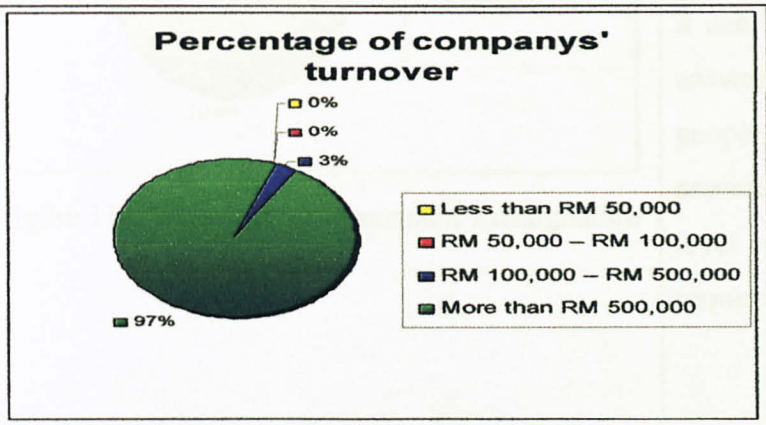


Figure 10: Percentage of company's turnover

From the respondents' information, most of their company's turnover are more than RM 500,000 which shows most of the companies involved in mega project in Malaysia

4.3 Respondent's Information:

4.3.1 Respondent's Designation:

Table 10: Respondent's Designation

No.	Respondent's designation	No. of Respondent	Percentage (%)
1	General Manager	5	13
2	Project Director	5	13
3	Project Manager	19	50

4	Architect	1	3
5	Engineer	6	16
6	Other: QA and QS	2	5
Total :		38	100

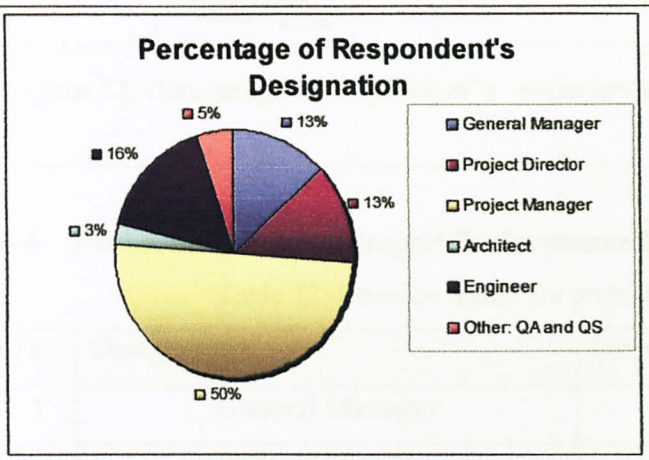


Figure 11: Percentage of respondent's designation

Most of the respondents' designation are from project manager who are very well verse in dealing with contractor performance. From the positions that the respondents held, it can be logically assumed that the answers given are from experienced people. Furthermore, it can also be assumed that high experience and level of technical knowledge is required to answer the questionnaire.

4.3.2 Respondent's Experience in Construction

Table 11: Respondent's Experience

No.	Respondent's experience (years)	No. of Respondent	Percentage (%)
1	Less than 5	1	3
2	5-10	5	13
3	11-20	21	55
4	*More than 20*	*11*	29
Total :		38	100

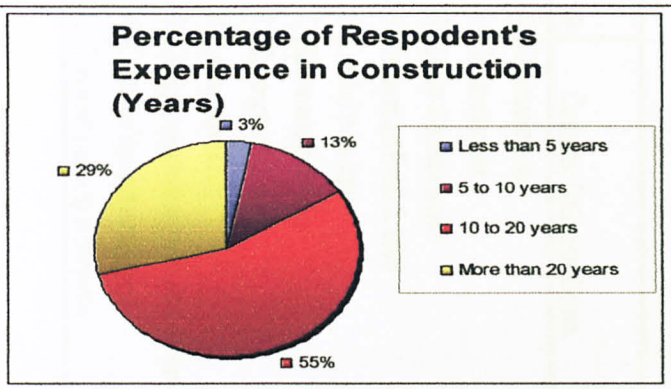


Figure 12: Percentage of respondent's experience

More than half of the respondents' experiences are between 10 to 20 years. Furthermore, 29 percent of the respondents have been experience in construction more than 20 years. Thus reflect the research results are reliable and trustworthy.

4.4 Decision Maker for Project Performance Evaluation

Table 12: Decision maker for project performance evaluation

No.	Designation	No. of Respondent	Percentage (%)
1	General Manager	21	22
2	Project Director	25	27
3	Project Manager	23	24
4	Architect	13	14
5	Engineer	11	12
6	Other: Investor and Public	1	1
Total:		94	100

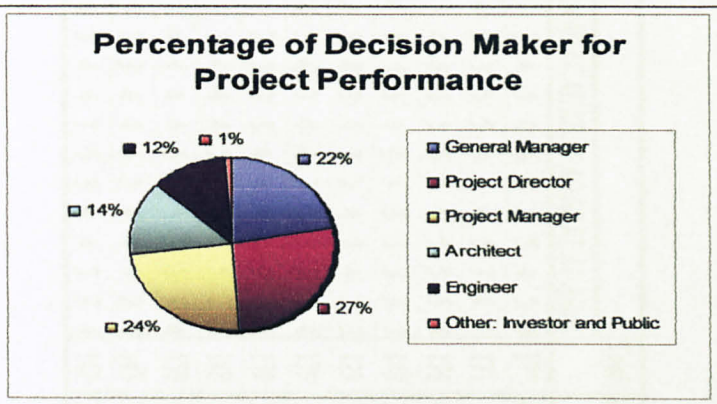


Figure 13: Percentage of decision maker for project performance

In real practice, most of the decision maker for project performance evaluation is done by the project director follows by the project manager. Investor and public represent one percent as "customer satisfaction is the ultimate goal".

4.5 Level of Contractor Criteria Performance in Construction Project

The data gathering process is conducted after the questionnaires submissions from respondents. From the total distribution, the author has managed to receive two respondents from government department which are Jabatan Kerja Raya Negeri Sembilan and Jabatan Kerja Raya Negeri Selangor. Generally, infrastructure construction is handled by the government thus accepting government departments are needed to represents the clients in infrastructure projects. Table 12 shows the lickert scale value of each criteria of contactor which are filled up by respective respondent. The complete name of companies and their states are represented by alphabet (A-AL). Please refer to appendix F for respondent's company information.

Table 13: Lickert scale value of each criteria of contractor

		Respondent (company)																																				Total	Mean	Variance
No	Contractor Performanc Criteria	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL			
1	Construction cost	5	4	5	5	5	5	5	5	5	4	5	5	4	5	5	4	5	5	5	4	5	5	4	5	5	5	3	3	4	5	4	5	3	5	5	4	5	5	175	4.6053	0.40754
2	Construction time	5	4	5	5	5	4	5	5	5	3	5	5	5	4	5	5	5	4	5	5	5	4	4	5	5	5	4	3	3	5	5	5	4	4	5	3	4	4	171	4.5	0.47297
3	Quality of finished project	5	4	4	5	5	5	5	5	5	4	5	5	5	4	5	4	5	4	5	4	5	4	4	5	5	5	5	4	4	5	5	5	4	4	5	5	5	4	176	4.6316	0.23898
4	Occupational Health & safety	5	4	4	5	4	4	5	5	5	4	4	4	4	4	4	3	4	3	4	3	5	4	3	4	4	4	4	4	5	3	4	4	4	3	3	3	3	3	149	3.9211	0.45306
5	Level of technology	4	4	3	4	4	4	4	1	4	3	2	4	4	3	3	3	4	2	4	4	3	3	4	4	4	4	4	3	4	3	4	3	2	4	3	4	2	3	129	3.3947	0.62376
6	Environment friendliness	4	4	3	5	4	5	5	3	4	3	3	5	4	4	3	2	4	3	4	3	4	4	4	4	4	4	4	3	4	3	4	4	3	3	3	3	2	4	139	3.6579	0.55548
7	Construction flexibility	4	4	2	4	4	4	4	5	3	4	3	4	5	4	4	3	4	3	4	3	4	4	4	4	3	3	5	3	3	3	3	4	3	4	4	4	2	4	139	3.6579	0.50142
8	Labour dependency	4	5	4	5	4	5	4	5	4	2	4	4	4	3	4	2	5	3	4	3	4	4	4	3	3	4	3	3	4	4	4	5	4	4	5	5	2	5	148	3.8947	0.74538
9	Quality of coordination by construction team	4	4	4	5	4	5	5	5	4	3	4	4	5	4	3	4	4	4	5	4	4	4	4	5	3	4	4	4	4	4	4	5	4	5	5	5	3	4	159	4.1842	0.37055
10	Contractor's project management	4	4	3	4	4	5	5	5	3	4	4	4	5	4	4	4	4	4	4	3	4	3	4	3	3	3	5	3	3	4	4	3	2	4	4	4	2	4	143	3.7632	0.56401
11	Contractor's capacity of manpower	4	4	4	4	4	3	4	4	4	3	3	3	4	4	5	4	5	3	3	4	3	4	4	4	3	4	4	3	4	4	3	5	3	4	4	3	3	4	142	3.7368	0.36131

4.5.1 Analysis using mean and variance

Analysis using mean and variance is one of the methods which used to determine the level of important for each criteria. The higher the mean value, the higher the criteria will be. The concept applies for variance is different where the higher the variance value, the lower the criteria will be. Based on the results, the author has managed to constrcut a comparison based on both analysis. The ranking results to determine the level of important for each criteria are not equal and it is represented in Table 14.

Table 14: Ranking based on mean and variance analysis.

No	Contractor Performance Criteria	Analysis			
		Mean	Ranking	Variance	Ranking
1	Construction cost	4.60526	2	0.40754	4
2	Construction time	4.5	3	0.47297	6
3	Quality of finished project	4.63158	1	0.23898	1
4	Occupational Health & safety	3.92105	5	0.45306	5
5	Level of technology	3.39474	11	0.62376	10
6	Environment friendliness	3.65789	9	0.55548	8
7	Construction flexibility	3.65789	9	0.50142	7
8	Labour dependency	3.89474	6	0.74538	11
9	Quality of coordination by construction team	4.18421	4	0.37055	3
10	Contractor's project management	3.76316	7	0.56401	9
11	Contractor's capacity of manpower	3.73684	8	0.36131	2

Therefore, the results conclude that the mean and variance method cannot be applied as the result is not equal and consistent to both analysis. Further method of analysis should be applied in order to come out with more accurate results based ordinal type of data.

4.5.2 Analysis using severity index

Severity index is calculated based on the response of the survey to reflect the level of severity effect. The severity index and the ranking of problems for each individual party is calculated providing the basis for the statistical measures. Below is the formula to calculate the index:

$$\textbf{Severity Index (I)} = [\sum a_i . x_i] / [4 \sum x_i] \times 100\%$$

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 $a_4 = 0$

The severity index calculated will give the results in term of percentage. The higher the percentage, more important the criteria will be. This method is more accurate then mean and variance method as it is more consistent and accurate in term of the respondent's frequency of respond. Table 15 shows the analysis using severity index method and the level of importance for each contractor performance. Figure 14 shows the severity index of contractor performance in percentage (%).

Table 15: Analysis of contractor performance criteria using severity index method

	Variable (frequency of response)	0	1	2	3	4					
No	Description	Very low	low	Moderate	High	Very high	Total	Mean	Category (Based on Abd Madjid and McCaffer, 1996)	Severity index for ranking (%) based on Abdulmohsen al hammad and sadi assaf, 1996	Ranking
1	Construction Cost	0	0	3	9	26	38	3.6053	Very high	90.131579	2
2	Construction time	0	0	4	11	23	38	3.5	Very high	87.5	3
3	Quality of finish project	0	0	0	14	24	38	3.6316	Very high	90.7894737	1
4	Occupational health & safety	0	0	10	21	7	38	2.9211	High	73.0263158	5
5	Level of technology	1	4	12	21	0	38	2.3947	High	59.8684211	11
6	Environment friendliness	0	2	13	19	4	38	2.6579	High	66.4473684	9
7	Construction flexibility	0	2	12	21	3	38	2.6579	High	66.4473684	9
8	Labour dependency	0	3	7	19	9	38	2.8947	High	72.3684211	6
9	Quality of coordination by construction team	0	0	4	23	11	38	3.1842	Very high	79.6052632	4
10	Contractor's project management	0	2	10	21	5	38	2.7632	High	69.0789474	7
11	Contractor's capacity of manpower	0	0	13	23	2	38	2.7105	High	67.7631579	8
	Total	1	13	88	202	114					
	Mean	0.09091	1.18	8	18.36	10.3636					
	Variance	0.09091	2.16	21.2	23.25	90.4545					

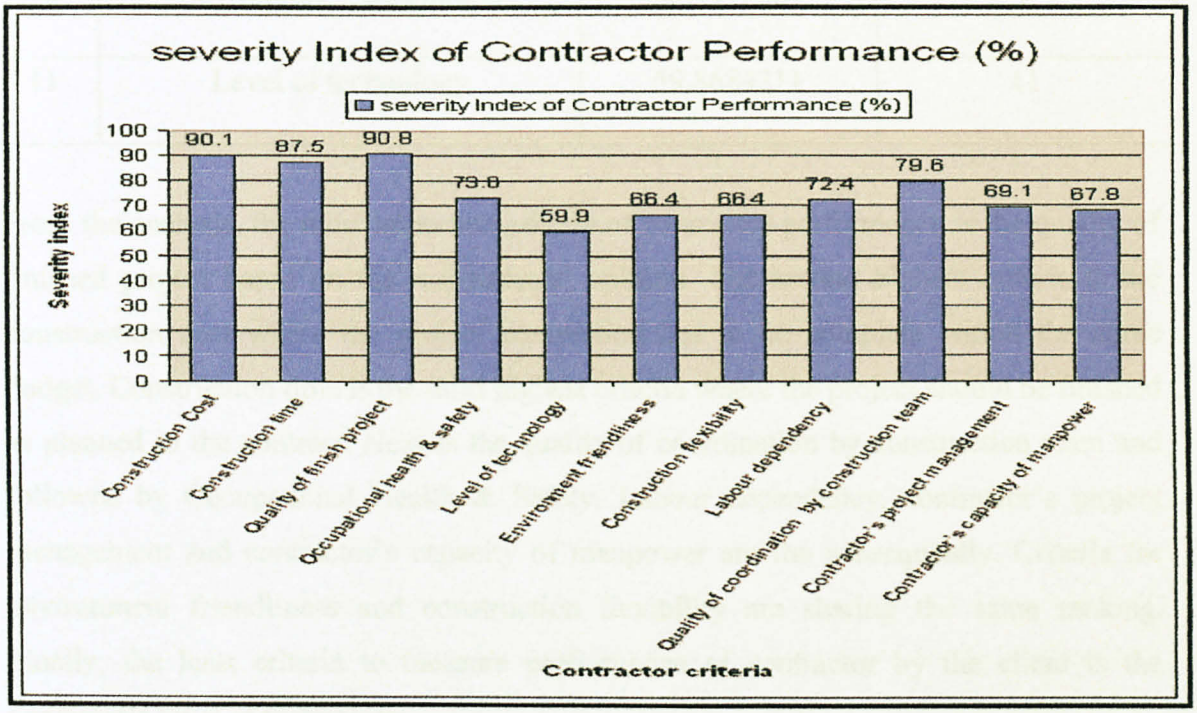


Figure 14: Severity index of contractor performance in construction

Table 16: Summary level of importance for contractor performance criteria

No	Description	Severity Index (%)	Ranking
1	Quality of finish project	90.7894737	1
2	Construction Cost	90.131579	2
3	Construction time	87.5	3
4	Quality of coordination by construction team	69.0789474	4
5	Occupational health & safety	73.0263158	5
6	Labour dependency	72.3684211	6
7	Contractor's project management	69.0789474	7
8	Contractor's capacity of manpower	67.7631579	8
9	Construction flexibility	66.4473684	9
10	Environment friendliness	66.4473684	9
11	Level of technology	59.8684211	11

From the analysis, the most important criteria of contractor performance is the quality of finished project based on the respondents' opinion. The second highest criteria is the construction cost where the project completion has to be complete within the agree budget. Construction time is the third highest criteria where the project should be finished as planned in the contract. Next is the quality of coordination by construction team and followed by Occupational Health & Safety. Labour dependency, contractor's project management and contractor's capacity of manpower are the subsequently. Criteria for environment friendliness and construction flexibility are sharing the same ranking. Finally, the least criteria to measure performance of contractor by the client is the contactor's level of technology.

4.6 Discussion

4.6.1 Number of respondent

1) The significant of targeting specific number of feedbacks:
   a) For this research, the purpose of targeting at least 30 feedbacks from overall sample population of 300 companies is to reach the minimum number of central limit theorem.
   b) When the sample size approaches 30, the distribution of population is assumed to be normal for inference purpose. This normal distribution will have the same mean as the parent distribution and variance equal to the variance of parent divided by the sample size.

2) Respondent location distribution:
   a) Based on the results of percentage of respondents' from respective state, most of respondents come from state of Selangor follows by Penang and Johor. The lowest respondent comes from Kedah and Kelantan.
   b) From the results above, it can be observed that the distributions of the feedback are received from states which are very advance in term of construction growth. These states have experience many project and very active in running the construction industry in Peninsular Malaysia. Therefore, it can be logically assumed that the company comes from develop state have no difficulties to give opinion to the survey as they are very know-how and experience dealing with contractor during construction project.
   c) For the lowest respondent, it can be observed that it come from less development states in term of construction business. Therefore, fewer projects have been managed or completed by companies which cause difficulties to give judgment towards the performance of contractor during construction project.

4.6.2 Level of important for each contractor performance criteria

a) During the construction project start from the initial stage until its completion, the quality of finish product is the most important and essential criteria. This criteria has been chosen by the respondent in current practice.

The significant of quality criteria can be explain by:

i) The client goal is to achieve a long term goal where to cut down the maintenance activities after delivery of project by the contractor to the client. The good quality of product will lead to reduce the defect in the long run during the facility is being use for it purpose.

ii) The quality is important for the reputation and credibility of the owner of project. The end user are indirectly will assess and evaluate the visual appearance and architectural quality. The satisfaction of the end user is the major aspect as they are the party who will buy and use the facilities while in returns profit receive to the client. When good quality of project is provided, the end user would invest to client's future project as they have firm confidence and trust to the client.

iii) The quality is related to the safety as good quality will contribute to the safety ness to the end user. By providing the good quality to the project, less safety issues will be uncounted.

iv) The quality is also to meet the desired function. The construction work done by the contractor must be as same as the design parameter in drawing detail.

Quality has become one of the most important consumer decision factors in the selecting among competing project. In its broadest sense, quality is a degree of excellence: the extent to which something is fit for its purpose. Contractor must apply a good work of quality control and quality testing to ensure the quality is achieved as per required by the client. Therefore, good quality that the contractor can offer to the client will be the major indicator to determine performance of the contractor.

b) Cost of completion is the next important criteria after quality. Contractor that manages to complete the project within the budgets based on the contract sum is an excellent contractor. This capability shows the contractor's professionalism in handling project .The good quality of planning and scheduling will help contractor to manage the cash flow with the activity and to ensure finish project within the budget.

In real work practice, the performance of cost is determined by the Cost Performance Indicator (CPI). From this method, the cost performance is identified based on the Earned Value (EV) analysis. Earned value is the budgeted cost of work actually completed up to Time-now. This analysis compares the cost variance between works done with the value of work that should have been done (cost baseline). The value of work done comprises of indirect cost, cost of materials delivered on site, cost if actual physical work on site and others.

This analysis would help the contractor to understand and aware whether the total actual cost (AC) that is spent at particular time is within the budget or over budget. This analysis also would help the contractor to know whether the project will be completed on budget

or over budget in future. Therefore, should a project is determined to be completed over budget, contractor needs a re-planning and re-scheduling the engineering activity and the allocation of the cost to balance the total cost to be spent in the future activity to ensure project finish within the budget.

. For the next indicator under cost criteria, no additional cost claim by contractor will demonstrate that the contractor is good in handling a project. Overall cost from modification or rework done by the contractor should be minimized and good work method implementation is essential in order to meet this cost requirement. Therefore, completion of project within budget by the contractor is the important criteria from client perspective. Hence, contractor should have a good knowledge and skill for handling the cash flow for every activity during the construction stage.

c) Time is the third important criteria viewed by the client to the contractor. Time refers to the duration for completing the project. On client perspective, completion of project within the time is essential and it can be explain by:

   i) The reputation of client is affected when it fail to deliver the project on time. The investor and buyer will dissatisfy when client brake the promise.

   ii) The unsatisfied buyer would sue the client for not being on schedule to deliver the project due to prolonged project

During the construction period, client access the time performance of the contractor by referring the progress of work with respect to time. Client representative would determine the time performance during the process of progress payment and claim by contractor. There are three ways to access the time performance which are:

i) Schedule Performance Indicator (SPI)

ii) Speed of construction

iii) Construction time

The Performance indicator is measured by determining the Earned Value (EV) and the Planned Value (PV). Planned value is defined as the budgeted cost of work planned to have been completed up to Time-now. From Earned Value analysis, the performance of time can be measured by determine schedule variance between EV and PV.

The Earned value can also be represented in the form of S-Curve which is widely used in contractor project management to control the time performance. From this analysis, it will examines and compares the value of work done with the actual value or progress in term of time (delays) or amount (over or under-achievement).

Speed of construction is determined by the relative time, which is defined by the gross floor area divided by the construction time. The time variation is measured by the percentage of increase and decrease in the estimated project in day/weeks, discounting the effect of extension of time (EOT) granted by the client. For the construction time, it is absolute time that is calculated as the number of days/weeks takes from the start on site to practical completion of the project. Therefore, to delivers the project on time is the major challenge to the contractor as client expectation is very high towards time performance.

d) From the analysis of severity index, the quality of coordination by construction team is very important to the client. From the client perspective, it can be observed that good coordination between contactor and client will leads to good results. In this sense, two way communications is important tools as to update the issues arise so that the client aware and update with the current status of the project. For example to address issues of unexpected condition or to address issues that only could be identified after the construction has started.

During site meeting, by having a good coordination and discussion with the client, any request or additional work scope can be discuss without any delay as the contractor clear what necessary actions to expedite the work as both party are up-to-date with the same information.

From the client point of view, good coordination between contractor and local authority is also an indicator towards the contactor performance. To know authorities requirement is essential so that no delay of work due to the non-compliance requirement of legal requirement.

e) Occupational health & safety is the other criteria that measure contractor's performance. It can be defined as the degree to which the general conditions promote the completion of a project without major accidents or injuries. There are many accident causes such as fall from height, struck by moving, injured while lifting and many more. In construction industry, this issue can be evaluated by the total accident that occurs in construction site. The higher the accident indicate that the contractor is not emphasis and stress more on safety issue to their worker.

In construction stage, the significant of client to choose occupational health and safety as one of the indicator to measure performance of contractor could be explained by:

i) Accident will reduce the total number of worker to perform specific work as it result in personal injuries. This eventually will effect the time taken to complete the work and thus delay the construction project.

ii) Some special accidents will affect the client's name. This is especially when it involved death of the worker. The news published in the news paper will affect client's business as it gives indication that client is not good in term of safety. The buyer will afraid to buy and use the facilities therefore effect client business.

Therefore, safety in project site influences the performance of contactor. Contractor should constantly remind and alert to the worker on the possibilities of accidents and avoid taken unnecessary risks during construction.

f) Labour dependency is how reliable the worker to complete the specific work. Skilled worker and semi-skill workers are workers who already possess specific skills in specific trade and able to work independently. From the perspective of client, the quality of workmanship is depending from this people who will give guidance to the general labour. Therefore, it is important for the contactor to hire the best and qualified skilled and semi-skilled worker to ensure the quality of workmanship meet the standard and its specification.

g) Contractor's project management technique is one of the criteria which affect the performance of contractor during the construction stage. In client perspective, good project management by contactor

will helps to increase and improve the efficiency of the project work. Good planning and scheduling is base on contractor's experience, skill and knowledge. The client wills emphasis more on the work sequence to complete the project. A good logical relationship between one activity to the next activity together with the resources helps to optimum the production. The client also gives high respect to the contactor who is good in monitor and control the schedule with regards to the construction progress. The usage of good software also helps contractor for the efficiency to project management such as Primavera and Microsoft Project software.

h) Contractor capacity of man power from the client perspective is the total of worker that needs to finish specific task. Higher total of man power will result higher in production. A good contractor is determined by their talent to allocate the total workers and their total cost to finished specific job. It is not necessary that higher man-power capacity will results the efficiency to the work as efficiency depends on the work process, sequence and procedure. This aspect is also being considered by the client to the contractor performance in construction.

i) Construction flexibility is the ease of change during the construction stage. A good contractor is the one who can entertain the client's will even if the implementation will cause delayed to the project schedule. Even if the changes cause delay, the contractor still can request for the Extension of Time (EOT). The client satisfaction is the most important criteria in order for the contractor to get future project with the same client. Therefore, to consider and to meet the requirement changes by the client is essential which demonstrate good performance of contractor.

j) Environmental friendliness is the second lowest criteria to access the performance of contractor by the client. This can be assumed as in construction site, the environment management practice is being control by representative from the authority which known as Environment Officer (EO).Therefore, the waste disposal, water quality and the pollution condition will fully be supervised by the Environment Officer instead of contractor.

k) Level of technology is the lowest indicator to measure the performance of contractor. This can be assumed that the client is not really focus and depend on the technology of the system or the equipment as long as the specific work/ product can be finished with the correct standard and specification. For example the testing machine, surveying, precast or in-situ method.

4.6.3 The reliability of results

a) From the results of respondent's designation, half of the feedbacks are completed by project manager. The second highest is engineer with 16 percent followed by general manager and project manager where the same fraction of 13 percent respectively. This show the feedback data are very reliable and dependable.

b) The comment from project manager, project manager and general manager are very vital to this research. They are the important person to evaluate contractor performance during construction. This three positions are normally assigned as a Superintendent Officer (SO) who has the highest authority to any construction project. They are role as administers the project contract including changes such as

variation order, certifying work done and certifying progress payments to the contractor.

c) From the analysis of respondents' experience in construction, more than half of the respondent have experienced from 10 to 20 years. Furthermore respondents having experience more than 20 years are the second highest to give opinion of contractor performance. Only 3 percent of respondents are having experience for less than 5 years. This demonstrates the level of important of each criteria is qualified and practical as it involved comment and recommendation from respondents with very experience and good technical knowledge.

d) The research has successfully covered all type of construction business which are residential project, industrial project, commercial project and infrastructure project. About 97 percent of the respondents company's' turnover are more than RM 500,000. This indicates business project that most of company involves are mega project. Therefore, this indicates that the company organizations are very particular on evaluating contractor performance in construction to ensure the desired profit by the owner will be achieved.

4.7 Other criteria to measure contractor performance in construction project

The additional criteria which are included in the questionnaire are presented separately with other available criteria stated. The purpose to include other criteria is to give opportunity for respondents to add any additional criteria to measure performance of contractor which is to ensure research cover all criteria which used by the client in current practice. However, the additional criteria are not included in the main analysis result as it has only been commented by some particular respondents from whole respondents.

There are seven respondents which have commented on other criteria to measure performance of contractors. There are two respondent come from the same state which are Melaka state. The other respondents (companies) come from different states which are from Selangor, Penang, Johor, Kuala Lumpur and Terengganu. The table below is the summary of comments from respective respondent.

Table 17: Summary of other criteria to measure performance of contractor in construction project

No	Respondent (company)	Other criteria (Contractor performance)	Description
1	H	1.Contractor pervious experience 2. Contractor Cash Flow 3. Contractor reputation (Contractual)	1. To ensure contractor manage to complete project and avoid unnecessary error 2. Financial status to ensure contractor complete job without delay and/or additional assistant from the developer. 3. Every instruction must be detail as lack of information will results unexpected management time.
2	M	1. Responsiveness 2. Productivity	1. Metrics that show how responsive the contractor is to client's needs and how they respond when a need arise 2. Measure of how much work is getting

			done per unit of resource such as hour of labor.
3	R	1. Financial capacity 2. Experience with authority	1. Financial status so that work can carry on continuously. 2. To know authorities requirement so no delay work due to non-compliance of legal requirement
4.	T	1. Site machineries	1. Essential to speed up the construction time such as mobilization of construction material and loading or unloading material
5	U	1. Team spirit and attitude	1. Very important from starting a project until completion and after sales service (defect liability)
6.	Y	1.Contractor capability to liaison with authorities for timely CF approval 2. Contractor level of service during Defect liability period (DLP)	1. Crucial to make sure timely approval of CF building. e.g. JBA, TNB Telekom and IWK 2. Contractor level of service to make sure all complaints from client are attended to expeditious manner "customer satisfaction is the ultimate goal "
7.	AH	1. Client satisfaction	1. The end product inevitably satisfies the client in all aspects.

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Identifying the criteria as well as to know the level of importance for each performance criteria is important to achieve the most favorable and desired outcome for each party. This research has reached it objective which to provide level of importance for contractor performance criteria in construction project within client perspective. The results will directly helps the client in current practice to ensure success in construction project as it provide better understanding on the most important criteria which should be applied by their contractor during construction stage. This finding would also directly help the contractor to be attentive and focus for every criteria that emphasized by the client. For contractor to gain client's satisfaction is vital as it would help them to gain more future project from the same client.

The challenge of this report is to identify the criteria which used in current practice to measure the contractor performance in construction project. The finding would change if it were to consider the view from the public sector which very is emphasized more on cost of the project as well as the project management approach to construction project. It is hoped that by this findings will give benefits to all levels of professional levels related to this field and to the societies as well.

5.2 Recommendation

For future works, the main aim is to come out with the standard guideline of contractor performance criteria within client perspective. Every criteria to provide more detail clarification on it significant and correct way to apply or implement during the construction stage. The scope and framework for every criteria should also be established to ensure efficiencies and effectiveness to the client as well as the contractor.

REFERENCES

1. Love,E.D & Holt.D, (2000), "Construction Business Performance Measurement: the SPM alternative".
   Journal of Business Process Management, 6: 408-416

2. Chan,P.C & Chan,P.L, (2004), "Key Performance Indicators for Measuring Construction Success",
   Journal of Benchmarking-Bradford, 2: 203-221

3. Rashid ,Taib, (2006) "Effect of Procurement System on the performance of construction project"

4. Love,E.D & Holt.D, "Construction Business Performance Measurement: The SPM alternative".

5. Othman,M.R. "Forging Main and Sub-Contractor Relationship for Successful projects"

6. Kemp.S, 2004 "A Self-teaching Guide", Project Management Demystified, McGraw.Hill.

7. Cowie, A.P ,1990, Oxford Advanced Learner's Dictionary of Current English, 4th ed. Oxford University Press, Oxford.

8. Kerzner.H, 1997, "Successful Practice in High Performance Organization", In Search of Excellence in Project Management, ITP.

9. Kumaraswamy, MM and Thorpe,A (1996), " Systematic Construction Project Evaluation s", *Journal of management in engineering*, 12:34-9

10. Compilation of Company 2007/2008, "Rehda Directory 2007/2008", Rehda

11. Compilation of Company 2004/2005, "Rehda Directory 2007/2008", Rehda

12. Al Hammad, A.M. and Assaf, S (1996), Assessment of Work Performance of Maintenance Contractors in Saudi Arabia. *Journal of Management in Engineering* 12(2): 44-49.

13. Ismail,M., Zin, R.M., Ismail, M.A., Yatim, J.M., and Omar, W. (2008), Awareness among Professional in Malaysian Construction Industries on Reinforcement Corrosion Prevention and Protection. *Malaysian Journal of Civil Engineering* 20(1): 200-210.

14. Abd.Majid, M.Z. and McCaffer, R. (1997) Assessment of Work Performance of Maintenance Contractors in Saudi Arabia, *Journal of Management in Engineering* 13 (9): 91-91

15. Elhag, T.M.S and Boussabaine, A.H. (1999) Evaluation of Construction Cost and Time Attributes. *15th ARCOM Conference*. Liverpool, John Moore University, Sept. 15-17: 473-480.

16. Ballal, T.M. (2000) *The Use of Artificial Neural Network for Modeling Build ability in Preliminary Structural Design*. Ph.D. Thesis, Loughborough University of Technology. 2000.

17. Idrus, A and Newman, J.B. (2002) Construction Related Factors Influencing The Choice of Concrete Floor System. *Construction Management and Economics* 20: 13-19.

18. Al Hammad, A.M. (2000) Common Interface Problems among Various Construction Parties. *Journal Performance Construction Facilities* 4(2): 71-74.

Appendices

Appendix A: Pilot Survey Questionnaire

SURVEY QUESTIONNAIRE

Evaluation of Construction Project Performance Criteria

Successful project performance helps to develop a good delivery product to the customers. A good management system comes with good planning, execution, monitoring and control processes. It is vital and necessary for the success of any construction business.

There are many criteria are used to measure project performance in construction industry. Currently there is no standard approach to evaluate construction project as project success means different things to different people. Therefore this research seeks to find out the criteria that the client used in current practice to measure the project performance The questionnaire below is divided into 4 sections which are section A, B, C and D. Please answer the questionnaire by referring to every section's instructions.

Section A: General / Background Information

Respondent can tick more than one for each [ ] provided or fill in the blanks.

I. Company Information:

1. Name of Company: _____

2. Type of business :
   [ ] Property developer (residential) [ ] Property developer (commercial)
   [ ] Property developer (industrial) [ ] Property developer (infrastructure)
   [ ] Other: _____

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

4. 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. Please specify your designation with the company:
   [ ] Project Director [ ] Architect [ ] Project manager
   [ ] General Manager [ ] Engineer [ ] Other: _____

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

Section B: Project Performance Evaluation Criteria

Please give your opinion on the following matters below. Other factors which are not covered here can be added to the list and rated as before.

Note: 1. 1= least important; 2= less important; 3= important; 4= very important
5= Most important

No	Project performance criteria	Level of importance				
		1	2	3	4	5
1	Construction cost : • Project completion within budget					
	• Overall cost from rework/modification					
	• Maintenance					
	• Legal claim					
2	Construction time • Schedule met from start up phase to full production					
	• Speed of construction					
	• Time variation					
3	Quality of finished project (architectural quality e.g. visual appearance)					
4	Design meet specification (technical specification e.g. technical standard)					
5	Occupational Health & safety					
6	*Friendliness of environment*					
7	Level of technology					
8	Method of procurement					
9	Construction flexibility (ease of change during construction)					
10	Innovation					
11	Labour dependency (skilled and unskilled)					
12	Design and construction team (level of coordination with client e.g. team work and cooperation)					
13	Other:					
14	Other :					

Please feel free to brief comments on other criteria which are added to the list to evaluate project performance in construction project.

_____

_____

_____

Section C: Decision maker for project performance evaluation

1. Who normally evaluate project performance in your company?
   (You may select more than one)

No	Designation	Tick [√]
1	General Manager	
2	Project Director	
3	Project Manager	
4	Architect	
5	Engineer	
6	Others : _____	

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 13th October 2008.

Do you have any suggestions on how to improve this questionnaire? Please feel free to write it on the space below.

_____

_____

_____

_____

_____

_____

_____

_____

Appendix B: Respondent's Information for Pilot Survey

Internal Respondent

- **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 specialization: Highway and Transport Planning Engineering

2. Assoc. Prof. Dr.Narayanan Sambu Potty

Doctor of Philosophy, Building Technology and Construction Management Madras India

Master of Technology (Structural Engineering) NIT Calicut India,

Bachelor of Engineering, Kerala University, India

Area 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

Area of specialization: Sustainable Building and Construction, Green Building Assessment Tool and Rating

External Respondent

- Client

1. Saiful Bukhari

   Project Manager,

   KLCC Project Sdn Bhd

   Currently representative for KLCC for project in Universiti Teknologi PETRONAS

Appendix C: Questionnaire Cover Letter (First Phase Distribution)

To:

Date: 15th November 2008

Dear Sir/Madam,

Prioritizing Criteria to Measure Performance of Contractors in Construction Projects

We seek your help in a university research survey on criteria to measure performance of contractor in construction project within the construction industry in Malaysia.

Successful performance in a construction project helps to deliver a good product to the client. At present, there is no standard approach used by clients to evaluate project performance as project success carries different definitions to different management. Some used the traditional project performance measures of cost, quality and time while others used additional non-traditional measures such as the environment, health and safety, level of technology and contractor planning.

Therefore this research aims to find out the criteria used by clients in current practice to measure the performance of a construction project during construction as well as upon completion. This research hopes to be able to help contractors in identifying which criteria are given more emphasis and their importance from the client perspective, during the construction stage as well as upon completion of the project. For clients, the research would help them to understand which criteria, in their order of priority, should be given more attention that would lead to the successful completion of the project.

In relation to the above, we have devised a questionnaire which we would like you to complete and return and which will only take no more than 15 minutes of your time. With your cooperation, we should be able to collect as many data as possible regarding the criteria to measure performance of contractor in construction project.

It would help us very much if you could complete and return the questionnaire attached by 28th December 2008. As an enclosure, 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). Should you require any further information regarding this questionnaire, please do not hesitate to contact **Mohd Haq Bin Husin at 012-6553798** or email mohd_haq@mail.utp.edu.my.

We thank you in advance for your support.

Yours truly,

_____

(Assoc. Prof. Ir. Dr. Arazi Idrus)
Associate Professor/Research Cluster Leader
Civil Engineering Department,
Universiti Teknologi PETRONAS

cc: Assoc. Prof. Ir. Dr. Hj. Muhd Fadhil Nuruddin
Mohd Haq Bin Husin

Appendix D: Questionnaire Cover Letter (Second Phase Distribution)

To:

Date: 10th January 2009

Dear Sir/Madam,

Prioritizing Criteria to Measure Performance of Contractors in Construction Projects

We seek your help in a university research survey on criteria to measure performance of contractor in construction project within the construction industry in Malaysia.

Successful performance in a construction project helps to deliver a good product to the client. At present, there is no standard approach used by clients to evaluate project performance as project success carries different definitions to different management. Some used the traditional project performance measures of cost, quality and time while others used additional non-traditional measures such as the environment, health and safety, level of technology and contractor planning.

Therefore this research aims to find out the criteria used by clients in current practice to measure the performance of a construction project during construction as well as upon completion. This research hopes to be able to help contractors in identifying which criteria are given more emphasis and their importance from the client perspective, during the construction stage as well as upon completion of the project. For clients, the research would help them to understand which criteria, in their order of priority, should be given more attention that would lead to the successful completion of the project.

In relation to the above, we have devised a questionnaire which we would like you to complete and return and which will only take no more than 15 minutes of your time. With your cooperation, we should be able to collect as many data as possible regarding the criteria to measure performance of contractor in construction project.

It would help us very much if you could complete and return the questionnaire attached by 23rd February 2009. As an enclosure, 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). Should you require any further information regarding this questionnaire, please do not hesitate to contact **Mohd Haq Bin Husin at 012-6553798** or email mohd_haq@mail.utp.edu.my.

We thank you in advance for your support.

Yours truly,

_____

(Assoc. Prof. Ir. Dr. Arazi Idrus)
Associate Professor/Research Cluster Leader
Civil Engineering Department,
Universiti Teknologi PETRONAS

cc: Assoc. Prof. Ir. Dr. Hj. Muhd Fadhil Nuruddin
Mohd Haq Bin Husin

Appendix E : Questionnaire

SURVEY QUESTIONNAIRE

Prioritizing criteria to measure contractor performance in construction project

Successful performance in construction project helps to deliver a good project to the client. A good management system comes with good planning, execution, monitoring and control processes. This is vital and necessary for the success of any construction business.

There are many criteria used to measure performance in construction project. Currently there is no standard approach to evaluate the performance as project success carries different definition to different management. Therefore this research seeks to find out the criteria in current practice used by clients to measure the performance of contractor in construction project during construction and upon completion. The questionnaire below is divided into 5 sections; which are section A, B, C, D and E. Please answer the questionnaire by referring to every section's instructions.

Section A: General / Background Information

Respondent can tick more than one for each [ ] provided or fill in the blanks.

I. Company Information:

4. Name of Company: _____

5. Type of business :
   [ ] Developer for residential project [ ] Developer for commercial project
   [ ] Developer for industrial project [ ] Developer for infrastructure project
   [ ] Other: _____

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

4. 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

3. Please specify your designation with the company:
   [ ] Project Director [ ] Architect [ ] Project manager
   [ ] General Manager [ ] Engineer [ ] Other: _____

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

Section B: Criteria to measure contractor performance in construction project.

Please give your opinion of the following criteria by circling a number to the lickert scale below. *Other factors which are not listed here can be added to the list and rated as* following.

No	Criteria to measure performance in construction	Level of importance*				
1	**Construction cost :** (project completion within budget and overall cost from rework/ modification done by contractor)	I	2	3	4	5
2	**Construction time** (schedule met from start up phase to full production and speed of construction)	1	2	3	4	5
3	**Quality of finished project** (architectural quality e.g. visual appearance)	I	2	3	4	5
4	**Occupational Health & safety**	1	2	3	4	5
5	**Level of technology** (technology of system /equipment used by contractor to finish specific work)	1	2	3	4	5
6	**Environment friendliness** (environment management practice e.g. waste disposal and pollution)	1	2	3	4	5
7	**Construction flexibility** (ease of change during construction)	1	2	3	4	5
8	**Labour dependency** (skilled of labour)	1	2	3	4	5
9	**Quality of coordination by construction team** (e.g. with client)	1	2	3	4	5
10	**Contractor's project management** (e.g. usage of management technique, computer software and etc)	1	2	3	4	5
11	**Contractor's capacity of manpower** (e.g. total of worker)	1	2	3	4	5
12	Other:	1	2	3	4	5
13	Other :	1	2	3	4	5
14	Other :	1	2	3	4	5

Note: Level of Important*

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

Section : Other information

For respondents who have added additional criteria regarding criteria to measure contractor performance in item 12, 13 or 14 in **section B**, please explain each of those criteria below:

_____
_____
_____
_____
_____
_____

Section D: Decision maker for project performance evaluation

1. Who normally evaluate project performance in your company?
   (You may select more than one)

No	Designation	Tick [√]
1	Project Director	
2	General Manager	
3	Project Manager	
4	Architect	
5	Engineer	
6	Others : _____	

Section E: Feedback

3. How do you prefer to know the result of research?
   [ ] via email [ ] via phone [ ] no, thank you

4. Please provide information below to send the result of survey.
   [ ] My contact telephone number is _____ ext: _____

   [ ] My email address is _____

Thank you for your time and cooperation in completing this questionnaire. Your response will be used for research purpose only. It would be appreciated if you could return this questionnaire as soon as possible using the self-address enveloped; alternatively, you may send by fax to 05-3656716 with attention to Assoc.Prof.Ir.Dr.Arazi Idrus/Mohd Haq Husin.

Appendix F : Respondent's Company Information

No.	Symbols	Company name	State
1	A	Bertam Development sdn bhd	Selangor
2	B	Country Height Properties sdn bhd	Selangor
3	C	Kelana Property Development sdn bhd	Selangor
4	D	Tropicana Golf & County Resort Bhd	Selangor
5	E	Paramount Property Development sdn bhd	Selangor
6	F	3 Two Square Sdn Bhd	Selangor
7	G	Jabatan Kerja Raya Negeri Selangor	Selangor
8	H	D'TIARA Corp Sdn. Bhd.	Selangor
9	I	IJM Land Berhad	Penang
10	J	Abad Naluri sdn bhd	Penang
11	K	Masmayar Holding sdn bhd	Penang
12	L	Jelutong Development sdn bhd	Penang
13	M	Hunza Properties Berhad	Penang
14	N	Emas Jaya Properties sdn bhd	Johor
15	O	Plenitude Tebrau sdn bhd	Johor
16	P	*Daiman development Berhad*	*Johor*
17	Q	Hena Chin Development sdn. bhd	Johor
18	R	Nice Frontier sdn bhd	Johor
19	S	Suria Bistari Development sdn bhd	Johor
20	T	NKS Development Sdn Bhd	Melaka
21	U	Jayamuda Group Sdn Bhd	Melaka
22	V	Farmosa Tiara Sdn Bhd	Melaka
23	W	Bentuk Cemerlang Development Sdn Bhd	Melaka
24	X	Metacorp Properties Sdn Bhd	Melaka
25	Y	Sime Darby Property Berhad	Kuala Lumpur
26	Z	IJM Land Berhad	Kuala Lumpur
27	AA	DC Avenue Sdn Bhd	Kuala Lumpur
28	AB	Zone Victory Sdn Bhd	Pahang
29	AC	Segi Raya (M) Sdn Bhd	Pahang
30	AD	Pasdec Corporation Sdn Bhd	Pahang
31	AE	Jabatan Kerja Raya Negeri Sembilan	Negeri Sembilan
32	AF	Matrix Concepts Sdn Bhd	Negeri Sembilan
33	AG	Trek Development Sdn Bhd	Terengganu
34	AH	GPQ Sdn Bhd	Terengganu
35	AI	Seri Iskandar Development Corporation Sdn Bhd	Perak
36	AJ	Total Investment Sdn Bhd	Perak
37	AK	Binaraya PKINK Sdn Bhd	Kelantan
38	AL	Darulaman Realty Sdn Bhd	Kedah