

**SELECTION OF THE BEST CONSULTANT
PROJECT USING
ANALYTIC HIERARCHY PROCESS**

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ABSTRAK

Pemilihan Perunding ialah masalah kompleks yang melibatkan pelbagai kualitatif dan kuantitatif kriteria. Dalam kajian ini, model pemilihan perunding berasaskan AHP digunakan untuk membangun dan membantu membuat keputusan untuk menyelesaikan masalah pemilihan perunding dalam memilih kombinasi kriteria perunding yang paling baik. The Analytic Hierarchy Process (AHP) adalah satu kaedah keputusan ditubuhkan untuk mensintesis pertimbangan dan memilih alternatif terbaik. Apabila objektif dan skop kajian yang ditetapkan, maka pengumpulan data dibuat melalui dua kaedah iaitu melalui kajian sastera dan kajian soal selidik. Maklumat yang diperolehi daripada soal selidik diterjemahkan ke dalam bentuk yang lebih mudah dan dianalisis dengan menggunakan perisian Expert Choice. Data-data ini dikira dengan menggunakan perbandingan dari segi pasangan. Ia dianggap secukupnya konsisten jika nisbah konsisten yang berkaitan (CR) adalah kurang daripada 0.1 (<10%). Nilai kurang daripada 0.1 adalah baik, bagaimanapun, ambang 0.1 dianggap sebagai amalan biasa. Hasil kajian ini menggambarkan bahawa terdapat persamaan dan ketidaksamaan di antara persepsi responden dengan latar belakang yang berbeza

Kata-kata berkaitan | Perunding, membuat keputusan, pertimbangan, Analytic Hierarchy Process (AHP), perisian Expert Choice, perbandingan dari segi pasangan, nisbah konsisten (CR), penilaian, pemilihan.

ABSTRACT

Consultant selection is a complex problem involving qualitative and quantitative multi criteria. In this study, an AHP-based consultant selection model is applied to develop and assist decision making to resolve the consultant selection problem in choosing the most favourable consultant's criteria combination. The Analytic Hierarchy Process (AHP) is an established decision method used to synthesize judgements and select the best alternative. When the objectives and scopes of study are set, then the data collection are made through two methods which are through literature review and a questionnaire survey. Information obtained from the questionnaire is interpreted into a simpler form and analysed by using the Expert Choice software. These data calculated by using Pairwise comparison. It is considered to be adequately consistent if the corresponding consistency ratio (CR) is less than 0.1 (<10%). A value less than 0.1 is good, however, the threshold of 0.1 is considered as the rule of thumb. The results of the survey depicts that there are similarities and dissimilarities between perceptions of respondents with a different background.

KEYWORDS | *Consultant, decision making, judgements, Analytic Hierarchy Process (AHP), Expert Choice software, Pairwise comparison, consistency ratio(CR), ratings, selection.*

TABLE OF CONTENT

DECLARATION	
TITLE PAGE	
ACKNOWLEDGEMENTS	1
ABSTRAK	2
ABSTRACT	3
TABLE OF CONTENT	4
LIST OF TABLES	8
LIST OF FIGURES	9
LIST OF SYMBOLS	11
CHAPTER 1 INTRODUCTION	12
1.1 Introduction	12
1.2 Background of Study	12-14
1.3 Problem Statement	15-16
1.4 Research Objective	17
1.5 Research Question	17
1.6 Scope of Research	17-18
1.7 Significance of Study	18
1.8 Expected Result	18
CHAPTER 2 LITERATURE REVIEW	19
2.1 Introduction	19
2.2 Consultants	19-20
2.3 Categories of Consultants	21

2.3.1	Consultant in Private Sector	21
2.3.2	Consultant in Government Sector	22
2.4	Issues Involving Consultants	22-27
2.5	General Procedure for Selecting and Engaging Consultants	28-30
2.5.1	Quality and Cost-Based Selection (QCBS)	31
2.5.2	Quality-Based Selection (QBS)	31
2.5.3	Fixed Budget Selection (FBS)	31-32
2.5.4	Least Cost Selection (LCS)	32
2.5.5	Consultant's Qualification Selection (CQS)	32
2.5.6	Single Source Selection	32-33
2.6	Consultant Registration Requirement & Procedure with CIDB	34
2.7	Procedure in Selecting Consultant with CIDB	34-35
2.8	Qualified Consultants	36-37
2.9	Criteria of Consultant	37
2.10	Relevant Previous Research	38-39
2.10.1	Quality	39-40
2.10.2	Cost	40-41
2.10.3	Time	41-42
2.11	Among Project Teams, There Are The Consultant	42-43
CHAPTER 3 METHODOLOGY		444
3.1	Introduction	444
3.2	Study Design	444-45
3.3	Data Sources	446
3.4	Analytic Hierarchy Process	446

3.4.1	Theoretical Basis	47-48
3.4.2	AHP Methodology	49-54
3.5	Data Collection	55
3.5.1	Questionnaire Design	55-59
3.6	Expert Choice Software	60
3.7	Data Analysis	61-62
 CHAPTER 4 RESULTS AND DISCUSSION		63
4.1	Introduction	63
4.2	Result of Questionnaire Analysis	63
4.2.1	Population Characteristics	63
4.2.1.1	Gender of Respondents	64
4.2.1.2	Experience of Respondents	64
4.2.1.3	Profession of Respondents	65
4.2.1.4	Company/Organization of Respondents	65
4.2.2	Comparison Between Two Factors	66-72
4.3	Solution with Expert Choice	73
4.3.1	Inconsistency	74-75
4.3.2	Synthesis (Obtaining the Result)	75-77
4.3.3	Sensitivity Analyses (Graph)	77-78
4.3.3.1	Dynamic Sensitivity Graph	79
4.3.3.2	Performance Sensitivity Graph	80
4.3.3.3	Gradient Sensitivity Graph	81
4.3.3.4	Head-to-Head Graph	82

CHAPTER 5 CONCLUSION AND RECOMMENDATION	83
5.1 Introduction	83
5.2 Summary of Results	883-85
5.2.1 Decision Support	86-87
5.2.2 Problems During Research	87
5.3 Conclusion	88-89
5.4 Recommendation	90
REFERENCES	91-93
APPENDIX A SAMPLE APPENDIX 1	94

LIST OF TABLES

Table 2.1	Summary of issues by authors	25
Table 2.2	Newspaper report on consultant's problems	26-27
Table 3.1	Pairwise compare the objectives and sub-objectives	53
Table 3.2	Rating scale of pair-wise comparison	58

LIST OF FIGURES

Figure 2.1	Relationship between time, cost and project quality	39
Figure 3.1	Quantitative research approach	45
Figure 3.2	Proposed AHP for consultant's selection	49
Figure 3.3	AHP in decision making	50
Figure 3.4	General AHP model	51
Figure 3.5	Final hierarchical structure	52
Figure 4.2.1.1	Pie chart for the respondent's age	64
Figure 4.2.1.2.1	Bar chart for the experience of works of respondent	64
Figure 4.2.1.3.1	Bar chart of the profession of respondents	65
Figure 4.2.1.4.1	Pie chart of the company/organization of the respondents	65
Figure 4.2.2.1	Bar chart of comparison between financial stability & past experience	66
Figure 4.2.2.2	Bar chart of comparison between financial stability & past performance	66
Figure 4.2.2.3	Bar chart of comparison between financial stability & references	67
Figure 4.2.2.4	Bar chart of comparison between financial stability & current workload	67
Figure 4.2.2.5	Bar chart of comparison between financial stability & safety performance	68
Figure 4.2.2.6	Bar chart of comparison between past experience & past performance	68
Figure 4.2.2.7	Bar chart of comparison between past experience & references	69
Figure 4.2.2.8	Bar chart of comparison between past experience & current workload	69
Figure 4.2.2.9	Bar chart of comparison between past experience & safety performance	70
Figure 4.2.2.10	Bar chart of comparison between past performance & references	70
Figure 4.2.2.11	Bar chart of comparison between references & current workload	71
Figure 4.2.2.12	Bar chart of comparison between references & safety performance	71
Figure 4.2.2.13	Bar chart of comparison between past performance & current workload	72
Figure 4.2.2.14	Bar chart of comparison between past performance & safety performance	72
Figure 4.3.1	Tree structure of consultant selection problem-solved	73
Figure 4.3.1.1	Inconsistency check	74
Figure 4.3.2.1	Results view	75

Figure 4.3.2.2 Subcriteria rating	76
Figure 4.3.3.1.1 Dynamic sensitivity graph	79
Figure 4.3.3.2.1 Performance sensitivity graph	80
Figure 4.3.3.3.1.1 Gradient sensitivity graph	81
Figure 4.3.3.4.1 Head-to-head graph	82
Figure 5.2.1 Highest priority value	84

LIST OF SYMBOLS

AHP	Analytic Hierarchy Process
ADB	Asian Development Bank
CIDB	Construction Industry Development Board
CSRN	Consulting Services Recruitment Notice
EOI	Expression of Interest
PAI	Project Administration Instructions
RFP	Request for Proposal
TOR	Term of Reference

CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, include the background of study, problem statement, research objective, research question, scope of research, significance of research and operational of research.

1.2 Background of Study

The success of large construction projects, especially infrastructure projects, depends on many elements such as budget, quality, and rate of progress. To ensure success, all parties in project need to have a really close cooperation via co-ordination and mutual assistance (Tran Thanh Hai, Long Le Hoai and Young Dai Lee, 2015). A good teamwork amongst the client, consultant and contractor to complete construction projects successfully are being experienced and enjoyed in Malaysia construction industry to transform Malaysia into developed world by 2020 (Abdullah *et. al.*, 2004).

Consulting firms live their day after day routine through acquiring, assigning and carrying out projects through their teams. It also well-known that usually consulting firms have more extensive and challenging recruitment processes in order to select the future consultants for their project teams. Several ways of assuring that the job applicant has what it takes to develop him/herself in this environment have been developed such as the well known assessments, that are a type of workshops where companies test the theoretical knowledge of the applicants, as well as a practical exercises with the purpose of analyzing their personality and behavior in action (Isaac *et al.*, 2007).

A consultant (from the Latin *consultare* means "to discuss" from which we also derive words such as *consul* and *counsel*) is a professional who provides advice in a particular area of expertise such as management, accountancy, the environment, entertainment, technology, law (tax law, in particular), human resources, marketing, medicine, finance, life management, economics, public affairs, communication, engineering, sound system design, graphic design, or waste management. A consultant is usually an expert or a professional in a specific field and has a wide knowledge of the subject matter. A consultant usually works for a consultancy firm or is self-employed, and engages with multiple and changing clients. Thus, clients have access to deeper levels of expertise than would be feasible for them to retain in-house, and may purchase only as much service from the outside consultant as desired. It is generally accepted good corporate governance to hire consultants as a check to the Principal-Agent problem (<http://en.wikipedia.org/wiki/Consultant>).

The consultants can be the design consultants, cost and contract consultants, land surveyors, etc. The design consultants usually comprises of the architect, civil and structural engineers, mechanical and electrical engineers and other specialist designers, such as interior designers, landscape architects, lighting specialists, town planners, etc. Design consultants as a designer of the project in the area he/she is specialized in. They also as a facilitator of client's need and project brief. Besides, they as an advisor to the client on matters relating to design and on statutory requirements and by-laws relating to the project. The cost and contract consultant can be the quantity surveyors. The quantity surveyors usually act as the cost and contract consultant for a project.

As Clark Wilson (2008) notes in his article, the role of the consultant during construction is to administer the contract as being described in the Contract Documents. Consultants play a major role in the supply of new and fashionable organization concepts on the market for management solutions. In this study based on the drawing on the work of Schön, "consultants do neither regard the construction of problems and solutions as predetermined by these concepts nor as an entirely unstructured and open-ended effort" (Heusinkveld.S and Visschev.K, 2006).

Selecting right consultant for right project is the most crucial challenge for any construction owner (Tran Thanh Hai et al, 2015). It is vital for the client/owner to select the best consultant in their project. Hence, client satisfaction towards consultant's work is very important in order to be able to survive in the marketplace. Based on the research findings, it costs five times more expensive to develop a new construction client than maintaining the existing one. It is a fundamental issues for construction participants to be alert as they must constantly seek to improve their performance if they want to be remain to survive in nowadays global marketplace (Cheng.J et al, 2005).

Successful project is lead by the best selection of suitable, qualified project team, and experience project manager with good leadership skills. The criteria are most often related to the candidate's personal skills and experience in handling similar or multi projects. This study aims in providing an effective selection and recruitment of consultants on different projects for the contribution success of a project in terms of time, cost and quality (Natasa.M, 2014). It has been acknowledge that the selection of the consultants for construction projects should be on the basis of a set of multiple decision criteria that is both price and non-price related (San Cristobal, 2012; Singh and Tiong, 2005; Fong and Choi, 2000).

Consultant selection can be regarded as a complicated nonlinear classification problem, in which decisions are made according to the qualification criteria, consultant's attributes and decision makers' judgment. Furthermore, consultant selection is a multi-criteria decision problem that is, in essence, largely dependent on the uncertainty and vagueness in the nature of construction projects and subjective judgments of the decision makers (Singh and Tiong, 2005). Russell and Skibniewski (1988) also pointed out that consultant selection is a decision-making process that involves the development and consideration of a wide range of necessary and sufficient decision criteria as well as the participation of many decision-making parties.

The most important issue in the process of consultant selection is to develop an effective method to select the best one (S. Mahmoud et al., 2009). As mentioned above, this problem is a group decision making. Hence, in this research all issues and problems associated to the consultant will be discussed and the best criteria for selecting consultants will be weighted by using Analytical Hierarchy Process (AHP) method.

1.3 Problem statement

According to a study by Kabir.G et al., (2014), evaluation of the proper and appropriate consultants can play an important role in successful total quality management (TQM) program implementation and helps the organizations to attain competitive advantage. In general, many conflicting factors affect the appropriate consultant selection problem which adheres to uncertain and imprecise data.

In implementing the Analytical Hierarchy Process (AHP) method, there also uncertainty in making decision process. The model have their drawback which tend to ignore vagueness, fuzziness, and human behavior inherent in the nature of construction projects (Li and Nie 2007) such as, firstly, it does not take into account the imprecise criteria; secondly, the decision is made by a single person rather than multiple decision makers; and thirdly, it is used crisp value which is inadequate in the uncertain environments.

Involving several people from functional areas in the selection process increased the complexity of this process. MCDM refers to making preference decision (e.g. evaluation, prioritization, and selection) over the available alternatives that are characterized by multiple, usually conflicting criteria (Kabir & Hasin, 2012; Padhi & Mohapatra, 2009). Real-life application of MCDM methods require the processing of imprecise, uncertain, qualitative or vague data (Chu, 2011; Omar, Trigunarsyah, & Wong, 2009).

A consultant selection problem is complex and difficult since there exist: multi-criteria both qualitative and quantitative in nature; multiple decision makers; uncertainty and risk; and incomplete information, imprecise data, and vagueness surrounding the decision making. Thus, according to Hipel et al. (1993), consultant selection is a multiple participant multiple criteria decision making process. This process is a complex multi-

criteria decision making (MCDM) problem in which involves much inexact, uncertain, incomplete, or qualitative information that is very difficult to measure, especially, the judgments and preference of decision makers. The conventional AHP approach may not fully reflect a style of human thinking because the decision makers (DM) usually feel more confident to give interval judgments rather than expressing their judgments in the form of single numeric values (crisp value) (Trivedi et al., 2011).

Summarizing, the aim of this research is to identify the criterias that construction industries looking for towards consulting firm in order to incorporate individuals into their project teams, either when attracting talent from the outside or from the inside when carrying out the team building process. Also to formulate a consultant selection decision support tool, which would determine influential and conflicting criteria and sub-criteria, and evaluate appropriate consultant

1.4 Research Objective

The objective of the research are follows:

- i. To identify the criteria in selecting consultant of the project.
- ii. To develop weighted criteria using AHP method

1.5 Research Question

The question of the research is as following :

- i. What is the conflict among the parties involved in the project?
- ii. Which is the most criteria being weighted on selecting consultants?
- iii. What is the issues of affecting the selection process?

1.6 Scope of Research

This study focuses on the best selection of criteria for consultant of the project. The researcher also want to compare the method used in selecting consultant either using traditional method or worldwide method, Analytic Hierarchy Process (AHP).

The research area is involving at whole state in Malaysia including Kuantan, Pahang. The target respondent in the research are the client, the company that register in CIDB and the construction key players including contractor who are the experienced in handling problems and issues related.

The involvement of consultant in the construction phases is crucial as any issues regarding delay in certification by consultant may cause late or non-payment by employer.

Delay in certification means the delay in approving the application for payment claim by contractor.

The reason why researcher choose Malaysia is that to know how is the response among different parties either in public or private sectors regarding the criteria in selecting the best consultants in handling their projects. From that, it can give potential to improve the productivity or quality of design project in construction and give the good feedback for the image company.

1.7 Significance of Study

To improve the productivity of service between the parties involved in the construction industry. Due to the many issues arised as the engineers and consultancy firms being blamed if any failure building occurs, this study hope can give clear understanding about the responsibilities of each key players. Other than that, the researcher also wants to find out how by using AHP method can give benefit to the company. From that, the expert review can be ranking out to idealise the consistency of decision makers in the process of comparing criteria hierarchy.

1.8 Expected Result

The expected result when the research is finish is the researcher hope that the company and key players can gain knowledge about the scoring score in determining the weights of attributes and ranking alternatively. From that, the productivity, skill and other related would increase and hope give the good potential and image to company. The results can be a starting point for different stakeholders such as consulting firms, employees, job applicants, the consulting industry itself, etc in order to benchmark the criterias-checklist between consulting firms.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to provide an overview of published research works related to criteria in selecting consultant of the project and the consulting sector. It will also discuss about the issues and problem faced by the consultants. The issues and problems covered the cases occurred in Malaysia.

2.2 Consultants

Consulting is an industry that has been growing rapidly in the last decades due to the enterprise focus on understanding the market and the organization in order to become competitive and ensure their survival and/or success in the marketplace (Isaac L.A et al., 2007).

In Act 520 , Section (19) of the Construction Industry Development Board Act mention that *“No person shall offer his service as a Consultant or Contractor unless he is registered under the Construction Industry Development Board Act”* . According to Act 520, Section (2) of the Construction Industry Development Board Act, the definition of a consultant is a Firm that provides consultancy services in the construction industry including a Foreign Consultant. Besides, the clause of 2.1.4.1 in Consulting Services Manual said that the consulting services is the services of an intellectual and advisory

nature provided by consultants using their professional skills to study, design and organize specific projects, advise clients and transfer knowledge (The World Bank, Washington USA).

Based on “*Manual Perolehan Perkhidmatan Perunding Edisi 2011 (Pindaan Kedua)*” from Clause 2.1.2 said that “*Perkhidmatan perunding adalah melibatkan perkhidmatan perundingan bagi pelaksanaan projek pembangunan fizikal atau yang berbentuk kajian/penyelidikan*”. In Clause 2.1.3 took from the Manual on the Use of Consultants In Developing Countries produced by United Nations Industrial Development Organization, Vienna said that “Consultants are professional problem-solvers, whose expert knowledge may cover a number of traditional professional fields, and who are particularly qualified to undertake an independent and unbiased study of a given problem and reach a rational solution. The value of consultant lies in his training and previous experience in the solution of related problems, and in his ability to select the course of action which, in his expert opinion, should be implemented”.

Consultants should have the following points to avoid any delay issues which can affect the performance of entire project. Firstly, reviewing and approving design documents. Any delay caused by the consultant engineer in checking, reviewing and approving the design submittals prior to construction phase, could delay the progress of the work. Next is the inflexibility. Consultants should be flexible in evaluating contractor works. Compromising between the cost and high quality should be considered. Furthermore, avoid making mistakes and discrepancies in design documents and produce the design documents on time.

Consultants services as being described in the Guidelines on The Use of Consultants by Asian Development Bank and Its Borrowers (March, 2013) are generally of an intellectual and advisory nature covering a wide range of sectors, both public and private, and a wide range of services¹⁰ at all stages of the project cycle. These guidelines do not normally apply to other types of services in which the physical aspects of the activity predominate (e.g., construction of works).

2.3 Categories of consultants

Consultants can be either in government or private sectors. Government sector can be Public Works Department or Jabatan Kerja Raya (JKR), Municipal Council or Majlis Perbandaran, Malaysian Highway Authority or Lembaga Lebuhraya Malaysia and etc. Private sector is like GTP Consultants Sdn. Bhd. , PDC Consultancy Sdn. Bhd. ,PDC Nusabina Sdn. Bhd and etc.

2.3.1 Consultant in private sector (Nongovernment Organizations , NGOs)

Private sector jobs are those found with employers who are non-government agencies. These can include both individual business owners and other forms of company organization such as corporations or limited partnerships (Jared Lewis, 2010). The benefits that can be earned in private sector are salary factor, advancement opportunities and cutting-edge projects.

In term of salary factor, it is more higher than work in public sector. The Washington Post presents statistics from the National Treasury Employees Union according to which, in some cases, employees working in the federal sector receive remuneration up to 26% lower than what they could receive in the private sector for a similar role. Next, the jobs in the private sectors provide more growth opportunities. Time taken for salary increment approvals and to reach the upper hierarchy is less in private sector jobs as they do not tied with federal or state regulations. Lastly the cutting-edge projects as they have lesser bureaucratic protocols, obtaining funding approval for new projects and corresponding infrastructure become more easier (David Stewart, 2017).

2.3.2 Consultant in government sector

Public sector is any organisation run by the government and funded by tax-payers money that can be classified as public sector. This includes local and national councils, hospitals and clinics, emergency services, schools, and much more. The main benefits working in public sector are long-term, stable work with a high level of job satisfaction and a pension scheme (Ben Davies, 2017).

In term of job security, the public sector is relatively stable while the profit-based companies are prone to closure, public sector organisations have the stability of government-backing. Next, is the working atmosphere. The public sector is less demanding compared to the private sector and flexible working hours. Usually based around a core time of hours starting at 8 a.m and end up at 5 p.m depends on the current workload that they handle. Lastly, the most attractions in public sector is the pension scheme. According to the Institute of Fiscal Studies, benefits in the public sector are 14% higher than comparable private sector benefits on average (Ben Davies, 2017).

2.4 Issues involving consultants

Malaysia has a large construction industry of over RM 102.2 billion. The highest percentage share was contributed by construction of non-residential buildings which recorded 32.6%. This was followed by civil engineering sub-sector at 30.6%, 29.7% in residential buildings, and special trades at 5.1% . From the survey, Selangor recorded the highest value of construction work done at 24.5% among the states, followed up by Johor at 16.5%, Kuala Lumpur at 15.8%, Sarawak at 8.6% and Penang at 6.4% . The contribution of these five states accounted for 71.8% of total value of construction work in Malaysia (Department of Statistics Malaysia, 2014). However, the industry is always facing chronic problems such as time overrun, cost overrun, poor safety and poor quality (Nahmens and Ikuma, 2009).

The consultants have many problems, which involves with the peoples such as contractor, supplier, architect, and others. One of the problems faced is time overrun. Based on the findings research, thirty (30) large construction projects in Malaysia were identified facing time overrun during construction. Out of 30 projects, 17 (56.7%) projects were caused by 1-100 days time overrun, 5 (16.7%) projects in between 101-200 days , 5 (16.7%) projects between 201-300 days whereas 3 (10%) projects were delayed for time period above 300 days. It is a big issues related to project management consultants (PMC) as surveys was being conducted among them (Abdul.I, 2012). Time overrun can be due to the changes of design schedule and government restraints.

Other issues related is construction delays. By the perspective of the clients, eventhough the construction projects were planned and organized perfectly, it still run the risk of delays. Although many tools such as computer modelling technologies, Building Information Modelling(BIM) which created to assist the process of site management , delays keep occuring in construction projects (Gluszak.M and Lesniak.A, 2015). In addition, insufficient cost also may contribute to the construction delay due to the inflation and capital equipmet. From Wikipedia sources, *inflation* is a sustained increase in the general price level of goods and services in an economy over a period of time.

Next, current technologies have allowed the Building Information Modelling(BIM) process to replace many of the time tested design methods of the past. But it also come new risks which require recognition by the acoustical consultant to ensure our evolution to meet the new paradigm of the current design environment (Philipp.N, 2013).

Building failure is not a rare issues as it can occur due to the type of materials used, designs, environmental conditions, method of construction and which the building is put of the use to. More on the time initiated of building failure is when material stressed to its strength limit and fails to withstand the stresses imposed upon it. The failure will expose itself by crack or breaking, occur permanently deformed, becoming bending and more seriously may collapse (Wikipedia 2012). As an example, Sultan Mizan Zainal Abidin Stadium. It is a new multi-purpose stadium in Kuala Terengganu, Malaysia which was constructed by South Korean construction firm. But, on July 3, 2009, a major part of the roof construction was collapsed. The major cause such stadium collapsed has been identified due to failure of design and materials used, also rush development and under-

supervised. This is definitely the fault of consultants as they do not consider the wind load while designing it and lack of supervision throughout the designing and construction process.

The roof structure design was also changed to the light frame steel structure very late in the design meaning the time spent designing it was questionable at best. Prior to the collapse problems with the structure of the roof had already begun. Damage in the frames of the roof along with bang like noises coming from the roof had been observed. Besides that, the long gap between the last concrete stump and the concrete buttress was about 30 m wide. There was not enough support for the large magnitude of force from its own weight. In addition to that, buckling occurred in the inclined members (tube), a sign of load exceeding buckling capacity. Pullout of threaded screws out of the steel ball joints can also be observed after the incident. This means that they have been subjected to load beyond their capacities resulting in failure (Fahad Ali Gull and Chauhdry Mehr Ali, 2016). We can conclude that bad design criteria may lead to the bad design quality.

After all issues gathered from current and available literature, Table 2.1 summarizes all classifications of skills already presented by different authors.

Author(s)	Issues
Nahmens and Ikuma (2009)	Time overrun Cost overrun Poor safety Poor quality
Abdul.I (2012)	Time overrun by Project Management Consultants (PMC)
Philipp.N (2013)	Time overrun due to the recognition needed by the acoustical consultant
Gluszak.M and Lesniak.A (2015)	Construction delay although by using Building Information Modelling (BIM)
Fahad Ali Gull (2016) Chaundry Mehr Ali (2016)	Building roof failure

Table 2.1: Summary of issues by authors

For this research, 8 newspaper reports and other public sources are referred from 2004 up to 2017 which are deemed relevant to this study. These reports are presented in Table 2.2.

	References	Descriptions
1	The Sun Daily(2004)	Datuk Seri S.Samy Vellu admitted that the reasons for the cracks in the Middle Ring Road 2 (MRR2) is due to the defective design.
2	The Star(2004)	Datuk Seri S.Samy Vellu stated that the Government would seek views from an independent consultant to carry out a precise technological analysis.
3	Regina Lee(2007) New Straits Times	Datuk Moehamad Izat Emir blamed consultants for delays and cost overruns in government projects as he claimed that the consultants applied “suspicious standards” and favoured suppliers with whom they “are in cahoots with”.
4	Malaysian Kini(2010)	According to Datuk Shaziman Abu Mansor, the deficiencies in design factor, incomplete construction of roof and less inspection works lead to the roof collapse.
5	Lim Wing Hooi(2014) Star Online	Lawrence D.Miles developed a systematic methodology that reduced unnecessary costs by identifying and separating costs that had no impact on customers. Value engineering (VE) is a powerful approach as perunding ZNA (Asia) Sdn Bhd uses it for civil, structural and geotechnical consultancy works as well as reduced construction costs as much as 20%.
6	Ainol Amriz Ismail(2015) Utusan Online	Datuk Seri Mohamad Hasan stated that the delay is caused by the original design project that is not convenient to support the load. The initiative have been taken as the previous consultant have been stopped work and the new consultant being hire to handle the problem.

7	M.Hafidz Mahpar(2016) Star Online	According to MAHB, it had issued notices of arbitration to KLIA Consulting Services Sdn Bhd (KLIACS), Straits Consulting Engineers Sdn Bhd (SCE) and HSS Engineering Bhd's associate HSS Integrated Sdn Bhd (HSSI) regarding their alleged “breaches of obligations”.
8	Ermizi Muhamad(2017) Selangor Kini	Majlis Perbandaran Ampang Jaya (MPAJ) has consult a consultant to come up with a plan or initiative to solve the problem of flash flood in the potential area.

Table 2.2: Newspaper report on consultants' problems

2.5 General Procedure for selecting and engaging consultants

There are eleven procedures for selecting and engaging consultants as being mentioned in Project Administration Instructions No. 2.03 (PAI 2.03) by Asian Development Bank (ADB) and Executing Agencies (E.As). The procedures are

A) Advertising Consulting Services Recruitment Notice (CSRN)

CSRN is posted in the “Business Opportunities” section of ADB's website. The information included in the CSRN are Term of Reference (TOR), Cost estimate, Selection method, Time frame for recruitment as for firms, the duration is 30 days or 15 days minimum, otherwise for individual consultant, the duration is 7 days.

B) Expression of Interest (EOI)

It differs between individual consultant and firms. Individual offer their qualifications and experiences while firms / joint ventures highlight their most recent projects and geographical experiences and management capacity.

C) Preparing Technical Proposal Evaluation Criteria

The criteria is evaluate such as for

Qualification and general experience : 100 - 200 points (10 % – 20 %)

Project-related experience : 60% - 80%

Overseas / country experience : 10% - 20%

D) Preparing Request for Proposal (RFP)

RFP contains the shortlisted firm's names, selection method and type of technical proposal for the selection, TOR, evaluation criteria for technical proposals, budget for assignment, specific information data required in RFP datasheet, and letter of invitation.

E) Clarifying and Amending the RFP

Any amendments on RFP must be noticed to all shortlisted firms. The recruiting party also must record all clarifications / amendments that have been issued and informs to all proposal evaluators.

F) Acquiring and Rejecting Proposals

The shortlisted firms should submit proposals to the address provided in the RFP.

G) Evaluating Technical Proposals

Five tools are used during technical evaluation such as TOR, narrative evaluation criteria, personnel evaluation sheet, summary evaluation sheet and scoring guide. The minimum passing technical score as specified in RHP is 750 / 1000 points.

H) Requesting and Evaluating Financial Proposals (depends on the selection method)

I) Determining the Final Ranking of Proposals (depends on the selection method)

J) Negotiating Contracts

This step is where the recruiting party invites all the firm with the highest overall ranking.

This contract covers :

- Reconfirming / Replacing Personnel
- Identifying Issues (if has any correction during evaluation process)
- Documentation
- Contract Negotiation Agenda
- Cancelling Contract Negotiation

A) Contract Award

If the negotiation succeeds, the selected firm signs the contract with the recruiting party.

2.5.1 Selection Methods in Recruitment of Consulting Firm

The selection methods as being implemented by Asian Development Bank (ADB), (March, 2013) can be categorised into different selection.

2.5.1.1 Quality- and Cost-Based Selection (QCBS)

QCBS is based on the quality of the technical proposal and the cost of the services to be provided. QCBS focus on the cost of the proposed services in the selection, and only appropriate when

- (i) the scope of work can be precisely defined,
- (ii) the TOR are well specified and clear, and
- (iii) ADB or the borrower and the consultants can estimate with reasonable precision the personnel time as well as the other inputs required of the consultants.

2.5.1.2 Quality-Based Selection (QBS)

Quality-based selection (QBS) is a method based on evaluating only the quality of the technical proposals and the subsequent negotiation of the financial proposal and the contract with the consultant who submitted the highest ranked technical proposal. QBS is appropriate when

- (i) assignments are complex or highly specialised making it difficult to define precise

TOR and the required input from the consultants,

(ii) assignments where the downstream impact is so large

that the quality of the services is of overriding importance for the outcome of

the project, and

(iii) assignments that can be carried out in substantially different

ways such that financial proposals maybe difficult to compare.

2.5.1.3 Fixed Budget Selection (FBS)

This method is used when the TOR are precisely defined, the time and personnel inputs can be accurately assessed, and the budget is fixed and cannot be exceeded. It also specific for well-defined TA projects or projects where it is expected there will be no changes during implementation.

2.5.1.4 Least-Cost Selection (LCS)

The selecting consultants for very small assignments, of a standard or routine nature such as audits, engineering design / supervision of simple projects, and simple surveys implement this method. Generally for a project less than \$100,000.

2.5.1.5 Consultant's Qualifications Selection (CQS)

It is used for small assignments as highly specialized expertise is required for the assignment and recruitment of “boutique” consulting firms that provide depth of expertise

in specific areas. The recruitment time is critical and the assignment only took a short-term duration. Normally, a few consultants are qualified and the preparation and evaluation of competitive proposals is not justified. Generally for a project less than \$200,000.

2.5.1.6 Single-Source Selection (SSS)

In this method, the consultants does not provide the benefits of competition in regard to quality and cost, lacks transparency in selection, and could encourage unacceptable practices. Therefore, SSS shall be used only in exceptional cases such as cases involving the nature and complexity of the assignment. For example, the tasks that represent a natural continuation of previous work carried out by the firm, in emergency cases, such as in response to disasters, for very small assignments that not exceed \$100,000 or when only one firm is qualified or has experience of exceptional worth for the assignment.

2.6 Consultant Registration Requirements and Procedure with CIDB

The Construction Industry Development Board Act is the regulations made by the Minister after consultation with the Council, under section 34 and cited as the Construction Industry Development Board (Registration of Consultants and Contractors) Regulations 2014. In Clause 3.1.b , no firm of engineers shall be registered as a consultant in the field of civil, electrical or mechanical engineering unless the firm is under the control of a civil, electrical or mechanical engineer, as the case may be.

For the purpose of Clause 3.2.a , section 19 of the Act, an application for the registration as a consultant in the field of architecture, civil engineering, electrical engineering, project management in construction or quantity surveying, as the case may be, shall be made in such form as the Council may approve. Clause 3.3, an application made shall be accompanied by the appropriate non-refundable processing fee as specified in the Schedule .

Next, Clause 3.4, the Council shall, within 30 days from the date where all necessary information is obtained, determine the application. Where the Council grants the application, it shall notify the applicant of its decision in writing. An applicant, shall within 30 days from the date of notification, pay the appropriate registration fee specified in the Schedule, failing which the grant of the application shall lapse.

2.7 Procedure in Selecting Consultant with CIDB

The process of identifying and selecting consultants for development projects is one of the most important tasks in real estate development. The selection process begins with development of a list of prospective consultants deemed qualified to design and construct a project of this scope and complexity. These prospects are generated

from direct experience, outside references and unsolicited inquiries generated from project publicity. An initial long list of candidates is prepared. Based on a preliminary review, this list is then narrowed. Contract is made with the remaining prospects through a letter requesting specific information about the firm. Interviews are then scheduled and conducted at the office of each prospect.

Based on thorough review of this information, as well as firm references and interview responses, the prospects are further narrowed to a short list. At that time, a formal Request for Proposals (RFP) is issued to the approved prospects with a strict deadline for submittal. The RFP is based upon the agreed-upon scope of work. Based upon this comprehensive evaluation process, qualified design consultants and contracts will be identified and selected for participation in the project.

Based on "Consultant Services Procurement Manual Edition 2011 (Third Amendment)" from Clause 5.1 said that "The appointment of consultants is based on the expertise, professional ability, financial situation, performance of services, the firm's experience and other appropriate criteria". In Clause 5.2, it mentioned three (3) ways to select consultants. Clause 5.2.1. "Appoint Continue With Cost Ceiling" or in other words "*Lantik Terus Beserta Kos Siling*" as it mentioned that "the Agency may propose a name consultants and consulting service cost ceiling for approval Approving Authority. Consultants who graduate will submit technical proposals and cost to be agreed by the Agency before a formal appointment is made. "In Clause 5.2.2. "Limited Tender" mentioned that "the Agency may mengemukakan three or a maximum of ten firm of consultants to the approval of the short list. The consultants are invited to submit technical proposals and proposed cost. "In Clause 5.2.3. "Open Tender" mentioned that "the Agency shall advertise the invitation through major local daily newspaper, website and portal My Procurement Agency to eligible and interested consultants to submit technical proposals and proposed cost."

2.8 Qualified Consultants

In Malaysia most public work projects, including any construction projects under government authority or under private are awarded on a competitive basis using the traditional approach. The consultants and contractors are engaged in separate contracts. The contractors commonly would be involved until the whole project have been completed.

The most appropriate Consultancy Firm for a project is chosen on the basis of its skill, experience and other essential attributes, leading to the negotiation of a mutually agreed remuneration for an agreed scope of services. Selecting a Consultant is one of the most important decisions an Owner or Client makes. Every project is unique and each has its own challenges. At the outset of many projects, it is difficult for a Client to prejudge the likely complexity of his/her project/problem or the variety of professional services that may be required to develop an appropriate solution. The success of any project depends upon obtaining the most appropriate expertise available in terms of skill, knowledge, past experience, managerial abilities and reputation. It is simple logic to recognise that Clients who shop for Consultancy Services on the basis of appropriate quality will obtain a quality of service commensurate with their needs (FIDIC 2011).

In practice, a consultant selection process can be divided into two stages. First, a number of potential consultants are invited and investigated based on a set of predetermined criteria and then a short list of consultant is finalized by project owner, or prequalification stage. Second, an appropriate consultant is selected from the short list. A proper consultants selection process, which takes into account other quality-based criteria, is therefore necessary to ensure the quality of the consultants appointed (Ng et al. 2001).

There has been a trend that lowest-price is a commonly used key for consultant selection. But, the lowest bidder is not always the most economic choice in the long term as the client runs the risk of poor performance by that consultant during the project life (Nieto-Morote and Ruz-Vila, 2012). In addition, project owner should realize that the most qualified consultant firms may not necessarily offer the lowest price (Tran Thanh Hai, Long Le Hoai and Young Dai Lee, 2015). Ibnu Abbas Majib (2006) in his study of causes and effects of delay in Aceh construction industry, Indonesia suggest some

methods which can be employed to minimize construction delays. A total of thirty five methods of minimizing delays were identified in his study. One of the most effective methods of minimizing delays identified are to awarding bids to the right/experience consultant and contractor.

2.9 Criteria of Consultant

Contracting business is considered as a very difficult business which needs to overcome all the inherent difficulties to become competitive and efficient. The business is fragmented and resources driven in nature which needs proper management to ensure the success of the project in term of time, budget and also quality (Koon, 2005).

The industry is always facing chronic problems such as time overrun, cost overrun, poor safety and poor quality (Nahmens & Ikuma, 2009). According to Ng et al. (2001), employing incompetent consultants may lead to problems in designing, planning, cost control and supervision, which could in turn affect the time, cost, quality and risk levels of a project.

Based on the previous reasearch by Nilco Postma (2009), mentioned that the reputation of the consultancy firm depends on the ability to create support, ability to cooperate with the client, approaching client as a relation, ability to transfer knowledge, values, business philosophy, and the ability to define the problems of the client firm. The dependency from the client in quality and usefulness of the eventual service means that the objectives achieved is determined by the client itself. They have the power to rate the consultancy firm's quality work based on their performance records. The ability to create support and the importance to work well together with the client act as a keyword for network creation between team players.

2.10 Relevant Previous Research

Criteria for consultant's selection may vary between projects since the characteristics of them are distinct although there are some common characteristics of process (Nieto-Morote and Ruz-Vila, 2012). The starting point of this research is to identify criteria for PMC selection. At first, a list of criteria is established. From the study of Tran T.H et al. (2015) , a semi-structured interview is organized with the participation of eighteen experienced experts. They all have at least ten years of experience in project management and bidding field. During the interview, the experts give many suggestions to add, delete, or adjust criteria. The main criteria (and sub-criteria) are finally screened and selected as followings:

- Past experience: The consultant should have similar and sufficient past experience with the current project.
- Financial stability: The consultant must prove the overall stable financial status and capability to accomplish the work in the required time.
- Management resource: The consultant must have project manager and key team members qualified to perform the work categories on the project.
- Tender price

Remember that time, cost and quality are all interact. It is not possible to have the shortest construction time, lower cost, and highest quality at the same time, and decisions must be taken at the outset of the project (John Frank Woodward (1997). Figure 2.1 illustrates triangulation of all 3 factors.

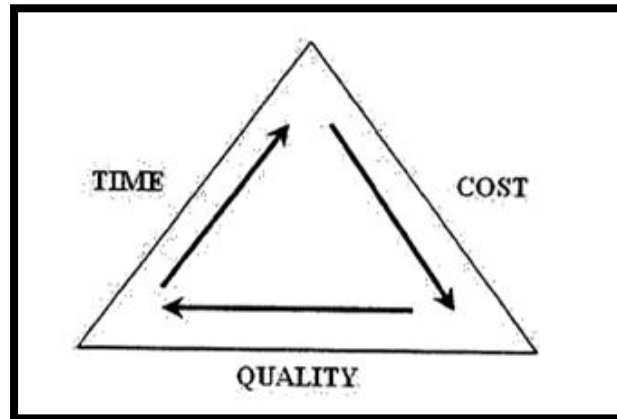


Figure 2.1: Relationship between Time, Cost and Project Quality

(John Frank Woodward, 1997)

2.10.1 Quality

This aims to ensure that the quality of the project is effectively translated into a physical construction of quality, and one that furnishes a structure which has low operational and maintenance costs. It is common and serious problem as the expected quality is not complied in the construction projects (Kometa and Olomolaiye, 1997). The quality of the project must be monitor in every phase of construction so that it will fulfill the standard specification predicted by the client. (Andrew A.L.Tan, 2004).

Past performance can be relate to the quality achieved .It has been stressed the fact that performance in a particular field primes over technical skills. Research has shown that techniques and knowledge are best learned through exposure and experience with many different companies in diverse industries (Drucker, 1979 cited in Appelbaum and Steed, 2005) in order to perform successfully in this sector. On the other hand, the performance ratings will be an input for future short-listing. In the case of repeated poor performance, the firm will be notified and provided an opportunity to explain the reasons for it and the remedial action proposed (World Bank Borrowers, 2002).

Total Quality Management (TQM) is a long-term improvement process which must be an integrated, continuous, professional system based on the commitment of top management and employees, working together with customers so that the needs of all are met (Ahire & Rana, 1995; Kabir, 2014; Saremi, Mousavi, & Sanayei, 2009; Tan, 1997). It is broadly agreed that the key element to the long-term success of TQM within an organization is the implementation process (Shenawy et al., 2007; Wali & Boujelbene, 2010).

According to these literatures, TQM program fails due to lack of understanding on “Quality”, lack of awareness on the benefit of TQM implementation in the organization, lack of clarity in the guideline, implementation understanding of the measurement technique, lack of understanding about the positive results of continuous improvement and ignoring the importance of customers (Kabir, 2014; Saremi et al., 2009). Meditating entities such as consultants can play an important role in successful TQM program implementation in manufacturing organization’s. Selection of consultant depends on organization’s purposes, resources and preferences. This problem is affected by multiple factors which may be in conflict and adhere with uncertain and imprecise data (Kabir, 2014).

2.10.2 Cost

Cost is one of the major considerations throughout the lifecycle of a project. This refers to the need to ensure that budgets are not exceeded. Cost is measured in an objective way by examining the average cost deviation for which the company was responsible on projects it has carried out in the last 5 years in relation to the planned cost. But there have many cases where most of the projects failed to achieve project completion with the estimated cost. The ability of the consultant in leading the project according to the cost estimated to avoid cost over-run of the project that sure end up with the financial

loss for many parties involved. They also responsible in getting the best possible individual item cost to prevent the wastage to the project (Andrew A.L. Tan, 2004).

Financial stability can be relate to the cost factor. It is important for the consultant firms to have a good records of financial flows throughout their projects. This can be a key factor for the client to hire the consultant for their project work. The importance of teams is paramount since they must master the art of carrying out the project within time and budget as well as satisfying all stakeholders involved.

In addition, fee competitiveness is a commonly used factor, and in many cases the key dimension, for consultant selection (Ng,S.T. Et al., 2001). Clients should however realize that the most qualified consultant firms may not necessarily offer the lowest price (Hattan and Lalani, 1997), and there is a possibility that the lowest bid is indeed from a newly established consultant or one who does not have adequate experience or resources to handle the project. Therefore, the value of professional services should not be merely measured in monetary terms, but also consider consultants' experiences and resources that best suit a project (Parks and McBride, 1987).

2.10.3 Time

Completing construction project on time is a basis requirement but Malaysia also not left in facing a problem of time overrun (Alaghbari et al., 2007; Ibrahim et al., 2010; Sambasivan and Soon, 2007). This corresponds to the total period of the project and construction phase, the skill of planning correctly and finalizing activities in accordance with the deadlines laid down by the client. It is measured in an objective way by the average of the schedule deviations for which the company was responsible on projects it has carried out in the last 5 years in relation to the planned schedule. The ability of the consultant in estimating the activity duration and forecasting the activity will make the progress of the project goes smoother (Andrew A.L. Tan, 2004).

Past experience can be relate to the time taken to achieve the objectives. It has been stressed the fact that experience in a particular field primes over technical skills. Research has shown that the most important skill is not necessarily the technical one as it is the ability to understand or appreciate what is happening in a specific context dealing with a client's situation (Isaac L.A et al., 2007).

2.11 Among Project Teams. There Are The Consultants

Cohen and Bailey (1997 cited in Hacker, 2000) explain that unlike other teams, project teams are time limited. Hacker (2000) also clarifies that project teams often work towards the completion of a single outcome and after the attainment of the output the team disbands. Complexity in projects and the speed in which these are to be carried out have created the need for project teams composed of team members willing and able to form quickly, reach the objectives and move on to the next project team (ibid:2000). This can be better appreciated when project teams (consultants) in consulting firms work side by side with staff of their clients, personnel they have no control over and do not know at all.

Project teams in consulting firms are a bit different from the regular project teams. For starters they work inside an organization that lives by carrying out project after project and also can carry some projects simultaneously with some members of the project team performing in more than one project at the same time. Effective resource allocation of the staff and the project life cycle somehow become the norm in the modus operandum of these companies and these project teams sharpen certain skills thanks to the project after project, experience after experience way of working (Isaac L.A et al., 2007).

Consulting firms are unlike big companies located in other industries. They do not have hundreds of employees in each branch. Sometimes not even the headquarters have more than hundred consultants. However, they balance the skills needed and knowledge-sharing necessity through their networking of different expertise accrued by all their branches around the world, then they can build cross-cultural project teams for specific cases when needed (Isaac L.A et al., 2007).

Also is true that clients expect so much from a consultant, not just because he/she claims expertise, but because the consultation process is far from cheap (Gbadamosi, 2005).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the scope of study will focus on describing the methodology of study adopted. There are two types of research strategies, which are quantitative and qualitative research. Quantitative research is highlight in the collection and analysis of data. For the qualitative research, it approaches seek to gain insights and understand people's awareness. The understandings, opinions, and views of people are being investigated collected from survey questionnaires and document review. It also contains the explanation about the methods used for data collection and analysis.

3.2 Study Design

The work begins with a literature review of the major studies performed on criterias selected and their alignment with consulting project teams. This study then specifically, through a questionnaire, surveys a group of team players, who involves in the construction work and currently working in Malaysia in order to determine the criterias they hold as professionals and their employers demand from them.

This study is based on the qualitative approach suggested by O'Donnell and Cummings (1999) as illustrated by the Figure 3.1 below. As it can be appreciated the first section is a passive standpoint in which the researcher understands the topic based on

personal thinking and theoretical exploration. After this step, an active involvement by the researcher is visible while conducting the study, when the problem to investigate is defined, the study is designed and then implemented and the data is collected and subsequently it is analyzed. The significance of the study is achieved when the phenomena is understood, usually through the findings discussion and sometimes with a model framework or conceptualization.

Nonetheless, some quantitative approach will also be undertaken in order to analyze the trends and popularity of some criterias in the consulting world, as example the criterias that has been highly ranked by the respondents.

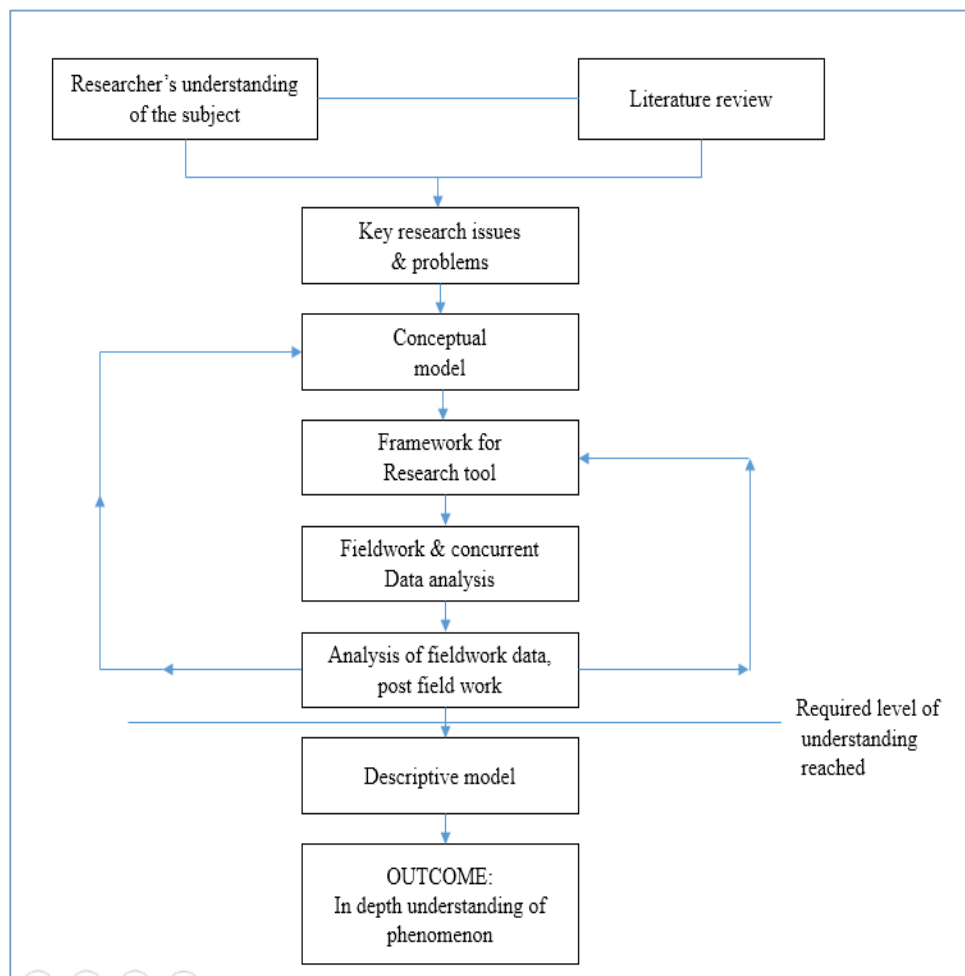


Figure 3.1 Quantitative research approach suggested by O'Donnell and Cummings (1999)

3.3 Data Sources

Primary and secondary data were used during this research project. Björk and Räisänen (2003) indicate that primary sources are the data gathered during the research from a direct source, such as company's annual statements, field studies, laboratory experiments, interviews, questionnaires, etc. On the other hand, secondary data consist in the information from other people's work on the same subject, i.e. text books, journal articles, books, newspaper, etc.

In this research, primary data was collected through questionnaires, and information provided by the firms through their corporate Internet websites. Secondary data was acquired from journal articles of both academic and practitioner professionals. This secondary type of data was employed for the literature review and demonstrated to be useful in the discussion of the results sections when contrasting the business consultant's perspectives with the academics and practitioners views.

3.4 Analytic Hierarchy Process

The research field of consultant selection has attracted numerous researchers around the world. Many different methods have been proposed and applied such as Analytical Hierarchy Process (AHP), Novel Approach to Imprecise Assessment and Decision Environments (NAIADE), Multi-Attribute Utility Theory (MAUT), and Multi-Objective Programming (MOP). Among these, AHP as a standard method to calculate weights has been widely used in the decision-making approaches (De Montis et al. , 2000).

3.4.1 Theoretical Basis

AHP is an excellent way to capture and synthesize qualitative knowledge, even from a group, a decision tool developed by Thomas Saaty (1980). It supports decision making by synthesizing pairwise comparisons of decision attributes across alternatives and calculating priorities (Saaty, 1980; 1990). The Analytic Hierarchy Process (AHP) is widely used for tackling multi-attribute decision-making problems in real situations (Chan & Kumar, 2007).

AHP approach (Saaty, 1971) has been reputed to be suitable for analyzing complex systems, extracting several alternatives, and then comparing the selected options. Since the approach is flexible enough to handle both qualitative and quantitative problems, it has been widely applied to many applications such as project selection (Mustafa and Al-Bahar, 1991), business performance evaluation (Lee et al., 1995), public policy, marketing, corporate planning, procurement, and many other areas (Nagi et al., 2005; Saaty, 1994). AHP is an application of the model developed to select consultants for a construction project (Luciana et al., 2009).

It appears inescapable that we need an organised way to make decisions and collect information relevant to them when a group must decide by laying out all the important factors and negotiating their understanding, beliefs and values. Here are a few examples where the process has been used in practice.

The Analytic Hierarchy Process (AHPs) has been used in various settings to make decisions.

- The AHP has been used in student admissions, military personnel promotions and hiring decisions.
- Cheung, Kuen, and Skitmore (2002) implemented analytic hierarchy process (AHP) for the architectural consultant selection for the design and construction of the projects in Hong Kong.
- Tsai, Shen, Lee, and Kuo (2007) applied AHP to set priority weights for consultant alternatives in order to solve the enterprise resource planning (ERP) consultant selection problems.

3.4.2 AHP Methodology

A methodology in obtaining the optimal consultant criteria is firstly, by identifying the criteria for consultant selection. Those criteria are examined by experienced experts in project management and bidding sector. The most important criteria are selected using AHP ranking method. After that, constructing the hierarchical decision making model where each of the main criteria was further decomposed into subcriteria, followed by the alternatives. Next, using AHP method to develop the weight of criteria. An expert group is invited to take part in a survey with AHP questionnaire. The validation process in this stage uses the inconsistency index. In the next stage, the weight of each criterion is calculated. Lastly, develop the hierarchical structure.

The framework of consultant's selection are shown in the model presented in Fig. 3.2.

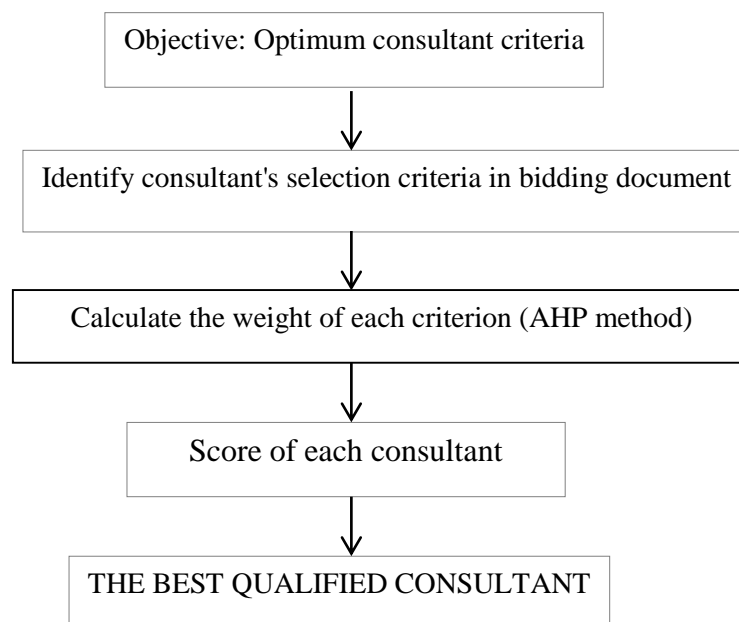


Figure 3.2: Proposed AHP for consultant's selection
(modified after Singh & Tiong, 2005)

To make a decision in an organised way to generate priorities we need to decompose the decision into the following steps and can be summarized like the Figure 3.3 :

1. Define the problem and determine the kind of knowledge sought.
2. Structure the decision hierarchy from the top with the goal of the decision, then the objectives from a broad perspective, through the intermediate levels (criteria on which subsequent elements depend) to the lowest level (which usually is a set of the alternatives).
3. Construct a set of pairwise comparison matrices. Each element in an upper level is used to compare the elements in the level immediately below with respect to it.
4. Use the priorities obtained from the comparisons to weigh the priorities in the level immediately below. Do this for every element. Then for each element in the level below add its weighed values and obtain its overall or global priority. Continue this process of weighing and adding until the final priorities of the alternatives in the bottom most level are obtained.

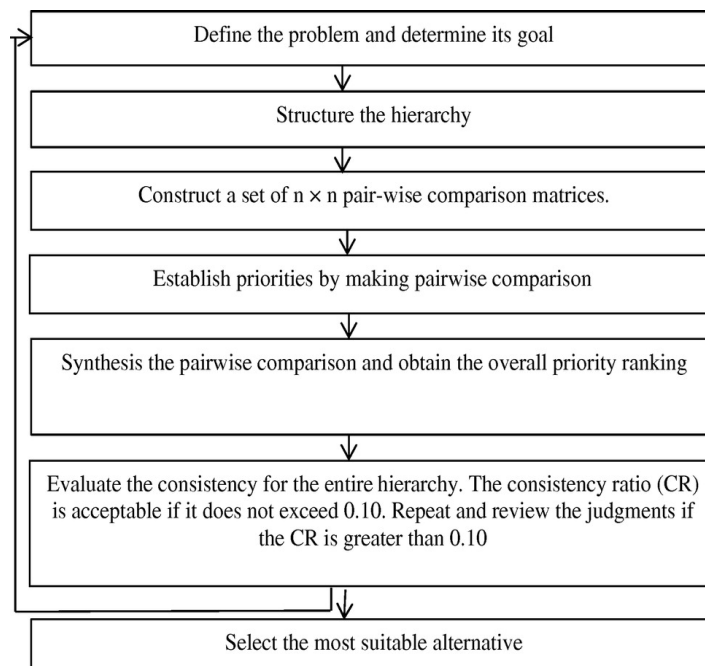


Figure 3.3: AHP in decision making

The main construction of the AHP is a hierarchy with the goal of the analysis at the top, a listing of decision attributes in the middle tiers, and a bottom tier of decision alternatives. Pairwise comparisons between each set of alternatives or attributes on the level below are made with respect to the attributes in the next highest level. For example, if a problem has three attributes and five alternatives, pairwise comparisons between all five alternatives would be done three times, one time each with respect to the first attribute, then the second attribute, and finally the third attribute. The framework of general AHP model are shown in the model presented in Figure 3.4.

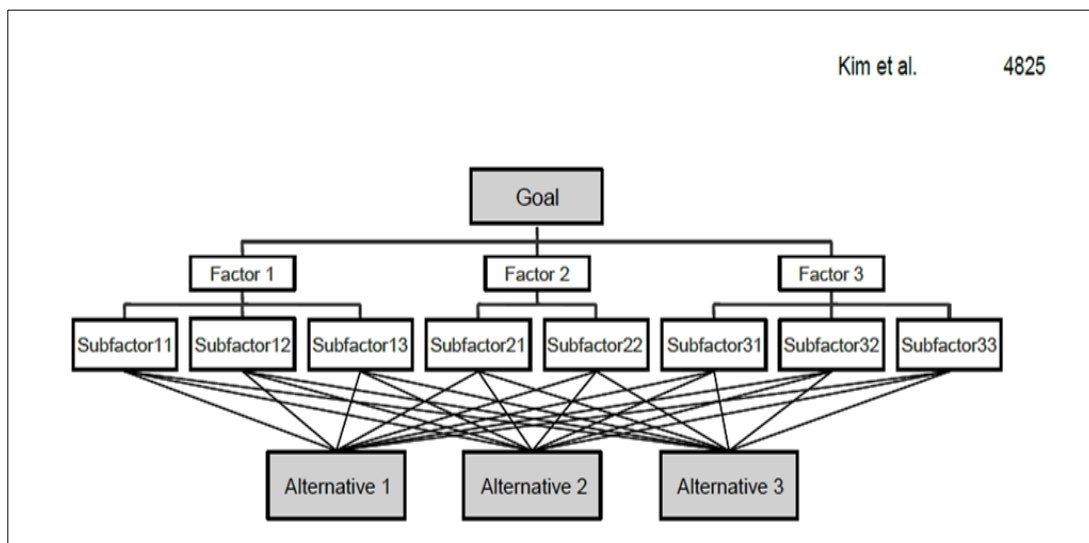


Figure 3.4: General AHP model

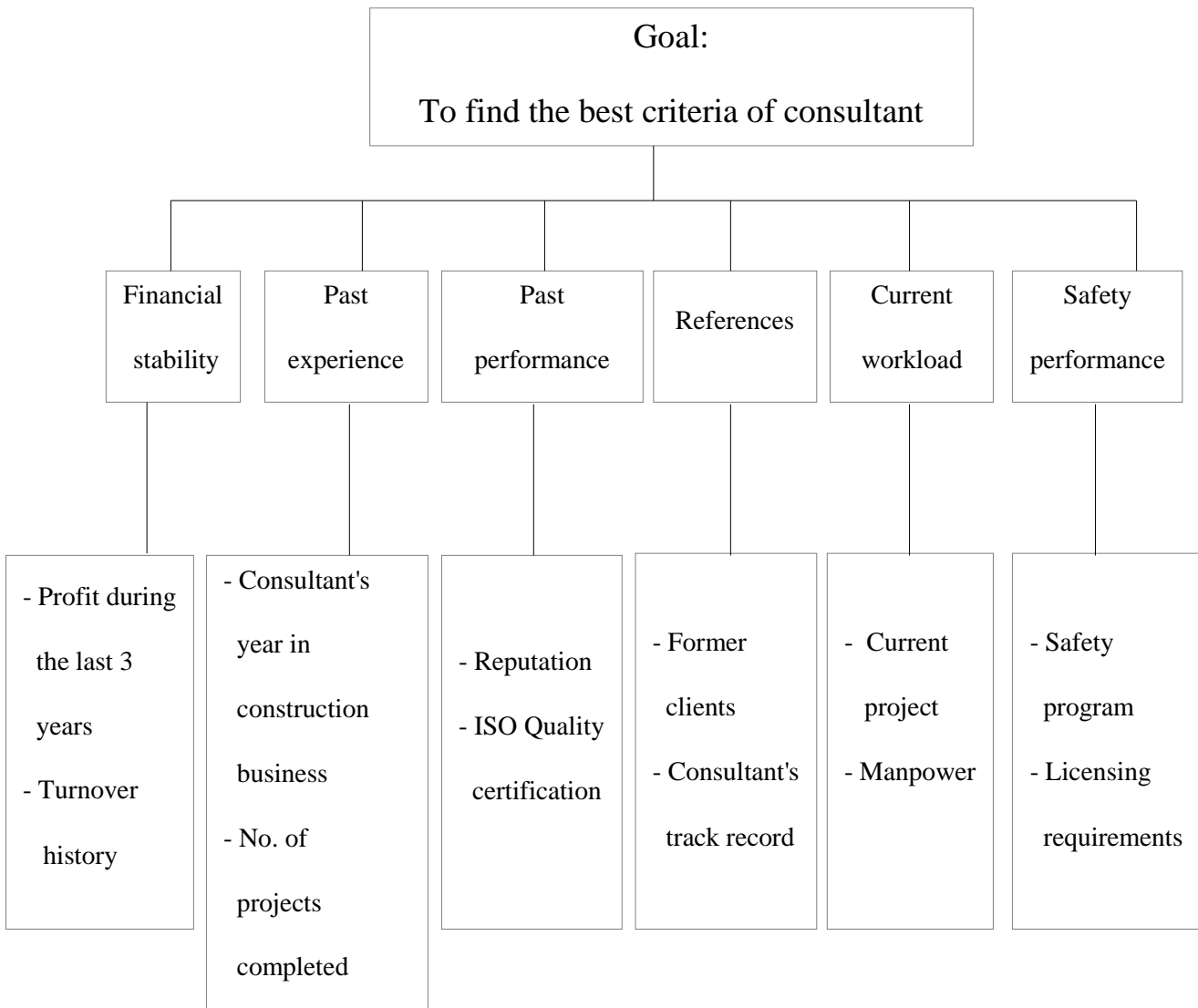
It also mentioned that Analytic Hierarchy Process(AHP) is known as a method for multicriteria decision making that help decision makers to select a choice between alternatives (Sadat Academy for Management Sciences, 2014). It is a reliable tool to reinforce logical and reasonable decision-making processes, and determine the importance of criteria and sub-criteria (Lee et al. ,2015).

Consultant selection first requires the identification of decision attributes (criteria). For this purpose we must consider all decision-making group opinion. There are a number of “group-based” research techniques available to determine the views or perceptions of individuals in relation to specific topics. The purposes of such work is to

increase the depth and scope of discussion, ensure wide coverage of ideas, and involve group members in selecting priorities and to seek agreement or consensus on the topic in question (Moor, 1994).

In using the AHP to model a problem, one needs a hierarchic or a network structure to represent that problem and pairwise comparisons to establish relations within the structure unit. The hierarchical model includes the main criteria (Level 2) and sub-criteria (Level 3). The final hierarchical structure of the model is shown in Figure 3.5 as below:

Figure 3.5 Final hierarchical structure



AHP is used to derive ratio scales from both discrete and continuous paired comparisons (Vaidya et al. ,2006). Pairwise comparisons are fundamental in the use of the AHP. Pairwise comparisons involve selecting which item is more important with respect to the attribute and then stating how much more important the item is over the other item. The pairwise comparisons are then synthesized through the use of linear algebra, and priorities for each attribute are given. The priorities are normalized to sum to one, and the priority with the highest value is said to be the best alternative (Saaty 1980; 1990).

The decision makers must first establish priorities for their main criteria by judging them in pairs for their relative importance, thus generating a pairwise comparison matrix. Judgments which are represented by numbers from the fundamental scale in Table 3.2 are used to make the comparisons. The number of judgments needed for a particular matrix of order n, the number of elements being compared, is $n(n - 1)/2$ because it is reciprocal and the diagonal elements are equal to unity. The paper by Harker (pp. 353-360) gives conditions under which it is possible to use fewer judgments and still obtain accurate results.

$i \backslash j$	Objective 1	Objective 2	Objective 3	Objective 4	...	Objective n
Objective 1	1	i_{12}	i_{13}	i_{14}	...	i_{1n}
Objective 2	i_{21}	1	i_{23}	i_{24}	...	i_{2n}
Objective 3	i_{31}	i_{32}	1	i_{34}	...	i_{3n}
Objective 4	i_{41}	i_{42}	i_{43}	1	...	i_{4n}
...
Objective n	i_{n1}					$i_{nn}=1$

i_{ab} : (a=1,..n; b=1,..n) = values (see table 1.)

Table 3.1: Pairwise compare the objectives and sub-objectives

In spite of its popularity and simplicity in concept, this method can deal with imprecision caused by the decision maker's inability to translate his/her preferences for some alternative to another into a totally consistent preference structure. In AHP, the so-called consistency ratios are used in order to measure the consistency of the decision-making process. This consistency is calculated in every step of the procedure. In case pairwise comparisons in some steps appear to be inconsistent, the consistency ratio for the whole process can be calculated and, if necessary some of the pairwise comparisons may be reconsidered (De Boer, Wegan, & Telgen, 1998).

If the CR of the matrix is too high, it implies that the judgments may be inconsistent and unreliable. In general, The inconsistency measure is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves. In general, the inconsistency ratio should be less than 0.1 or so to be considered reasonably consistent (Belton & Stewart, 2002). If CI and CR are satisfactory, on the contrary, then we can make decision in accordance with them.

The AHP incorporates an effective technique for checking the consistency of the evaluations made by the decision maker when building each of the pairwise comparison matrices involved in the process. By reducing complex decisions to a series of pairwise comparisons, and then synthesizing the results, the AHP helps to capture both subjective and objective aspects of a decision. In addition, the AHP incorporates a useful technique for checking the consistency of the decision maker's evaluations, thus reducing the bias in the decision making process.

3.5 Data Collection

The selected initial tool to be used in this study was the questionnaire. The next section explores the characteristics of methods as well as some benefits and limitations.

3.5.1 Questionnaire Design

Questionnaires are completed by respondents themselves, and are one of the main instruments for gathering data using a social survey design (Bryman and Bell, 2003). The questionnaire has no interviewer to ask the questions. The items in the questionnaire can take several forms: open-ended items, multiple-choice items and AHP-scale items.

The present research aims to systemically identify the main factors that the different parties that are involved in the construction industry believe to be important when selecting consultants. This will enable a comparison of how the different parties view these selection factors. In addition, the present research seeks to re-examine the prevailing notion that bid price is considered by practitioners to be the most important factor that should be taken into account when selecting consultants. To this end, a questionnaire was designed and distributed among construction industry experts in Malaysia from the project stake-holder organizations.

Questionnaires begin with an introduction, which explains the purpose of the survey and gives instructions to the respondent. There are two categories of data that can be collected: factual and content. The factual data is objective since the obtaining data is related to age, sex, occupation, marital status, and so on. On the other hand, the content items ask about respondent's opinions, attitudes, knowledge and behavior.

A very simple and friendly questionnaire was designed in order to collect data from current construction workers working in Malaysia. The questionnaire comprises nineteen questions categorized in mainly two types: choosing from options available and ranking questions. The questionnaire was designed in this way in order to avoid limiting the respondent in some of his/her answers.

The questionnaire consisted of two parts:

1. The first part of the questionnaire contained general questions related to the respondents' professional background, including the relevant industry sector and segment, and level of experience. This part includes five questions which were considered independent variables in the consequent statistical analysis.
2. The second section consisted of a six factors that could be deemed important in the selection of consultants. These factors were identified based on findings from the previous studies. Respondents were asked to rank each factor in terms of their importance either equally preferred or extremely preferred on a scale of 1 to 9. These factors were treated as dependent variables.

The respondents were contacted through two modes of communications: in person (38 %), by social media (62%). Based on the established hierarchical structure in the previous section, an AHP format questionnaire is designed for data collection.

In order to measure the data obtained from respondents, the frequency of data will be analyzed by using the Analytical Hierarchy Process formula. The aim of this formula is to determine the ranking of parameters given for each answer obtained from the questionnaire. For every question, the expert group is asked to rate on a 9-point scale of Saaty (1980) as shown in Table 3.2 to answer the questionnaire.

AHP scale	Definition
1	Equal importance
3	A little more importance
5	More importance
7	Much more importance
9	Strictly more importance
2,4,6,8	Intermediate values between two adjacent judgments

Table 3.2: Rating Scale of Pair-Wise Comparison

It is these scales that measure intangibles in relative terms. The comparisons are made using a scale of absolute judgements that represents, how much more, one element dominates another with respect to a given attribute. The judgements may be inconsistent, and how to measure inconsistency and improve the judgements, when possible to obtain better consistency is a concern of the AHP (Saaty;T.L., 2008).

The computations made by the AHP are always guided by the decision maker's experience, and the AHP can thus be considered as a tool that is able to translate the evaluations (both qualitative and quantitative) made by the decision maker into a multicriteria ranking.

The AHP was used in the pairwise comparison interviews. Employees were asked to make pairwise comparisons between each possible pair of influences in the group, selecting which of the two criterias was more important in the selection process of consultant project and stating how much so by using Saaty's Fundamental Scale of Absolute Numbers (Saaty, 1980; 1990). The basic scale ranges from odd numbers one to

nine, corresponding to qualitative descriptions of importance.

In an attempt to simplify the scale, provide clarity, and prevent inconsistency in responses, nine was not an option for employees in this process. Eliminating nine from the scale prevents extreme values and helps to keep the comparisons homogeneous. If nine is used in one comparison, then all other pairwise comparisons in that group need to have values less than nine, or they all have to be nine. Nine is the most extreme value on the scale, and nothing can exceed it (Vargas, 2010).

3.6 Expert Choice Software

The Expert Choice software is a multi-objective decision support tool based on the Analytic Hierarchy Process (AHP), a mathematical theory first developed at the Wharton School of the University of Pennsylvania by one of Expert Choice's founders, Thomas Saaty (1977). One of the major strengths of the AHP and Expert Choice is the use of pair wise comparisons to derive ratio scale priorities, as opposed to using traditional approaches of "assigning weights" which can also be difficult to justify (Goodwin & Wright, 2009).

The inconsistency measure is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves; this is accessed from the 'Priorities with respect to' window. In general, the inconsistency ratio should be less than 0.1 or so to be considered reasonably consistent (Belton & Stewart, 2002).

In order to solve the "Consultant Selection" problem with Expert Choice (EC) software, we need to structure the hierarchy first. While building the hierarchy tree, including more than nine elements in any objective group is not considered since it is cognitively challenging for humans to evaluate more than nine factors at a time. Once the model is built, the next step is to evaluate the elements by making pair wise comparisons. Since judgments about the relative importance of the objectives may depend on the alternatives being considered, it is most appropriate to make a judgment from the "bottom up", which is first for the alternatives with respect to the sub-objectives, then for the sub-objectives with respect to the objectives, and then for the objectives with respect to the goal. Only one example per level is demonstrated (Oyku Alanbay, 2005).

3.7 Data Analysis

The most difficult part of a qualitative research project tends to be the analysis process (Sapsford and Jupp, cited in Kakabadse et al., 2006). The interpretation of data is a matter that researchers often have conflict with. There are no set of rules, but from the relevant literature on research methods, the analysis process was suggested to be done in three steps.

1. Data organization.

The data recorded on the questionnaires need to be organized properly in order to be analyzed. Instruments such as tables, graphs, diagrams and conceptual maps were used to draw the general picture of criterias in the consulting firms. Respondents' answers constitute the raw material of the analysis. Therefore, researchers most carefully select the pieces of information that are relevant to their analysis (Ackroyd and Hughes, 1981).

2. Data Categorization.

It refers to the identification of patterns in the data that suggest a trend on the analyzed matter. Data categorization is a key step in the analysis process, it is used to break the collected material into smaller packages that are easier to understand, investigate and contrast among each other (Burns, cited in Kakabadse et al., 2006).

3. Results Interpretation.

Once the findings of the study have been identified, it is important to compare the results with the literature review in order to identify evidence of support, contradiction or areas that need further research on the field of study. It is necessary to specify if the research question was fully answered and whether the expected outcome was obtained or not.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

Proposed methodology is applied to evaluate and select the appropriate consultant for a construction project. A detailed overview of the consulting sector in Malaysia is presented. Discussing the findings regarding criterias versus company/organization, roles, and experience held by the consultants.

4.2 Result of Questionnaire Analysis

The result obtained from the questionnaire is being weighted and the criteria being categorize to the most prioritize as being rate by the experts. The main criteria that was identified based on the research in previous articles are financial stability, past experience, past performance, references, current workload, and safety performance. Second objectives is being achieved where the criteria is being weighted using AHP method in Expert Choice software.

4.2.1 Population Characteristics

This part mainly designed to provide general information about the respondents in terms of the gender, experience of works, profession and the company/organization that the respondents work now.

4.2.1.1 Gender of Respondent

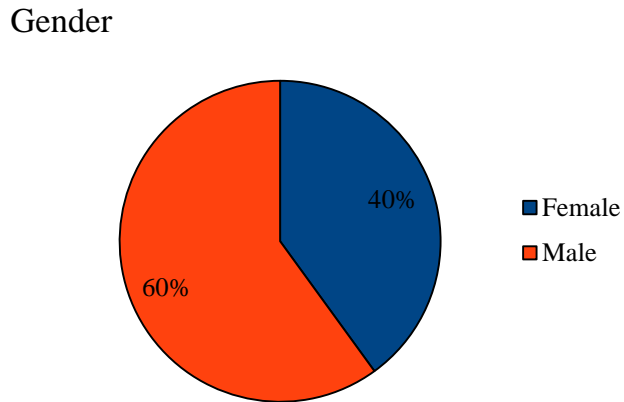


Figure 4.2.1.1.1: Pie chart for the respondent's gender

4.2.1.2 Experience of Respondents

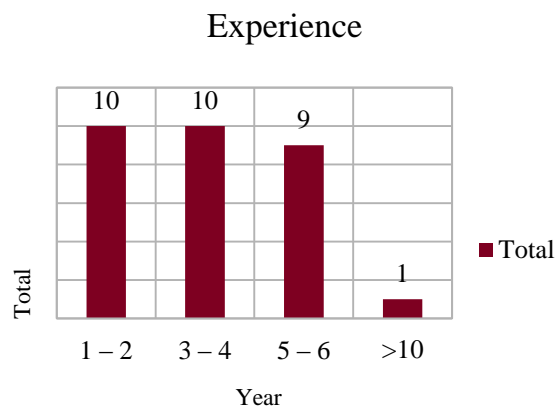


Figure 4.2.1.2.1: Bar chart for the experience of works of respondents

4.2.1.3 Profession of respondent

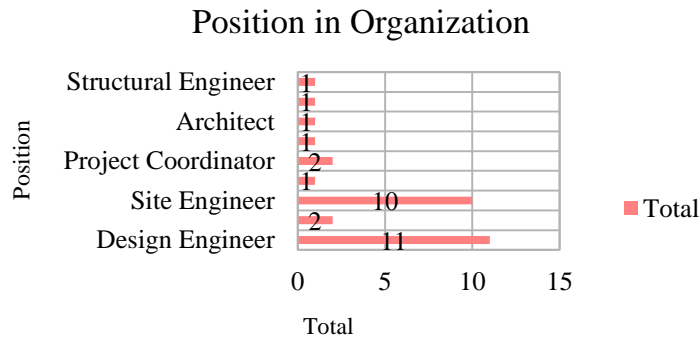


Figure 4.2.1.3.1: Bar chart of the profession of respondents

4.2.1.4 Company/Organization of respondent

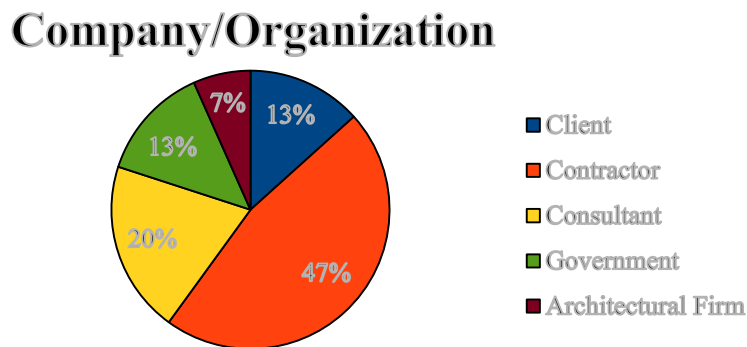


Figure 4.2.1.4.1: Pie chart of the company/organization of respondent

4.2.2 Comparison Between Two Factors

Comparison between financial stability & past experience

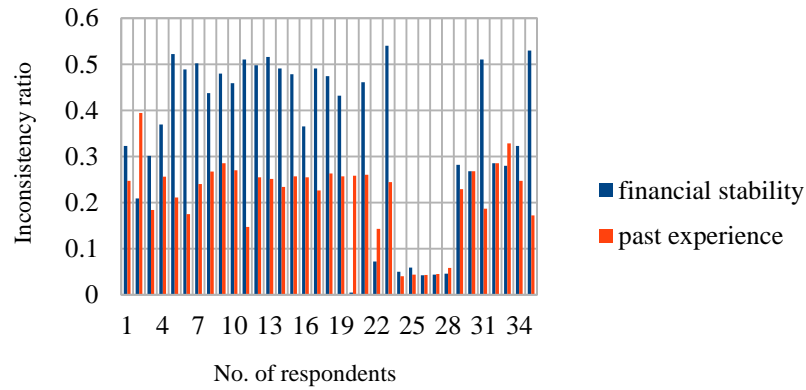


Figure 4.2.2.1: Bar chart of comparison between financial stability & past experience

Comparison between financial stability & past performance

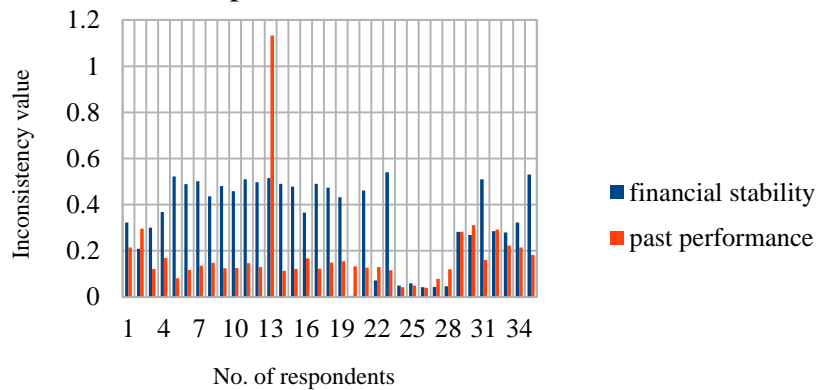


Figure 4.2.2.2: Bar chart of comparison between financial stability & past performance

Comparison between financial stability & references

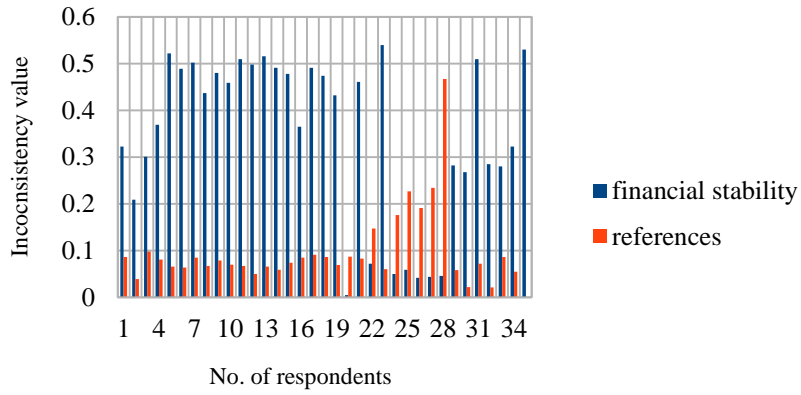


Figure 4.2.2.3: Bar chart of comparison between financial stability & references

Comparison between financial stability & current workload

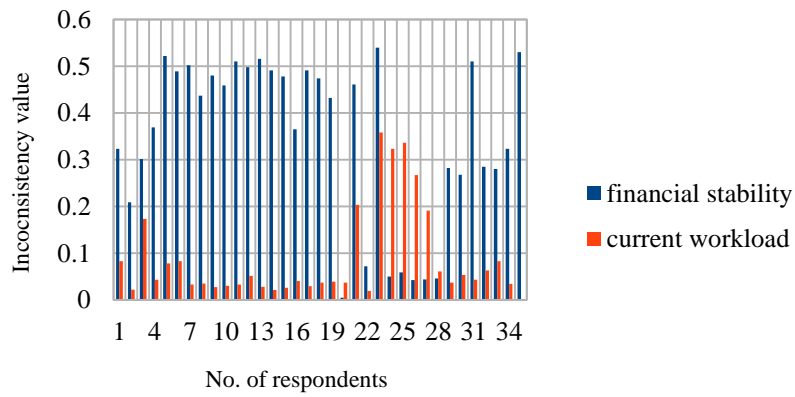


Figure 4.2.2.4: Bar chart of comparison between financial stability & current workload

Comparison between financial stability & safety performance

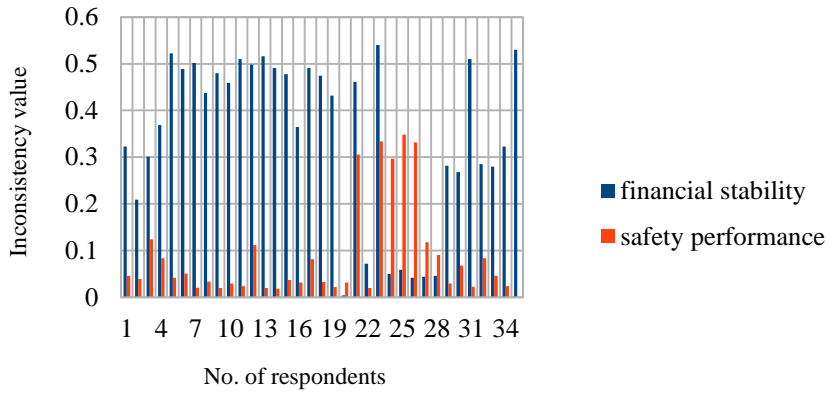


Figure 4.2.2.5: Bar chart of comparison between financial stability & safety performance

Comparison between past experience & past performance

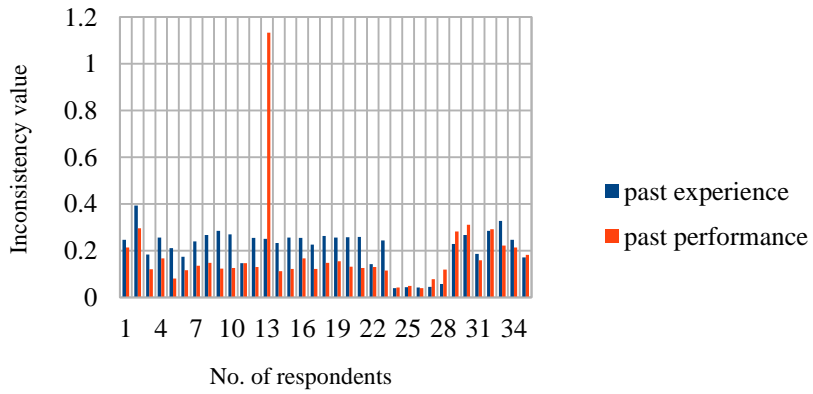


Figure 4.2.2.6: Bar chart of comparison between past experience & past performance

Comparison between past experience & references

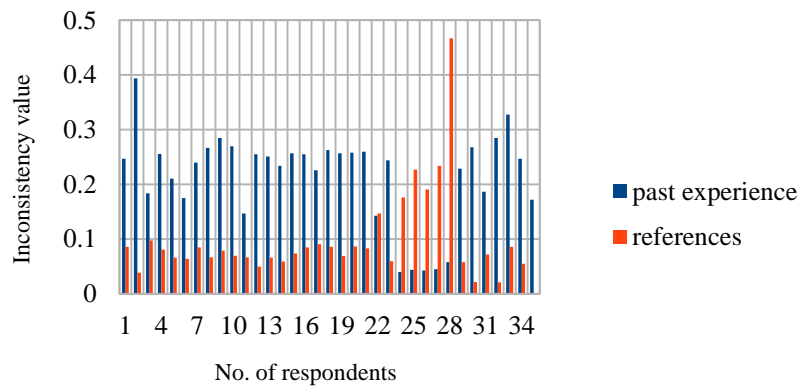


Figure 4.2.2.7: Bar chart of comparison between past experience & references

Comparison between past experience & current workload

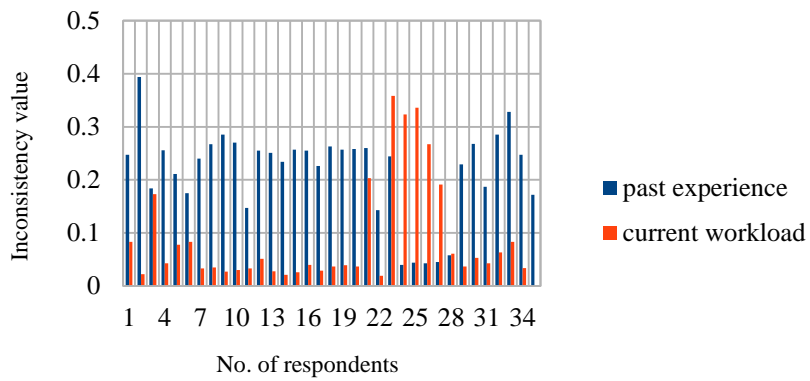


Figure 4.2.2.8: Bar chart of comparison between past experience & current workload

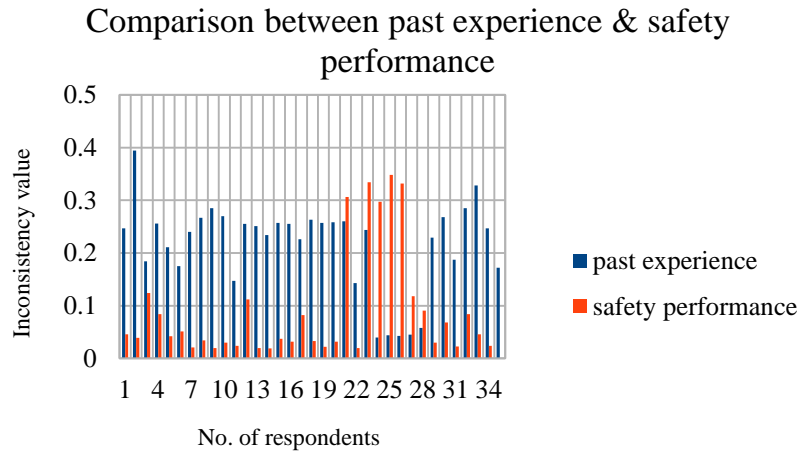


Figure 4.2.2.9: Bar chart of comparison between past experience & safety performance

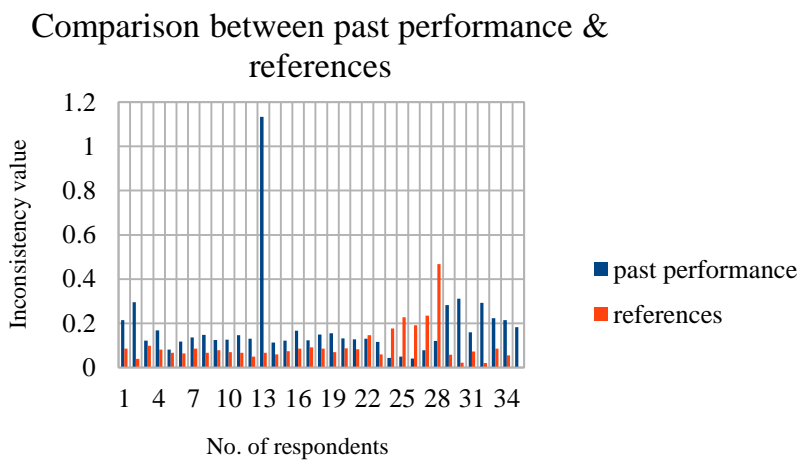


Figure 4.2.2.10: Bar chart of comparison between past performance & references

Comparison between references & current workload

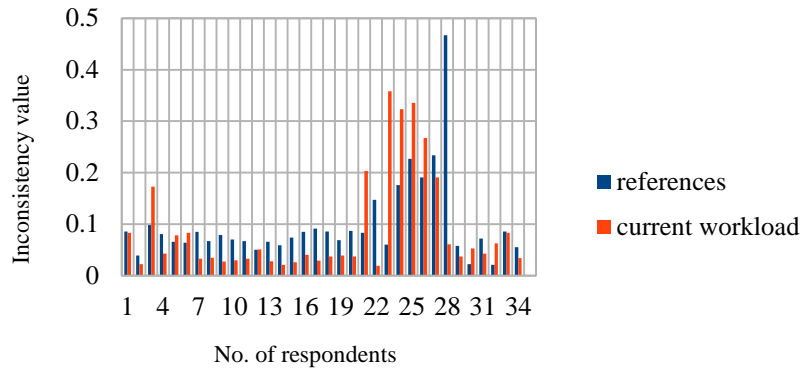


Figure 4.2.2.11: Bar chart of comparison between references & current workload

Comaprison between references & safety performance

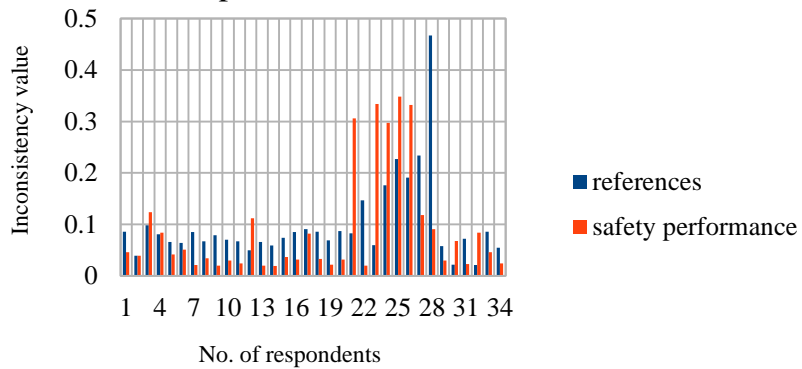


Figure 4.2.2.12: Bar chart of comparison between references & safety performance

Comparison between past performance & current workload

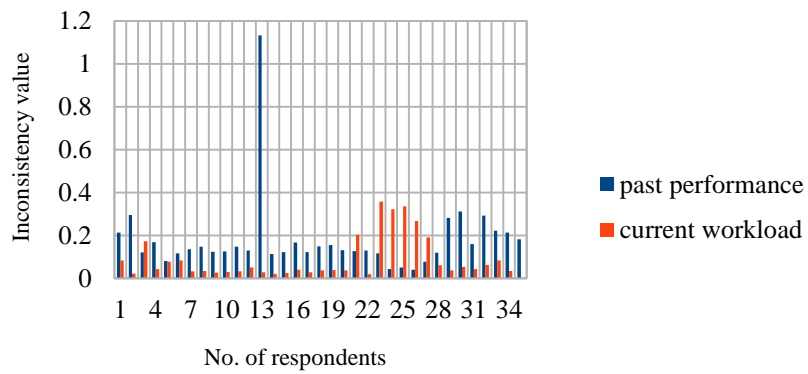


Figure 4.2.2.13: Bar chart of comparison between past performance & current workload

Comparison between past performance & safety performance

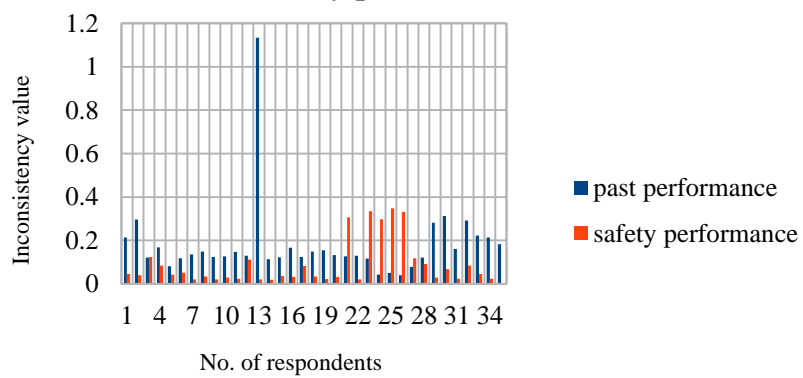


Figure 4.2.2.14: Bar chart of comparison between past performance & safety performance

4.3 Solution with Expert Choice

In this study, Expert Choice 2000 S/W was used for AHP pair-wise comparison, and as asserted by Saaty (2000), CR value of more than 0.1 as the result of experiment, was determined to be inconsistent and eliminated. The parties who responds to the questionnaires included the clients, contractors, architects, project engineers, project managers, project executives and the consultants. In the quantitative data gathering, questionnaire survey was divided into two sections which were a guide to filling up the form; demographics (general information of the respondent and the organization) and level of criteria rating in selection of consultant.

Expert Choice first calculates the local, and then the global weights of each objective and sub-objective, according to the AHP methodology. The final situation is seen in the Figure 4.2.2.1; the most important criteria is the Financial Stability one, followed by the Past Experience and then the Past Performance criteria. The values in parentheses next to the criteria indicate their global weights, reached after the final calculations.

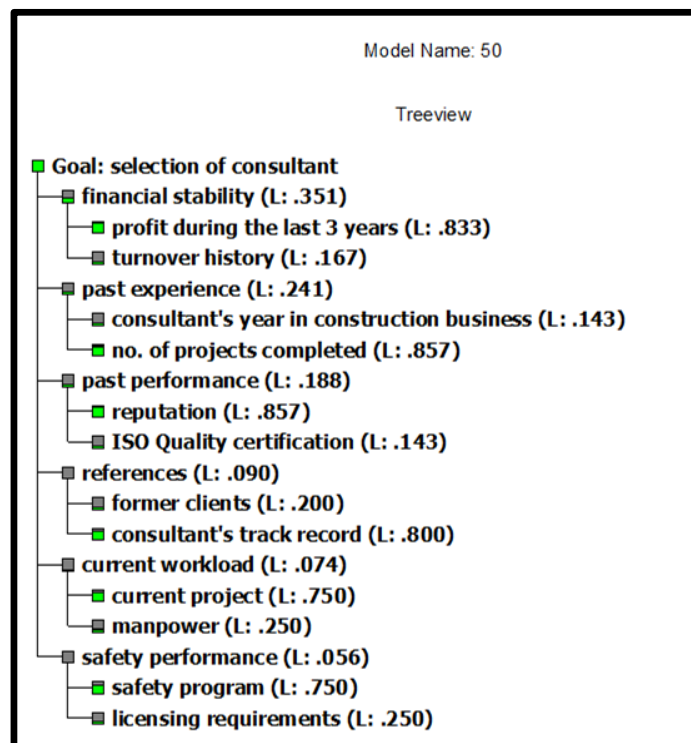


Figure 4.3.1: Tree Structure of Consultant Selection Problem – Solved

4.3.1 Inconsistency

The inconsistency measure is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves; this is accessed from the 'Priorities with respect to ' window. In general, the inconsistency ratio should be less than 0.1 or so to be considered reasonably consistent (Belton & Stewart, 2002).

Moreover, the inconsistency measure is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves. Inconsistency is not error but rather variation in the data. Because the authors plan to combine the judgments, an inconsistency ratio for greater than 0.10 at the individual level does not degrade the results. The inconsistency of the combined judgments will be less than the greatest inconsistency in an individual judgment in that group (Vargas, 2010).

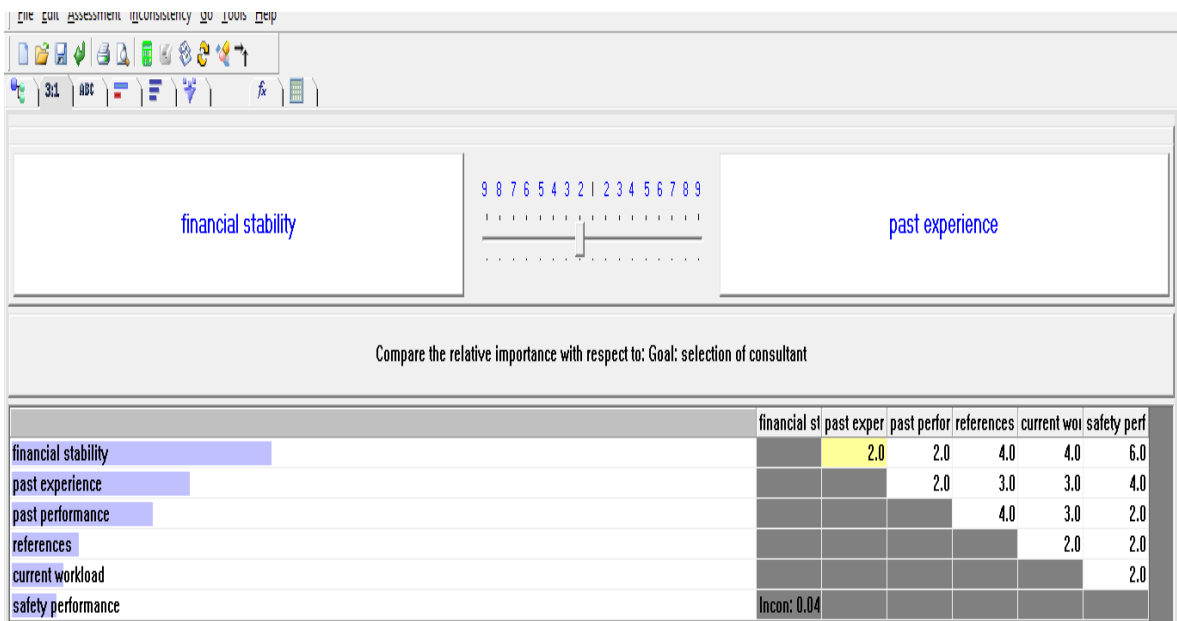


Figure 4.3.1.1: Inconsistency check

Figure 4.3.1.1 shows the 'Best Fit', where the judgement between financial stability and past experience has been entered. Once judgments have been entered, it is necessary to check that they are consistent. Some inconsistency is expected and allowed in AHP analysis. Since the numeric values are derived from the subjective preferences of individuals, it is impossible to avoid some inconsistencies in the final matrix of judgements. The question is how much inconsistency is acceptable (Michael Bruhn, 2014).

For this purpose, AHP calculates a consistency ratio (CR) comparing the consistency index (CI) of the matrix in question (the one with our judgments) versus the consistency index of a random-like matrix (RI). A random matrix is one where the judgments have been entered randomly and therefore it is expected to be highly inconsistent (Michael Bruhn, 2014).

4.3.2 Synthesis (Obtaining the Result)

A synthesis can be done for either the entire model or a portion of the model. From the 'ModelView', the 'Synthesize, With Respect to Goal' is selected. The synthesis window will then appear, showing the results (see Figure 4.3.2.1 and Figure 4.3.2.2).

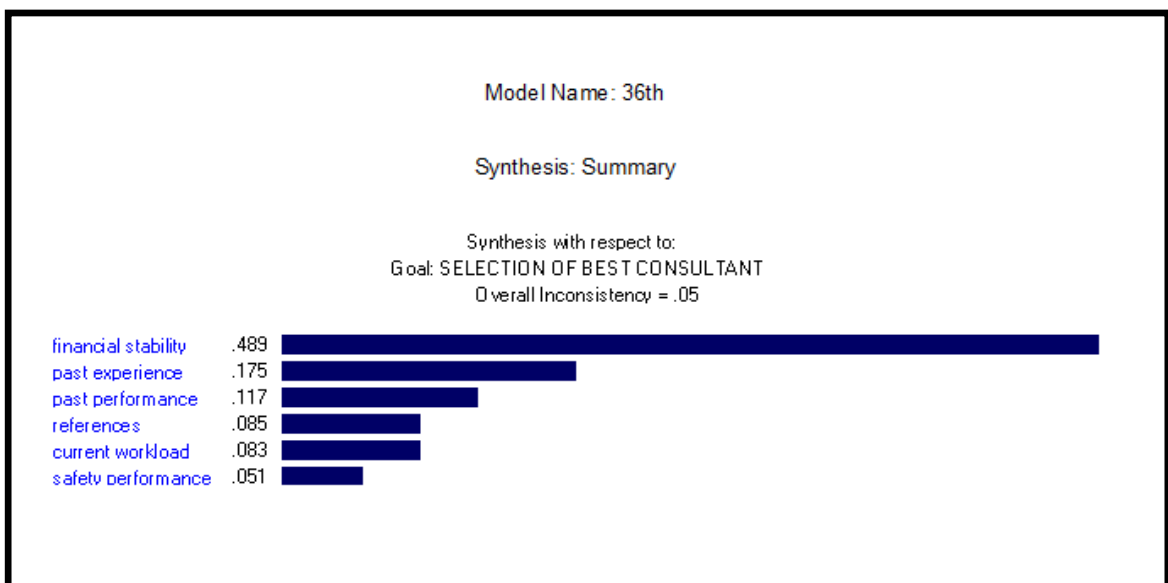


Figure 4.3.2.1: Results view

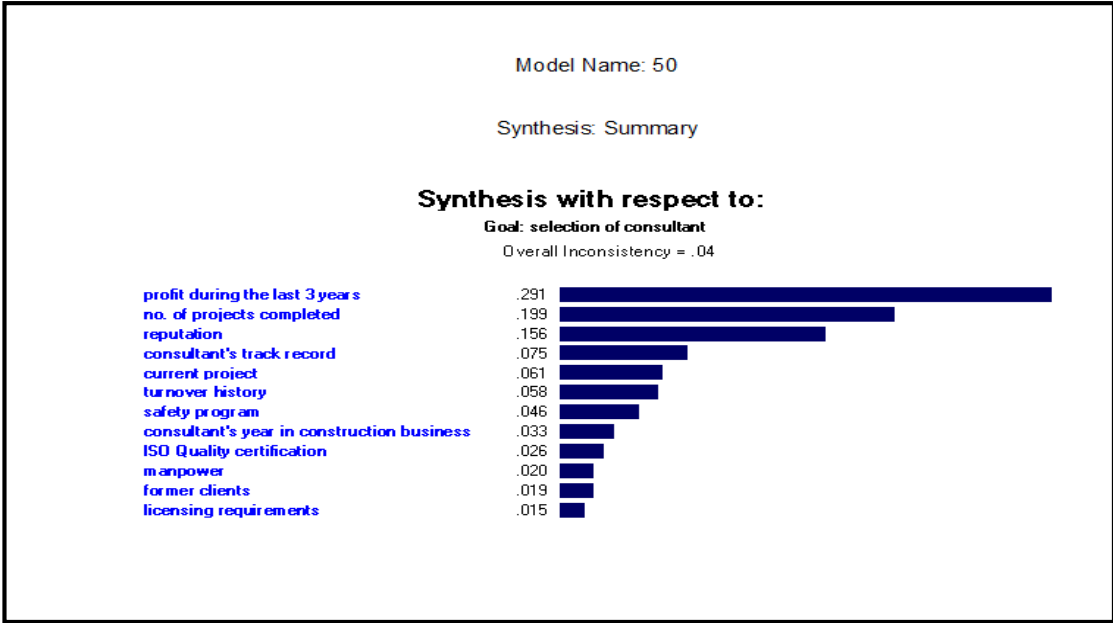


Figure 4.3.2.2: Subcriteria rating

Saaty (2012) has shown that a consistency ratio (CR) of 0.10 or less is acceptable to continue the AHP analysis. If the consistency ratio is greater than 0.10, it was determined to be inconsistent and eliminated. Based on the result obtained above, since this value of 0.05 and 0.04 for the proportion of inconsistency CR is less than 0.10, we can assume that our judgments matrix is reasonably consistent so we may continue the process of decision-making using AHP.

The AHP generates a weight for each evaluation criterion according to the decision maker's pairwise comparisons of the criteria. The higher the weight, the more important the corresponding criterion. The process of identifying influences and weighing them through group aggregation of the AHP, whether or not dispersion around the mean exists, can be applied in a multitude of corporate settings and to a varied set of decision making needs, Some inconsistency is expected and allowed in AHP analysis (E. Mu and M. Pereyra-Rojas, 2017).

4.3.3 Sensitivity Analyses (Graphs)

Sensitivity analyses from the 'Goal' node will show the sensitivity of the alternatives with respect to all the objectives below the goal. It can also be performed from the nodes under the goal if the model has more than three levels to show the sensitivity of the alternatives with respect to an objective or sub objective. When performing a sensitivity analysis it is possible to vary the priorities of the objectives and observe how the priorities of the alternatives would change (Michael Bruhn, 2014). There are four types of sensitivity analysis embedded within Expert Choice.

- Dynamic
- Performance
- Gradient

- Head to head

The different types of sensitivity analyses can be opened at once or each one separately. Each graph has its own unique menu commands and each sensitivity analysis can be compared to a "what-if" analysis because the results are temporary.

4.3.3.1 Dynamic Sensitivity Graph

‘Dynamic Sensitivity’ analysis is used to dynamically change the priorities of the objectives to determine how these changes affect the priorities of the alternative choices. By dragging the objective’s priorities back and forth in the left column, the priorities of the alternatives will change in the right column. If a decision-maker thinks an objective might be more or less important than originally indicated, the decision-maker can drag that objective's bar to the right or left to increase or decrease the objective’s priority and see the impact on the alternatives (Michael Bruhn, 2014). Figure 4.3.3.1.1 shows a Dynamic sensitivity graph.

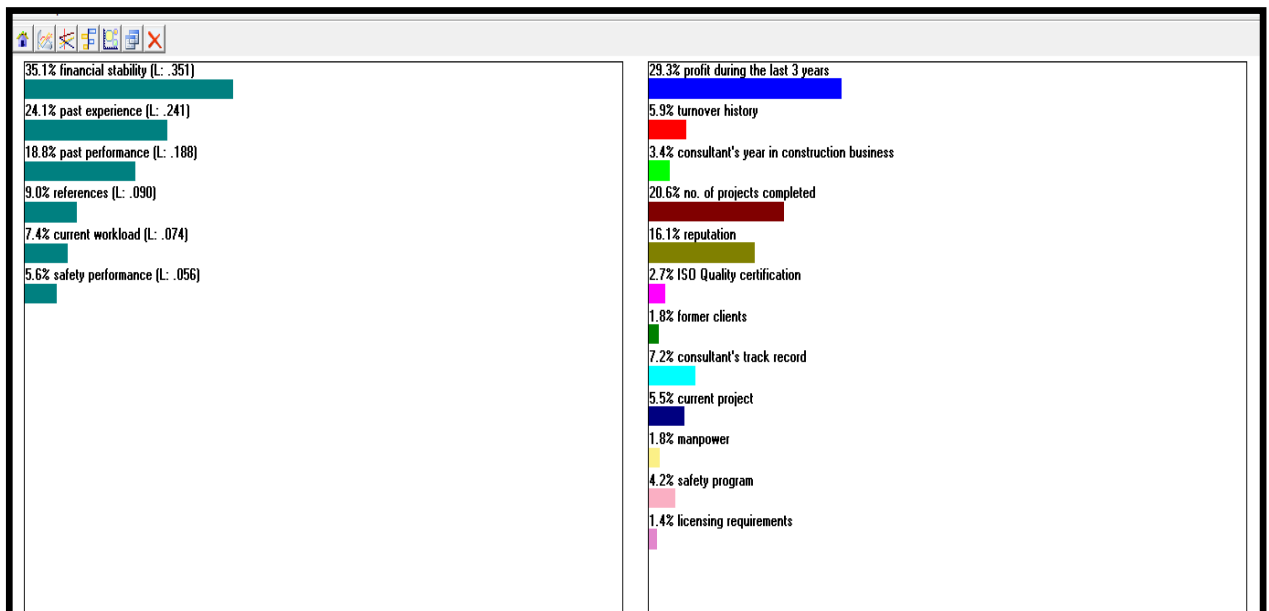


Figure 4.3.3.1.1: Dynamic Sensitivity Graph

By the projection of dynamic sensitivity graph above, we can said that the highest priority for main criteria is Financial Stability with 0.351. Regarding to Baki et al. (2017) in the Journal of Applied Environmental & Biological Sciences, said that the criteria with the highest priority is ranked as the best criteria. The highest priorities for sub criteria is “Profit during the last 3 years” with 29.3 % under the criteria of Financial Stability.

4.3.3.2 Performance Sensitivity Graph

The ‘performance sensitivity’ analysis, displayed in Figure 4.3.3.2.1, shows how the alternatives were prioritised relative to other alternatives with respect to each objective as well as overall (Michael Bruhn, 2014).

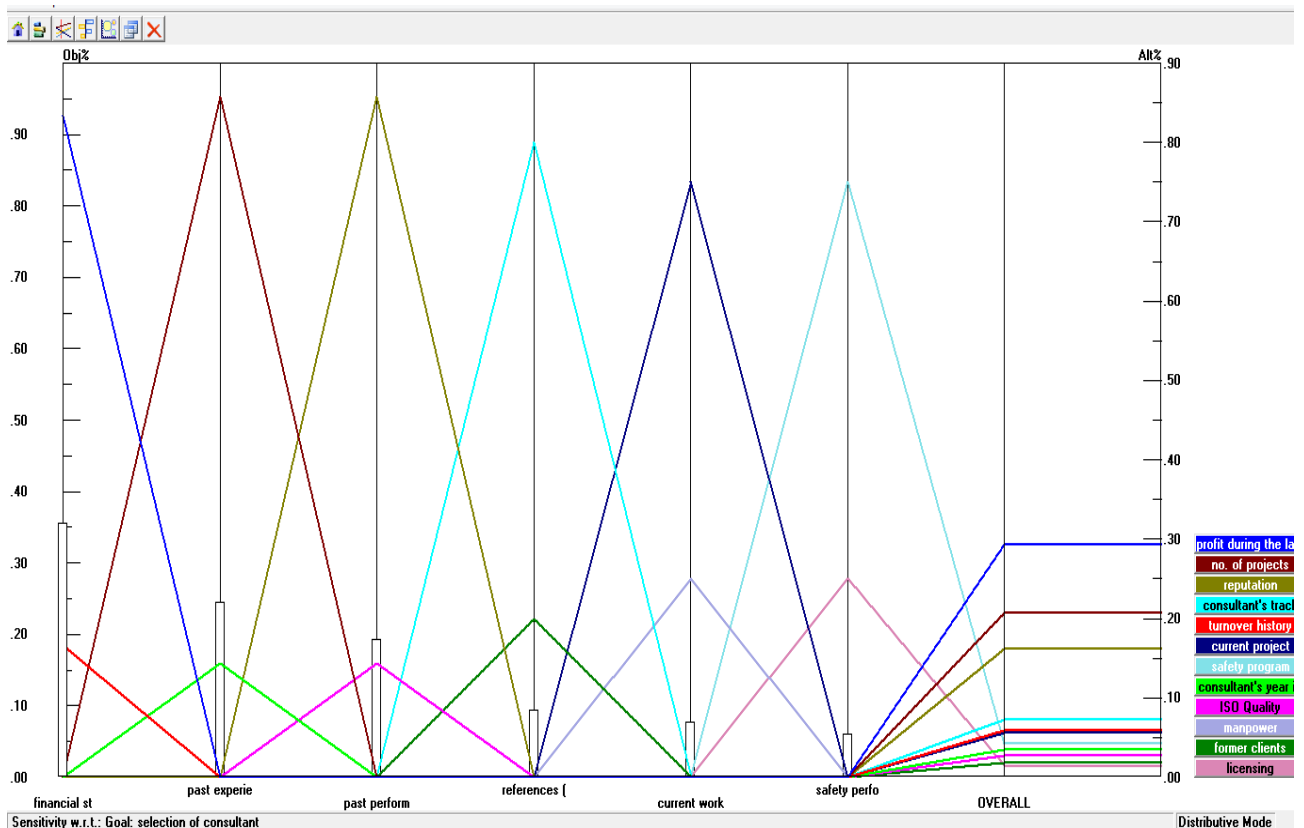


Figure 4.3.3.2.1: Performance sensitivity graph

To see how the best alternative performs compared to the second, third and fourth alternatives, read the overall priority from the intersection of the right y-axis and the overall priority for each alternative. In the case example, “Profit during the last 3 years” is approximately 0.293, “Number of projects completed” is approximately 0.206, “Reputation” is approximately 0.16 and so on. Note that the priorities for the alternatives sum to one.

4.3.3.3 Gradient Sensitivity Graph

The 'gradient sensitivity' graph shows the alternatives' priorities with respect to one objective at a time. By choosing the menu command 'X Axis', the user has the ability to select which objective appears on the x-axis. The red vertical line indicates the objective's priority (based on the decision-maker's pair wise comparisons). To indicate where an objective's priority changes the red bar can be dragged to either the left or right; this is shown as a blue dashed vertical line (Michael Bruhn, 2014).

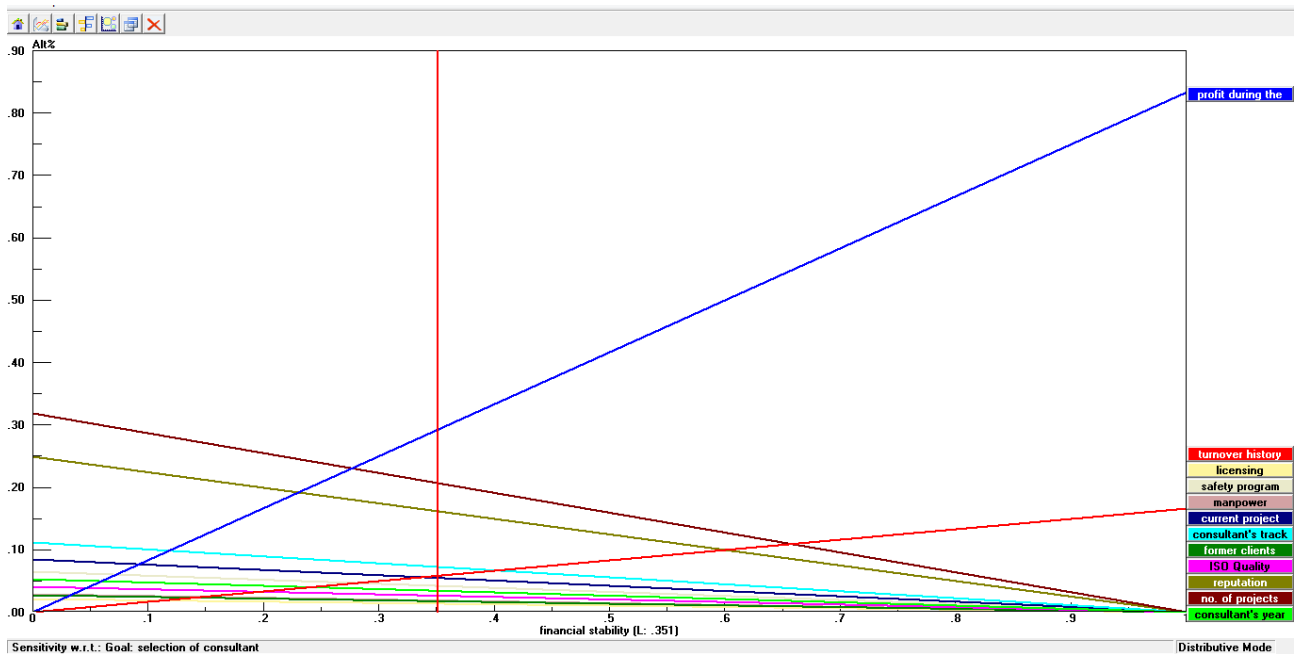


Figure 4.3.3.3.1: Gradient sensitivity graph

In Figure 4.3.3.3.1, it can be seen that increasing the priority of 'Profit during the last 3 years' from 0.0 to 0.83 changes the choice of the alternative with respect to 'Profit during the last 3 years'. When viewing a gradient graph the user should look for cross-over points of the alternatives.

4.3.3.4 Head-to-Head Graph

Figure 4.3.3.4.1 shows how two alternatives compared to one another against the objectives in a decision. One alternative is listed on the left side of the graph and the other is listed on the right. The alternative on the left is fixed while the alternative on the right can be varied, by selecting a different tab on the graph. Down the middle of the graph are listed the objectives in the decision. If the left-hand alternative is preferred to the right-hand alternative with respect to an objective, a horizontal bar is displayed towards the left. If the right-hand alternative is better, the horizontal bar will be on the right. If the two choices are equal, no bar is displayed. The overall result is displayed at the bottom of the graph and shows the overall percentage by which one alternative is better than the other; this is the composite difference. The overall priority can either be shown based on the objective weights (typical) or un-weighted.

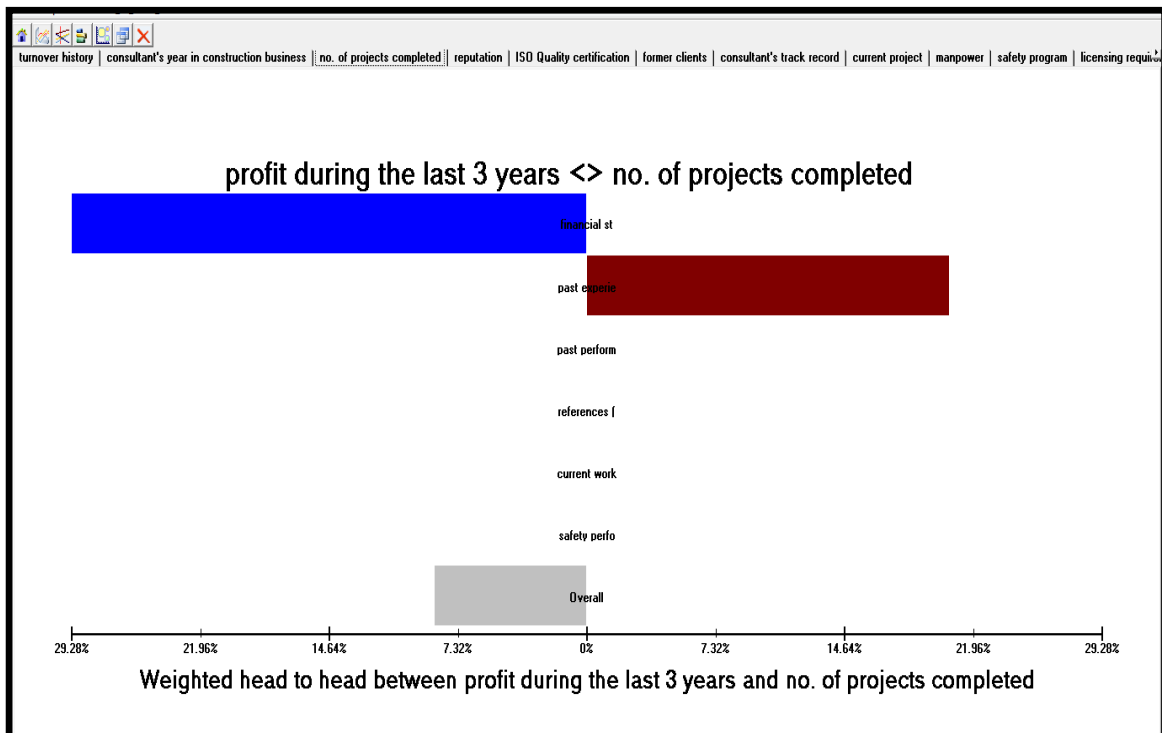


Figure 4.3.3.4.1: Head-to-head graph

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

The literature review shows that the consulting industry is a growing business worldwide. The advisory provided by this type of companies is their core process. Their services have a wide range including market analysis, setting strategies, client understanding, change management, information technologies implementation, process reengineering and so on.

This study has revealed the criteria possessed by the consultants. As stated in the research question, the aim of the research is to be acquainted with the mix of criterias that construction parties demand from their consultants, who represent the most significant asset for them in such a competitive market.

There is no definitive answer on the puzzle of consultant's criterias. Different combinations of criterias are better suited for certain types of circumstances. The consultant's perception itself, basis of this study, is different from one individual to another.

This chapter comprises the summary of results presented through the analysis from the questionnaire and also highlights the problems raised during the research.

5.2 Summary of Results

The Analytic Hierarchy Process (AHP), introduced by Thomas Saaty (1980), is an effective tool for dealing with complex decision making, and may aid the decision maker to set priorities and make the best decision. This study aims to check the usefulness of AHP method, which is an experimental method to find the most preferred factor for selecting the consultant project. Major factor failures which caused by consultants in the project or building are poor communication, bad design, lack of checking and inspect, inadequate awareness, lack knowledge about material, and professional negligence. Thus, the model presented permits consultants to be selected who are most committed to the aim of client.

A table in Figure 5.2.1 shows a summary of results emerged from the data analysis presented previously.

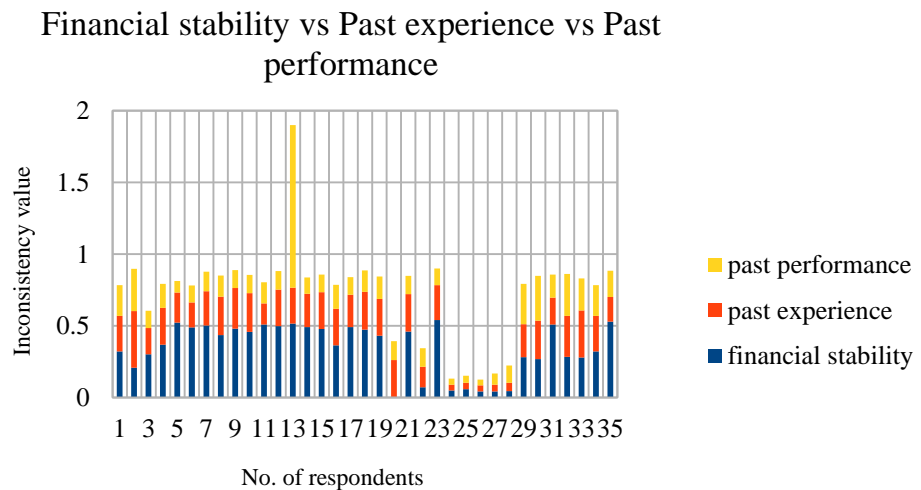


Figure 5.2.1: Highest priority value

The result obtained in Figure 5.2.1 depicts that the main criteria that are most selected by the experts in selecting consultant of the project. Firstly based on Past Performance, second is based on Past Experience in handling construction project and third, is based on their Financial Stability. These three main criteria has proved the triangulation of all 3 factors in terms of time, quality and cost. The criteria of Past Performance is related to the quality achieved in past project, the criteria of Past Experience is related to the time of the consultant firm operating in construction industry while the criteria of Financial Stability is related to the record of cost/budget of the consultant firm while handling the project.

5.2.1 Decision Support

Throughout this research's results, it was demonstrated that consultant's perception of their work is a key element to determine the required criterias for working in project teams within consulting firms. The research results also suggest that the construction firm where the consultant works, the role of the consultant in the project teams and the experience in consulting affects the criterias that consultants identify as the vital ones in order to perform their work.

This issue is clearly exemplified during the data analysis by company; the criterias-ranking among decision maker differs from one firm to another. It indicates that each organizational culture influences the consultant's conceptions regarding the ideal criterias that will allow them to get the job done. In order to create this team that will solve the client's problems, it is necessary to build it with the right consultants holding the right criterias.

According to this paper's findings, the results obtained can be support by a few evidences from the previous research. Barkley and Saylor (1994) claimed that it is widely accepted view that, at a minimum, performance measures of a project are based on time, cost and quality. This claim can also can be supported by George et al. (2005), that state the element of cost to measure the performance of engineering projects.

Furthermore, in an observation-based study by Ganaway (2006), in order to achieve a completed project that meets the owner's quality expectations, all parties to a project must acquire an understanding of those expectations, incorporate them into the contract pride and other contract documents to the extend possible, and commit in good faith to carry them out. This can be supported by Leon de Caluwe (2004), stated the effectiveness and quality of the consultant's work is taken into account.

In placing more emphasis, Josefin Sporrang (2011) states that the competence, commitment and attitudes of design consultants strongly influence the quality and cost of

built facilities. Thus, selecting the right design consultants is of utmost importance for any construction client.

According to a study by Salter and Torbett (2004), the cost variance was the most common technique used to measure design performance. It is not only confined to the tender sum, but the overall cost that a project incurs from inception to completion, which includes any costs arise from variations, modification during construction period and the cost arising from the legal claims, such as litigation and arbitration.

In advance, Bjorn Walenberg (2010) claimed that time path and budget were considered more important for consultants that were also involved as project manager. These studies have found the similar results where price is the professional fee charged by the consultant. Which states that in many cases, price is the main determinant in consulting selection, as eloquently quoted by Ling, Y. Y., Ofori, G., & Low, S. P. (2003).

5.2.2 Problems during Research

As previously explained in more detail in the methodology chapter, some problems emerged along the research, being the most important a change in the scope to perform the study only in the Malaysia consulting industry due to a lack of positive response and strong networking.

During the data collection phase, it was identified that some respondents did not answered all the questions or did not do it in the expected manner. As a result, it was necessary to add the interview as a complementary tool to refine the gathered information. When it comes to the data analysis stage, some interesting, controversial, contradictory and surprising results were found. Once again the interview was selected as the suitable tool to ferret out about these findings.

5.3 Conclusion

The use of AHP and aggregation of group judgments allows for representation of the range of knowledge and expectations across work groups and locations. The proposed methodology collects the experiences of multiple employees and synthesizes their qualitative data into a set of priorities for the influences to the spare parts process. The varied employee opinions can be brought together in a format that represents the overall goals and needs of the case study company. The process of identifying influences and weighing them through group aggregation of the AHP, whether or not dispersion around the mean exists, can be applied in a multitude of corporate settings and to a varied set of decision making needs.

Expert Choice can be used by a team to enhance the quality of group decisions by bringing structure to the decision making process and by synthesizing different points of view. This section deals with Expert Choice's group features that help synthesize individual judgments to arrive at a group conclusion. First, it is examined how to create a group enabled model. Second, how the group enabled models can be used, and third, how to combine participants' judgments to reach a group conclusion (Michael Bruhn, 2014). Although AHP calculations can be done using electronic spreadsheets, the appearance of software packages such as Expert Choice (2015) in the late eighties and Super Decisions (2015) and Decision Lens (2015) later on has made AHP mathematical calculations very easy to deal with.

The criteria chosen mostly depends on academic researchers but the weights assigned are personal points of view as any other person could have reached a totally different result by assigning different weights to criteria and sub criteria. Although the method is the same, results may change (Oyku Alanbay, 2005). Survey results concerning choice of project-specific selection criteria show that not all judging individuals have the same weight when the judgements are synthesized (T.L.Saaty and M.S.Ozdemir, 2008).

Trivedi et al. (2011) mentioned that the conventional AHP approach may not fully reflect a style of human thinking because the decision makers (DM) usually feel more confident to give interval judgements rather than expressing their judgements in the form of single numeric values (crisp value). By summarizing the finding of this research, the objectives of this research in identifying the criteria in selecting consultant of the project and develop weighted criteria using AHP method has been achieved.

5.4 Recommendation

Analytic Hierarchy Process benefits the most when some important elements in making the decision are difficult to measure, compare or agreed between the decision makers. This problem arise due to the differences of their expertise and preferences.

In obtaining a better result of the weighted data, it is recommended that the experts create a discussion room where all members of the team can brainstorm and answer the questionnaires effectively. The criteria must be ranked based on their contribution and effectiveness in consulting industry.

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APPENDIX A

APPENDIX 1 : QUESTIONNAIRE FORM

Selection of Consultant (Main Criteria) Survey

As part of my research thesis for Final Year Project at Universiti Malaysia Pahang (UMP), currently I am conducting a survey for the topic "Selection of The Best Consultant Project Using Analytical Hierarchy Process (AHP)". AHP method use a set of criteria for a decision making that derive ratio scales from paired wise comparisons. Choose ONLY ONE (1) answer for every questions. I will truly appreciate if you could complete the following table. Any information obtained in connection with this study will remain confidential.

* Required

1. Name (not compulsory)

2. Gender *

Mark only one oval.

Female

Male

3. Experience (years) *

4. Position *

5. Company / Organization *

Mark only one oval.

Client

Contractor

Consultant

Government

Architectural firm

Other: _____

Selection of Consultant (Main Criteria) Survey

Questionnaire (Survey Data)

1 = Equally preferred, 3 = Moderately preferred, 5 = Strongly preferred, 7 = Very strongly preferred, 9 = Extremely preferred

LS = Left Side, RS = Right Side

P/S : Just choose 1 answer per row

6. How much more important do you think Financial Stability is than Past Experience in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Financial Stability (LS) vs Past Experience (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. How much more important do you think Financial Stability is than Past Performance in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Financial Stability (LS) vs Past Performance (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. How much more important do you think Financial Stability is than References in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Financial Stability (LS) vs References (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. How much more important do you think Financial Stability is than Current Workload in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Financial Stability (LS) vs Current Workload (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. How much more important do you think Financial Stability is than Safety Performance in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Financial Stability (LS) vs Safety Performance (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. How much more important do you think Past Experience is than Past Performance in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Experience (LS) vs Past Performance (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. How much more important do you think Past Experience is than References in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Experience (LS) vs References (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. How much more important do you think Past Experience is than Current Workload in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Experience (LS) vs Current Workload (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. How much more important do you think Past Experience is than Safety Performance in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Experience (LS) vs Safety Performance (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. How much more important do you think Past Performance is than References in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Performance (LS) vs References (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. How much more important do you think Past Performance is than Current Workload in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Performance (LS) vs Current Workload (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. How much more important do you think Past Performance is than Safety Performance in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
Past Performance (LS) vs Safety Performance (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. How much more important do you think References is than Current Workload in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
References (LS) vs Current Workload (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. How much more important do you think References is than Safety Performance in selection criteria of Consultant Project? *

Mark only one oval per row.

	9	7	5	3	1	3	5	7	9
References (LS) vs Safety Performance (RS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>