THE SERVICES REQUIRED BY THE MALAYSIAN CONSTRUCTION INDUSTRY FROM QUANTITY SURVEYORS AND THEIR IMPLICATIONS TO QUANTITY SURVEYING GRADUATES

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THE SERVICES REQUIRED BY THE MALAYSIAN CONSTRUCTION INDUSTRY FROM QUANTITY SURVEYORS AND THEIR IMPLICATIONS TO QUANTITY SURVEYING GRADUATES

By

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DECLARATION

I CHONG BEE LING hereby declare that the dissertation is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

_____

(CHONG BEE LING)

Date _____

DEDICATION

TO MY BELOVED FAMILY, FIANCE AND FRIENDS

ABSTRACT

THE SERVICES REQUIRED BY THE MALAYSIAN CONSTRUCTION INDUSTRY FROM QUANTITY SURVEYORS AND THEIR IMPLICATIONS TO QUANTITY SURVEYING GRADUATES

Chong Bee Ling

A Quantity Surveyor is a professional working within the construction industry concerned with construction economics. During the last thirty years, a number of authors have foreseen on the future roles of the Quantity Surveyors within the construction industry. The profession of Quantity Surveying in Malaysia has evolved as a result of clients' additional needs and market requirements. Clients not only request for traditional services but are also asking for the contemporary services such as project management, risk management, feasibility study, construction financial practice, arbitration and productivity improvement in today's innovative and changing construction industry. Therefore, three objectives were formulated for this research and they are: (1) to identify the traditional and contemporary roles of Quantity Surveyors, (2) determine the threats to quantity surveying profession, and (3) propose the methods to improve performance of graduate Quantity Surveyors. To verify the validity of the data, a systematical procedure of study was designed. Firstly, a pilot study was conducted to verify the completeness of the questionnaire in capturing the factors. Secondly, questionnaires were distributed and finally

ninety-nine feedbacks were obtained from construction companies (consultants, contractors and developers). The questionnaires were analysed using the relative importance (RII), frequency (FI) and severity indices (SI) indices methods. Research findings (based on all respondents' overall ranking) indicated that the preparation of the Bills of Quantities (SI=0.812) is the most significant service carried out by Quantity Surveyors in their current role. On the other hand, intensive or severe fee competition (RII=0.703) is the most critical threat faced by Quantity Surveying profession. Furthermore, respondents mentioned that the most effective method to improve performance of graduate Quantity Surveyors is to have sufficient professional expertise and skills in the core competencies and continue to develop this expertise (RII=0.822). Finally, three cases were carried out to study the roles of Quantity Surveyors working in consultant, contractor and developer. According to the feedback from these case studies and later compared with the analysis of the questionnaires, it is found that they are agreeable with the individual roles of Quantity Surveyors meeting the consultant, contractor and developer's requirement. This research outcome also provides a guideline for the university to review and improve the Quantity Surveying course's syllabus so that the graduate could stay relevant and competitive in the industry.

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FACULTY OF ENGINEERING AND SCIENCE

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Date: _____

SUBMISSION OF DISSERTATION

It is hereby certified that **CHONG BEE LING** (ID No: **09UEM03800**) has completed this dissertation entitled **"THE SERVICES REQUIRED BY THE MALAYSIAN CONSTRUCTION INDUSTRY FROM QUANTITY SURVEYORS AND THEIR IMPLICATIONS TO QUANTITY SURVEYING GRADUATES"** under the supervision of **Assistant Prof. Dr. LEE WAH PENG** (Supervisor) from the Department of Surveying, Faculty of Engineering and Science, **Mr. LIM CHAI CHAI** (Co-supervisor) from the Department of Surveying, Faculty of Engineering and Science.

I understand that the University will upload softcopy of my dissertation in pdf format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

Yours truly,

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(CHONG BEE LING)

APPROVAL SHEET

This dissertation entitled **"THE SERVICES REQUIRED BY THE MALAYSIAN CONSTRUCTION INDUSTRY FROM QUANTITY SURVEYORS AND THEIR IMPLICATIONS TO QUANTITY SURVEYING GRADUATES"** was prepared by CHONG BEE LING and submitted as partial fulfillment of the requirements for the degree of Master of Science at Universiti Tunku Abdul Rahman.

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LIST OF ABBREVIATIONS

BQ	Bills of Quantities
BQSM	Board of Quantity Surveyors
ISM	Institution of Surveyors, Malaysia
QS	Quantity Surveyors
RII	Relative Importance Index
FI	Frequency Index
SI	Severity Index

CHAPTER 1

INTRODUCTION

1.1 Introduction

Profession Quantity Surveyor is believed exist in Malaya since the early of 1930. It was begun when immigration of few Quantity Surveyors from England to Singapore. In 1934, Mr. Watson and Mr. Water formed the first Quantity Surveying consultancy firm named Messrs Water & Watson in Malaya. This firm was operating until 1942. After Second World War, the Government of Malaya which is still under the British's rule established the Division of Quantity Surveyor under the Department of Architecture in 1950. However, the role of this division was limited at that time as it was a parked under the Building Branch and played the role as contract officer.

In those early days, many government projects seldom used the Bills of Quantities (BQ). The Quantity Surveyor acted as a contract officer, who called for the lump sum tenders without BQ, manage the contract and prepared Final Accounts after completion. Besides, there was no formal education to train the local staff at that time. The local staffs learned Quantity Surveying knowledge from foreign Quantity Surveyor who worked in Jabatan Kerja Raya. Therefore, few local Quantity Surveyors appeared after obtaining the working experience. In 1951, Quantity Surveying course was introduced by Maktab Teknik Kuala Lumpur to train locals to become qualified Quantity Surveyors. Thus more local Quantity Surveyors appeared after that.

Around 1958-1959, a few Quantity Surveying consultancy firms owned by foreign citizen base existed in Malaya such as Frank & Vargheson, Chris & Cavanaugh and Bridge Water & Coulton. Dato' Hj Ishak Mohd. Yusof was the first bumiputra Quantity Surveyor qualified to establish QS Pakatan International consultancy firm. More and more Quantity Surveying consultancy firms were established due to the development of the construction sector in Malaysia (Abd. Ghani et al., 2006). Currently, there are more than 200 Quantity Surveying consultancy firms and more than 700 Quantity Surveyors registered with Board of Quantity Surveyor Malaysia.

The Quantity Surveying profession in Malaysia has largely developed since building work increased in volume and complexity over the last century. As described by Seeley (1997), Quantity Surveying is a profession who would price and calculate any amendments that might arise through the development of the works and who would set up an accurate bill of quantities to be valued by tendering contractors. However, the environments for Quantity Surveying practice today have changed along with the country's rapid economic development. In recent years, many authors have reported on the roles of Quantity Surveying profession in the construction industry have evolved along with the changes (Page et al., 1999; Page et al., 2001; Boon, 2001; Fellows et al., 2003; Hardie et al., 2005; Fadhlin and Ismail, 2006; Ashworth and Hogg, 2007; Cartlidge, 2011).

1.2 Problem Statement

Previously, the perception of Quantity Surveyor was preparing bills of quantities and final accounts only. However when come to 80s, the changing role of the Quantity Surveyor had been significant. The emphasis has changed, with a shift from *cost* to *value* and the recognition of the importance of procurement and management skills (Ashworth, 1981; Ashworth, 1994; RICS, 1991).

In United Kingdom (UK), Royal Institution of Chartered Surveyors (1998) noted that there has been a rigorous debate taking place in the past few years regarding the role and future of the quantity surveying profession. Matzdorf et al. (1997) expressed that the Quantity Surveying profession faces threats to its traditional roles and functions as a result of changing client needs in the construction industry. In the QS Think Tank Report by the RICS has noted many regular clients are critical of traditional Quantity Surveying services and are demanding a different and more comprehensive range of services that is proactive, customer oriented and supported by significantly better management and business skills (Page et al., 2004). As a result, few evolving roles surfaced within the quantity surveying profession with increased importance and emphasis on meeting clients' needs. This involves quantity surveyors to work on procurement, design cost planning, whole life costing, value management, and risk analysis and management. Since the buildings have become more engineering services oriented, emphasis was placed on measurement, cost and value of such services. Other evolved roles have also included project and construction management, facilities management, contractual disputes and litigation (Ashworth and Hogg, 2007).

While in United States (US), their design and construction industry has changed the way it is doing business in the last 20 years. This has cause the industry to reassess its traditional roles, revise business practices, and look for ways to add value to the process without adding cost. The increase in popularity of alternative project delivery methods has significantly revised the set of professional skills and knowledge that the Cost Engineer must have to be successful in this business (Robson and Gransberg, 2004). The skills and knowledge areas of Cost Engineers are similar to those of Quantity Surveyors. In US, Quantity Surveyors are called Cost Engineers (Wikipedia, 2012).

Furthermore, Nkado (2000) did a research on the competencies required by Quantity Surveyors in South Africa to meet changing client needs and to grow the market for quantity surveying services. He found that management orientated competencies will become more important for the future business success of quantity surveyors, project management, marketing, and personal and interpersonal skills should be included in the academic and training curricula of Quantity Surveyors.

Ling and Chan (2008) investigated how the Quantity Surveying firms in Singapore internationalise their services. They found that QS firms that offer services overseas have more staff than non-exporters, handle larger projects and offer a wider range of services. Quantity Surveyors need to function as manager to increase the value of an organisation's product since the Quantity Surveying services have been internationalised with the advent of globalisation. Besides undertaking the usual Quantity Surveying services, a large of percentage of Quantity Surveying firms providing other related

services such as project management, contract management, construction management, project coordinator, and being clients' representatives.

In Malaysia, Abdul-Aziz et al. (2011) also mentioned that to internationalise Malaysian quantity surveying firms, their domestic reputation must be solid before the firm can aspire to build a name for itself abroad. Therefore, Hasmawati and Johan (2006) reported that the need to have cross-cultural skills is essential in this globalise environment. The modern Quantity Surveyors are no longer the "Measurer". They have got to have new business savvy. Strategic Planning, Strategic Management, indeed Strategic Thinking are important. It is essential to have highly developed Knowledge Management skills if knowledge truly is the new capital. The industry also needs people who are highly capable in business management and business organisation, particularly in people skills. The role of Quantity Surveyor has changed and it is unlikely to revert to the traditional role. Thus, they need to adapt to changes in work pattern, develop new markets and cultivate superior advantages over their competitors in order to maintain his competitive position and ultimately his profit market (Torrance and Harun, 2005).

Apparently, the roles of quantity surveyors are expected to develop in future for many countries. Each Quantity Surveying firm will need a team of graduates and professional quantity surveyors to offer basic and additional specialised services like project management, value management, facilities management, knowledge management etc to fulfil customer requirements. The professional Quantity Surveyor nowadays not only have to provide traditional Quantity Surveying services but also need to provide additional specialised services to

maintain their competencies. However for quantity surveying graduates, they should not be expected to be an expert in many fields at the initial stage. After some years of working experience, he should go for post-graduate studies in order to be equipped with additional specialisations. Thus, in future, Quantity Surveying firms will have a team of Quantity Surveyors who would be able to provide competent basic Quantity Surveying services as well as specialisations. Hence this study would show a reliable understanding of the present situation as well as the future needs of the quantity surveying practice in Malaysia. The present study also determines the threats to quantity surveying profession. Therefore, this research can be used as a basic guidance for graduate Quantity Surveyors. Once they clearly understand the demand of current Quantity Surveying profession and methods to improve their performance, then they will able to fulfil the need and stay employed in the industry.

Moreover, some skills or elements discussed in this study may be not taught or ignored by Universities. Hence this research also would help the universities especially the Department of Built Environment to review and improve the Quantity Surveying course's syllabus. As a result, the students could stay relevant in the industry.

1.3 Aim

The aim of this research is to identify the roles of graduate Quantity Surveyors to suit the current changing construction environment.

1.4 Research Objectives

This research focuses on the roles of graduate Quantity Surveyor in Malaysian construction industry. Particularly, the following objectives are recommended in order to reach the aim of the research:

1. To identify the traditional and contemporary roles of Quantity Surveyors.
2. To determine the threats to quantity surveying profession.
3. To propose methods to improve performance of graduate Quantity Surveyors.

1.5 Scope of Study

The scope of this research will focus on the following area:-

1. The roles of graduate Quantity Surveyors in today work environment within Malaysia construction industry.
2. The study will only focus on all the Quantity Surveying consultancy firms, contractor companies and developer companies in Malaysia. This is because the majority of professional Quantity Surveyors are working within these construction organisations.

1.6 Limitation of study

Low respondent rate is the limitation of this study. After completing the questionnaire, respondents for mail surveys may find it a burden in returning the survey. They need to perform trivial but necessary tasks to return

the survey, such as enveloping and mailing, which may hinder a prompt return after completion.

The next limitation is that the research did not get much feedback from the experienced quantity surveyors. The senior quantity surveyors (i.e. those with more than 5 years working experience) might not be willing to spend their time to answer the questionnaire. Finally, this may cause the majority of the feedback might come from junior level (i.e. less than 5 years working experience). The Likert scales may not be totally reliable because different respondents may attach different values to different points of the scale.

Additionally, the potential differences in market context between Malaysia, UK, US, etc. are not discussed detail in this study. This study is only concentrated on the Malaysian quantity surveying profession scenario.

1.7 Research Methodology

This research methodology will be used as a guideline so that the research could be done in a organised way to achieve the research objectives. The research process in general consists of 4 stages, i.e. 1st stage: initial study and confirmation of research area, 2nd stage: research proposal, 3rd stage: data collection and analysis and 4th stage: write-up and conclusion. The following will be the research process and the methods of approach used for this research (refer to Figure 1.1).

First stage of research involves initial study and fixing of research area. Literature review will be used as the initial study. This approach is trying to narrow down the research area. A rough idea of the research topic will be obtained at the end of this stage.

2nd stage of research methodology will be carried out after the initial study. An in-depth literature review is conducted to verify and enhance the research area. The scope and objective of the research are decided. A research outline will be prepared in order to identify what kind of data will be needed in this research. Also, gathering techniques and data sources will be recognised as well. After that, research proposal is drafted and confirmed.

3rd stage of research involves data analysis, interpretation and data arrangement. This stage is to process and convert the data collected as information that is useful for the research. Primary data is collected through a questionnaire survey. It is advisable to complete a pilot study in small-scale before collect the final data from the whole sample. Thus, a pilot study was conducted to test the wording of the question, identifying ambiguous questions etc. After that, the questionnaire is finalised and be distributed to the target group (Quantity Surveyor from consultants, contractors and developers) to gather data and information to achieve the predetermined research objectives. The questionnaires were distributed by way of post, facsimile, e-mail and/or by hand in person. Besides, three cases will be studied to reinforce the findings from questionnaire. While secondary data mainly derived from journals, articles and books.

Fourth stage of the research was the final stage of the research process. It was mainly concerned with writing up and suggestions for future research.

1.7.1 Research Methodology Flow

The research methodology of this study is shown in Figure 1.1.

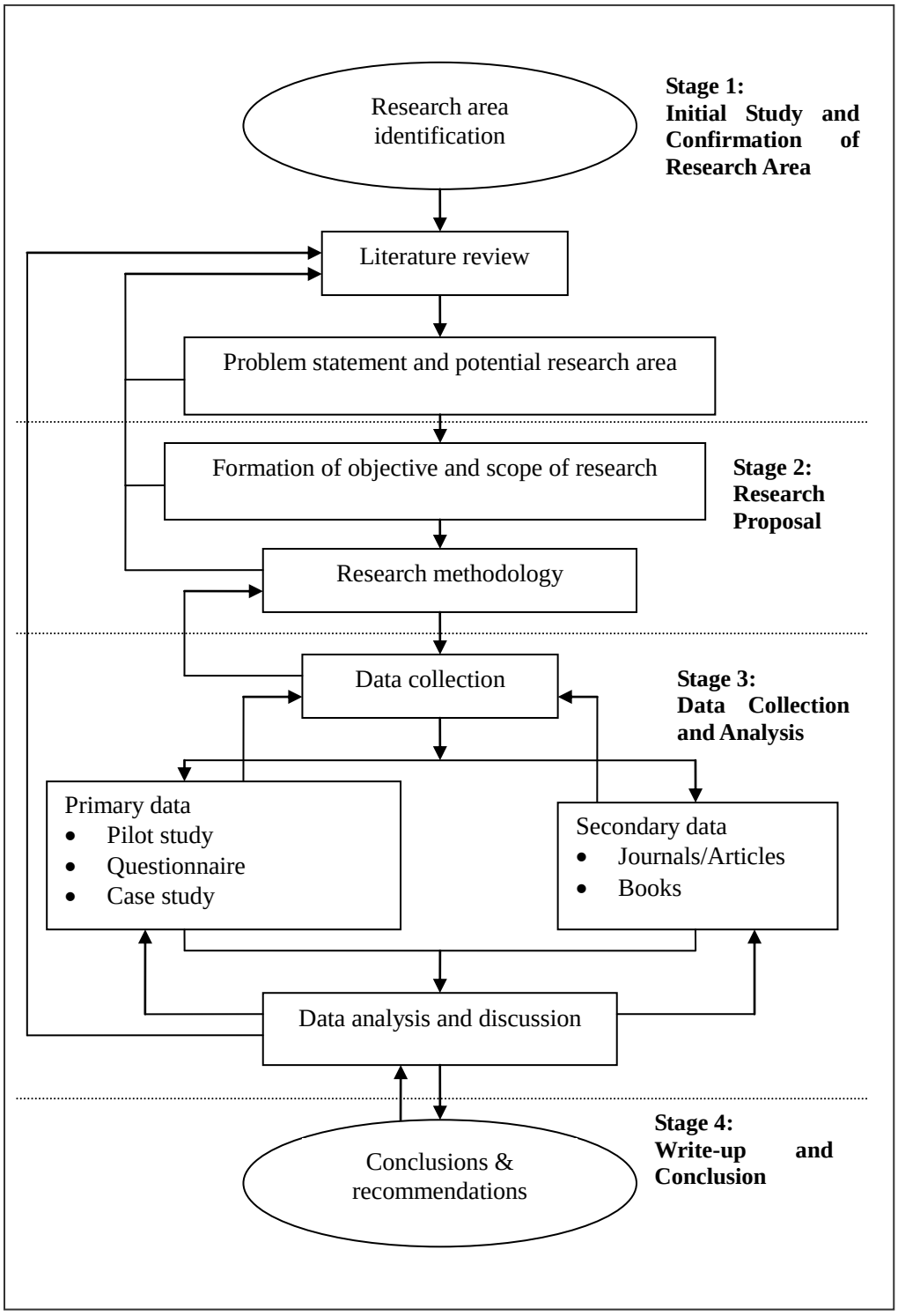

Figure 1.1: Research Methodology Flow

1.8 Layout of Dissertation

This research is organised into five chapters. Each of them is described in following sequence:

Chapter 1 (Introduction) presents the introduction, problem statement, aim, research objectives, scope of study, research significance and research methodology.

Chapter 2 (Literature Review) gives a general overview of Malaysian construction industry, the roles of Quantity Surveyors, threats to quantity surveying profession and methods to improve performance of graduate Quantity Surveyors. Based on the literature review, a questionnaire survey is designed and been further discussed in chapter 3.

Chapter 3 (Research Methodology) describes the types of research methodology in detail. Methods of calculation also will be introduced.

Chapter 4 (Results and Discussions) demonstrates the results of questionnaires. With statistical analysis, the significant factors of objective 1, 2 and 3 in the survey have been determined.

Chapter 5 (Case Studies), three cases are studied to improve the quality of the proposed factors among objective 1, 2 and 3. The analysis of the cases basically demonstrated their roles, threats and methods.

Finally, Chapter 6 (Conclusion and recommendation) concludes the summary of findings obtained from this study, recommendations and research limitation of the research, and provides some suggestions regarding on future research.

1.9 Summary

The Quantity Surveying profession has evolved since changing of clients' need and market requirements. Today, clients not only request the traditional services but also ask for the additional services in the changing construction industry. The scope of works for Quantity Surveyors is no longer limited to measurement and other regular practices. They will also be expected to provide additional services beyond this boundary. Quantity Surveying firms will need a team of graduates and professional quantity surveyors to offer additional related services like project management, value management, facilities management, knowledge management etc to internationalise their services.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will present and discuss the general background for Malaysian construction industry, Quantity Surveyors and their professional bodies, traditional and contemporary roles of Quantity Surveyors, threats to quantity surveying profession, and methods to improve performance of graduate Quantity Surveyors.

2.2 General background of Malaysian Construction Industry

Refer to Tony (2006), the Malaysian construction industry employs a workforce of about 2 million people and it engages support services from a wide range of skilled professional from architects to engineers, from arbitrators to quantity surveyors, from accountant to lawyers. Furthermore, it produces some of the best examples of engineering and building work in the world like Kuala Lumpur Twin Tower, Kuala Lumpur International Airport and Sepang Formula One Circuit.

Despite the global economic uncertainty, this industry is expected to record RM90 billion worth of projects in 2012 driven by government and private projects (The Edge Daily, 2012). Hence, the construction industry could be described as a substantial economic driver for Malaysia.

2.3 The Definition of Graduate Quantity Surveyors and Professional Quantity Surveyors

Graduate means a person who has completed his university education (Cambridge, 2003, p.544) while Seeley (1997, p.36-65) defined a Quantity Surveyor is professionally trained, qualified and experienced in dealing with the problem in construction industry on behalf of the employer.

In Malaysia, the Board of Quantity Surveyor, Malaysia (Lembaga Juruukur Bahan, Malaysia) (2009, p.3) has decided that from January 2002, only students admitted to the Quantity Surveying courses on the current list of recognized qualifications will be eligible on graduation to apply for registration with the Board without any topping up requirement. Graduates from universities whose quantity surveying courses are not on the list will be required to sit and pass the paper in the Institution of Surveyors Malaysia (ISM) Direct Final Exam before being eligible to apply for registration with the Board.

In addition, the requirements for registration as Registered Quantity Surveyor (Reg. QS) in Malaysia generally consist of the holding of a degree in quantity surveying, two-year's practical experience under the mentorship of a Registered QS, and must have passed the Test of Professional Competence conducted jointly by the BQSM and ISM.

In summary, a graduate Quantity Surveyor is not a professional Quantity Surveyor. A Graduate Quantity Surveyor is a person who has completed his study in a university recognised by the BQSM and ISM, applies

for registration to become graduate member. On the other hand, a professional Quantity Surveyor is a person who has been qualified and registered as Registered Quantity Surveyor. He/she have two-year's working experience under the mentorship of a Registered QS and have passed the Test of Professional Competence conducted jointly by the BQSM and ISM.

2.3.1 The Quantity Surveying Profession in Malaysia

In Malaysia the Quantity Surveying profession is governed by the Quantity Surveyors Act 1967 (incorporating all amendments up to 28 February 2002) (LJBM, 2002, p.5-14) and Regulations promulgated in terms of the Act. Only persons registered with the Board of Quantity Surveyors, Malaysia (BQSM) and The Institution of Surveyors, Malaysia (ISM), the Statutory Body, are permitted to call themselves "Registered Quantity Surveyors" (Reg. QS) and perform work reserved for registered quantity surveyors. At the same time, to be a graduate quantity surveyor member must holds a qualification in quantity surveying recognised by the Board (Section 10(1)(a) of the Act). This is open for those who are fresh graduates from the institute of higher learning which are recognised by BQSM. As at February 2014, 1013 registered Quantity Surveyors and 1442 graduate Quantity Surveyors were registered with the BQSM.

Besides, there are some requirements for the firms or Body Corporates which want to register with the Board as Quantity Surveying practices. The shareholding of a partnership or body corporate shall be consist of 100% Registered QS. The name of firms or companies shall be permitted by the

Board. There are 345 Quantity Surveying practices which were registered with BQSM up to February 2014.

2.3.2 Nature and Functions of the Malaysian Professional and Associated Bodies

There are a number of professional bodies connected with the Malaysian Construction Industry and these will be listed and described, together with their main functions.

2.3.2.1 Board of Quantity Surveyors Malaysia (BQSM)

The BQSM (2012), this body was set up by an Act of Parliament, i.e. Registration of Quantity Surveyor Act 1967, Act 487 (revised 1992). The Board consists of a President, a Registrar and sixteen members appointed by the Minister of Works, Malaysia. The main functions of this body are to keep and maintain a register of quantity surveyors, a register of firms and bodies corporate practising as consulting quantity surveyors, approve or reject applications for registration or to approve any such applications subject to such restrictions as the Board may deem fit, order suspension, cancellation, or removal of registered quantity surveyors or firms or bodies corporate from the register, fix from time to time, with the approval of the Minister of Public Works, the scales of fees for the provision of consulting quantity surveying services, hear and determine disputes relating to professional conduct or ethics of quantity surveyors, determine and regulate the professional conduct and ethics of the quantity surveying profession, review and approve, whenever necessary, the list of recognised qualifications necessary for the registration of

provisionally registered Quantity Surveyors and do everything necessary to carry out the provisions of the Quantity Surveyors Act.

2.3.2.2 The Institution of Surveyors, Malaysia (ISM)

ISM is the professional institution representing the surveying profession in Malaysia and consists of four main divisions: Property Consultancy Valuation Surveying Division (PCVSD), Geomatic and Land Surveying Division (GLSD), Quantity Surveying Division (QSD) and Building Surveying Division (BSD). The main duties under this institution: to secure the advancement and facilitate the acquisition of that knowledge which constitutes the profession of a surveyor, namely the art, science and practice promote the general interests of the profession and to maintain and extend its usefulness for the public advantage (ISM, 2011, p.1).

2.3.2.3 The Royal Institution of Chartered Surveyors (RICS)

RICS is the pre-eminent organisation of its kind in the world. Their members offer the very best advice on a surprisingly diverse range of land, property, construction and related environmental issues. The RICS is not a professional body whose members provide services provide quantity surveying services alone. The RICS also provides services include services by other RICS Divisions as well such as Land surveyors, Valuers, Property Managers and Auctioneers, and Building Surveyors. As part of their role, they help to set, maintain and regulate standards. With around 100,000 qualified members and over 50,000 students and trainees in some 140 countries, RICS provides the world's leading professional qualification in land, property, construction and the associated environmental issues (RICS, 2011).

2.4 Traditional and Contemporary roles of Quantity Surveyors

Royal Institution of Chartered Surveyors (RICS) prepared a report, *The Future Role of the Quantity Surveyor*, in 1971 which defined the work of the quantity surveyor as:

"ensuring that the resources of the construction industry are utilised to the best advantage of society by providing, *inter alia*, the financial management for projects and a cost consultancy service to the client and designer during the whole construction process."

In 1983, RICS produced a report, *The Future Role of the Chartered Quantity Surveyor*, the changing and shifting scene, the requirements of clients and their dissatisfaction with the services provided by construction professionals generally and their frequent disappointment with the products that they received are the issues which were examined in the report. Hence, it is very important to refine the services of Quantity Surveyors or Cost Engineers, to play a pro-active and efficient role during the progress cycle of projects (Brummer, 2004).

Moss (2004) described a Quantity Surveyor is a person skilled in all aspects of the construction process and building life cycle. He or she able to manage cost efficiently, equating quality and value with individual client needs. Besides, he/she must also have strong financial analytical, interpretive and teamwork skills. In his report, the roles of Quantity Surveyor are divided to three stages: historic, contemporary and future roles of Quantity Surveyor.

Historic roles of Quantity Surveyor (Moss, 2004):

1. Measurement, quantification, preparation of Bills of Quantities
2. Preparation of contract documents
3. Cost planning
4. Cost control
5. Procurement advice
6. Contract administration

Contemporary roles of Quantity Surveyor (Moss, 2004):

1. Construction planning & procurement
2. Client advocate and representative
3. Construction administration and management
4. Construction design and economics
5. Project management

Future roles of Quantity Surveyor (Moss, 2004):

1. Auditors
2. Facilitators
3. Leaders
4. Managers of the development process

The findings by Moss as shown as front page had identified different roles of a Quantity Surveyor: historical roles, contemporary roles and future roles. There are also many authors had their own opinions and findings on roles of Quantity Surveyor as well. Their findings are explained as follow.

Zack (2004) clearly demonstrated the effective role that the quantity surveyor could play in respect of the new areas of environment, claims and safety:

1. Environment: Management of the environmental force of a project is becoming very paramount and the Cost Engineer or Quantity Surveyor should play an essential role in respect of risk analysis, alternative selections, budgeting, control and cost planning.
2. Claims: As a result of cost of dispute resolution, arbitration and legislation; claims should be handled effectively. As these are areas where the Cost Engineer or Quantity Surveyor are very active it should be a centre area of the professions in respect of convincing parties, negotiations, adjudication and assessing claims in a fair and rational manner.
3. Health and Safety: Health and safety have become very paramount issues all over the world, this need proper management to ensure more suitable working circumstances for people. The Quantity Surveyor or Cost Engineer should play a role in respect of planning for health and safety as well as controlling cost in respect of risks, premiums, insurances and alternative selection.

Burnside and Westcott (1999) reported construction project management and facilities management are two specialist areas which encompass the entire construction process and could become the principal strands for the future direction of the Quantity Surveying profession. Both disciplines are potential areas where the Quantity Surveyor can add real value.

Indeed, both could come under the broader umbrella of Quantity Surveyors as ‘management consultants in the construction industry’. Arbitration has been a traditional specialisation of the more experienced members of the Quantity Surveying profession, but increasing interest in Alternative Dispute Resolution will create more opportunities for Quantity Surveyors to provide mediation services.

Additionally, Simpson (1996) did a survey to identify the new areas that help graduates carry out their work at current and also in futureUnder the new specialisation, the most popular options were Risk Analysis, Facilities Management, Project Management, Change management and Environmental Management.

The role of Quantity Surveyor has changed due to the demands of both the the construction client and construction industry. (Cartlidge, 2006, p.1). Smith (2004) pointed out the Quantity Surveying profession has experienced significant changes over the past 10 years in terms of type and scope of services provided outside and within the construction sector. As a result, Quantity Surveying firms develop and adapt their scope of services to fulfil changing industry requirement. According to him, the scopes of services provided by firms in Australia are summarised and shown as following:

Traditional Services (Smith, 2004)

1. Contract admin
2. Specification preparation
3. Builders Quantities

4. Bills of Quantities
5. Estimating/Cost Planning

Non-Traditional Building Services (Smith, 2004)

1. Cost benefit analysis
2. Due diligence reports
3. Premises Audits
4. Post Occupancy Evaluation
5. Facilities management
6. Quality management
7. Value management
8. Project management
9. Risk management
10. Insurance valuation
11. Expert witness
12. Arbitration/mediation
13. Tax advice
14. Construction Planning
15. Life Costs
16. Feasibility study
17. Other

Non-Building services (Smith, 2004)

1. Civil works
2. Research/Publishing
3. Marine works

4. Infrastructure works
5. Petrochemical
6. Transport
7. Aeronautical
8. Ship Building
9. Manufacturing
10. Mining
11. Other

Zakaria et al. (2006), the roles of Quantity Surveyors have been diversified in areas such as oil and gas, taxation, insurance valuation and several other areas. Thus quantity surveyors need to expand and include an ever-widening scope of services. According to Lenard (2000), the basic characteristics of the abilities and knowledge are important as those can lead them to become a competent quantity surveyor or project cost engineer. Computer and Information Technology Literacy is necessary for them to understand and know how apply the basic computer skills.

Based on McGraw (2007), more recently there has been a shift towards the title of Cost Manager rather than the traditional term of Quantity Surveyor. There are many ways for the Quantity Surveyor to genuinely take on the role of Cost Manager. Cost planning process is the one of the example. In UK, Quantity Surveyor also has a hand in project management which it is vastly different to the current model in Australia. Additionally, perhaps the most important service that the Quantity Surveyor can offer to its clients is

independence from other consultants and contractors. This is essentially especially in an industry where the level of integrity is often questioned.

Although McGraw mentioned that the traditional term of Quantity Surveyor has been shift towards Cost Manager recently, but the term 'Quantity Surveying' is already an established and well-known brand in the former British colonies such as Malaysia and some other parts of the world. Changing this 'brand name' now, in order to reflect the enlarged services that could be provided by QS firms might confuse potential clients and could lead to a loss of customers and potential students entering the profession.

Since the roles of Quantity Surveyors are evolved significantly according to the different papers by above authors, this is what graduate Quantity Surveyor should learn and acquire to make themselves marketable. At first this meant developing project management services, followed by the provision of development appraisals, lifecycle costing, facilities management and other services. Although Quantity Surveyors do still provide traditional services, this is now throughout the world, and today they service new industries and offer a wider spread of clients (Davies, 2006).

2.5 Threats to Quantity Surveying Profession

Without discerning future directions and actively preparing for changes, Quantity Surveyors stand at a risk of receiving revolutions as threats rather than opportunities (Frei and Mbachu, 2009). In this section, Fee competition, Professional Indemnity Insurance, CAD, Conservatism/Inability

to Change, Other Professions, Poor Marketing, Quality of Graduates, Basic Function and New Ways to Manage Contracts are identified as the major factor inducing the change in quantity surveying profession.

2.5.1 Severe Fee Competition

Although the tariff of fees is being used as a basis for fee negotiation, the competitiveness of the market has forced Quantity Surveyors to submit discounted fee proposals that usually falls somewhere between the recommended fees as published and a fee that is far below a fair remuneration for the services offered (Snyman and Cruywagen, 2006). The main threat facing by the Quantity Surveying profession is fee cutting and bidding between firms. Many authors have identified intensive or severe fee competition is the significant factor that influences current market (Bowen and Rwelamila, 1995; Boon, 1996; Smith, 2004; Hasmawati, 2006; Davies, 2006).

This threat is more relevant to quantity surveying practice as a whole. However, they have implication to the Quantity Surveyors. Quantity Surveyors are one of the key players in the construction industry. They are service-based that provide consultancy and manage financial-related issues for their clients. Quantity Surveyors will be servicing their clients from appointment until project concludes with a certain amount of professional fees which in turn, will be used to sustain their companies. Thus, the survival and eventually growth of the firms shall depend on the number of projects they service.

When fee competition is getting severe, it will influence the number of the projects they service. This will not only affects the growth of company but also affected the promotion and salary of Quantity Surveyors.

2.5.2 Professional Indemnity Insurance (PII)

Professional Indemnity Insurance (PII) indemnifies the insured against legal liability arising from professional activities. In the context of the construction industry, these activities include architectural and engineering design, cost monitoring and control from Quantity Surveyors, procurement and management from project manager etc. It is essential that parties providing these services maintain PII, as their resources are unlikely to be sufficient to meet anything other than minor claims (Johnson and Dracoulis, 2007). Regards this, Smith (2004) explained insurance premiums have increased from 100% to 800% for Quantity Surveying firms in the last few years despite Quantity Surveying is relatively low risk compared to other occupations in the industry. Yet the comprehensiveness and quality of this insurance has declined at the same time. The figure of insurers in this market has decreased from about ten to three of four.

PII is not only vital for company yet also important to Quantity Surveyor. Quantity Surveyors represent their company providing project management services to client. Company will be held responsible for any negligent caused.

2.5.3 Computer Aided Design (CAD)

Many firms saw the development of automatically generated quantities and CAD as a main threat especially in terms of the technical role of Quantity Surveyor (Smith, 2004). This idea also supported by Frei (2009), CAD is a potential threat to the Quantity Surveyors. Whereas the more enlightened firms trust that, the greatest threat actually lies in not implementing CAD and CAD measurement and developing with and being integrally involved in its expansion.

2.5.4 Conservatism/Inability to Change

According to Marsh and Flanagan (2000) and Sun and Howard (2003), the construction sector has for many years been a leading segment in engineering and design. According to them, nowadays' construction industry is recognised as a world leader in relation to problem solving and innovation. Nevertheless, even the construction industry's position is tough in relation to the matters mentioned above, when compared with other industries, the application and practice of Information Technology (IT) has been somewhat lacking (Sun and Howard, 2003).

Shen et al. (2003) revealed that the level of IT applications among Quantity Surveying companies in the local industry is relatively low in comparison with other developed countries. This low usage is perhaps related to the conservatism of the industry, whereby a "wait and see" approach is very common. Smith (2004) also agreed that the quantity surveying profession is perhaps more traditional than most in terms of IT utilisation. The incapability to re-engineer and transform processes to take full benefit of technological

advances was dragging the profession down. Too many firms focussed on the usual technical role of the Quantity Surveyor and were not equipped or able of raising their services to a more proficient and higher value-adding level.

2.5.5 Competition from Other Professions

There is very competitive in the construction industry market recently. As mentioned by Smith (2004), project cost management is not the unique domain of the quantity surveying profession. There are a number of other experts bringing out this service as well as many others with the potential to perform so. Besides, more "in-house" facility provision by larger firms or companies and the packaging of services under a "one-stop shop" approach was also recognised by many respondents.

Frei (2009) also agreed competition from other professions such as lawyers, accountants, valuers, property managers, management consultants etc., providing substantially similar, construction and property based services is one of the threats. The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction are the potential threats to Quantity Surveyor.

2.5.6 Poor Marketing

Refer to Smith (2004), effective marketing is possibly even more vital than is the case with other vocations. Nevertheless, many firms think that the profession as a whole was badly advertised and that the piece-meal approaches applied by individual firms were of no real advantage to the

profession as a whole. There is a clear message coming through from the opinions was that smaller firms believed that they required more support from the professional bodies in marketing their services.

Low and Kok (1997) expressed although Quantity Surveyors are aware of the necessitate to develop the way their services ought to be marketed, a lot of Quantity Surveyors still do not seem to pay enough awareness to marketing. The most frequent reason cited by Quantity Surveyors for not implementing marketing thoroughly is that they have been doing well and felt that they will keep on to do well exclusive of the need for market planning.

2.5.7 Quality of Graduates

For a number of years industrial practitioners have expressed a strong opinion that graduates of industry-focused courses should be capable of immediately undertaking skilled technical tasks. In the context of Quantity Surveying, practitioners frequently express the opinion to their university lecturer colleagues that the intellectual caliber of Quantity Surveying graduates is laudable, but the level of technical skill is lamentable. These criticisms are increasingly becoming formalised (Andrews and Derbyshire, 1993). Lay (1998) also uttered the graduate quality was declining in surveying profession.

In the study conducted by Smith (2004), some respondents were displeased with the performance of graduates especially in terms of core skills in construction knowledge and measurement. Furthermore, some of them are

found that graduates are not attracted in the technical measurement role. The core competencies and skills in the profession were declining generally.

2.5.8 Lack of Interest from School Leavers

"Quantity Surveyors are still hard to find, so we snap up good candidates whenever we can find them," says Morgan Est HR director Andrea Walton (Mann, 2008). Obviously, the surveying profession attracted fewer graduates (Lay, 1998). Smith (2004) viewed the greatest problem facing is the deteriorating level of interest revealed by school leavers in the profession.

2.5.9 Basic Functions

The basic or traditional functions of the Quantity Surveyor are estimating, evaluation of variations and finalising of accounts. Coincidentally, through not surprisingly, chief architect was not satisfied with the services of the Quantity Surveyor with which fall under these three functions (Hiew and Ng, 2007). Apparently, Quantity Surveyors still do not function well in their traditional services.

2.5.10 Management of Contract

There is another change that has appeared, the clients today began looking for new ways of managing contracts (Davies, 2006). Kennedy and Akintoye (1995) pressed that in recent years many forms of procurement have developed to address some of the shortcomings of the traditional procurement methods. The major procurement forms developed over the past two decades are management contracting and construction management, which are characterised by their construction time saving advantage. However, it has

been recognised by clients that these methods have some inherent disadvantages. Therefore, the most recent development in procurement forms is Design and Build. It is generally recognised that this method gives all the speed of management contracting along with price certainty. Anyhow, Ashworth (2002, p.297-318) stressed various procurement methods for various reasons and requirements are applied, such as construction management, design and manage, measured term contracts and cost plus.

2.6 Methods to Improve Performance of Graduate Quantity Surveyors

The Quantity Surveying profession is changing and must change further since they are facing threats in the industry. As described earlier, Quantity Surveyors are the one of the key players in the industry and their companies are service-based. So Quantity Surveyors must be aware of their importance in the company and make effort to improve their practice. They need to adapt to changes in many areas and repackaging in order to maintain and enhance competitive advantage and profitability.

2.6.1 Maintain and Develop Professional Expertise in Core Competencies

Smith (2004) noticed that first and leading firms need to make sure that their Quantity Surveyors have adequate professional knowledge in the core competencies and expertise of the profession and carry on to develop this skill. Practitioners need to be far more flexible and willing to alter their standard work practices than in the past. Hasmawati and Johan (2006) also

mentioned Quantity Surveyor today has to adapt to changes in work patterns. For example, with the advancement of technologies, it has carried E-Tendering into the equation of procurement. E-Tendering does supply the Quantity Surveyor with productivity-enhancing capabilities. Quantity Surveyor must well understood during the process of tendering (Seah, 2004).

2.6.2 Learn, Utilise and Evolve with CAD

As the number of parties in the construction process using computers increased (architects, Quantity Surveyors, engineers, contractors, consultants), there was increasing duplication of data, and so integration was recommended. Smith (2004; 2006) mentioned all construction professionals need to develop and expand skill in CAD sooner rather than later. CAD systems such as AutoCAD, Microstation, ArchiCAD, etc will be at the focus of future virtual projects and information management system. Therefore, professionals will require CAD qualifications and knowledge just to be a player.

2.6.3 Resources/ Invest in Necessary Technology

Today, there are many commercially developed software packages targeted at aiding the performance of quantity surveying duties (Odeyinka, 2008). To enable the offering of a better service, it is necessary to enhance Information Technology (IT) and Information Communication Technology (ICT) (Tse and Wong, 2004).

According to Simpson (1996), IT is the one that was highlighted most. Graduates are more sophisticated in their requirement of IT. Grant (2004)

agreed that to enable staff to function in a diverse business model they need to be developed, trained and displayed so that maximum flexibility exists. Therefore, resources are important to train the staff. Smith (2004), many firms cite cost and the time required to gain knowledge of CAD and other technology/software as the main inhibitors in the IT area. Besides of the CAD programs, the specialist automated quantities software like CostX, Eclipse, and Buildsoft Take Off System (BTOS) are identified as the three commonly used by the respondents in the survey (Smith, 2006).

2.6.4 Diversification/Specialisation of Services

Grant (2004) proposed aims and objectives expected at related areas (facilities management etc.) may give the Quantity Surveyor a constant earnings stream enabling the professional to become less dependent and more independent on the rise and fall of traditional revenue areas. Diversification may consequently be part of further strategies. Smith (2004) also agreed that this diversification is seen by many as significant to the prospect of the profession as a whole. Quantity Surveyors need to diversify their scope of services to better fulfil industry/client needs and to secure their long term future.

2.6.5 Continuing Professional Development (CPD), Education, Training, Research and Mentorship

The RICS has a requirement that members must undergo a minimum number of CPD training hours each year. This is currently seen as a mechanistic process to be followed in order to place an appropriate tick in an appropriate box. CPD's benefit is to genuine continuation of education and

learning undertaken by the professional so as to underpin and enhance their professional practice (Cartlidge, 2002, p259-277). Anyhow, Individuals undertake CPD, not only to satisfy their professional body's requirements, but to ensure credibility with colleagues and employers, improve current job performance, widen and deepen the capacity to perform in the current role and develop future capacity to enable promotion and progression (Roscoe, 2002).

This statement also supported by Pearl (2004), if wisely administered CPD programmes, it can prove to be the catalyst in improving quantity surveyor's service levels. It is important that submissions be carefully scrutinised to ensure that registered practitioners are gaining meaningful exposure to material which can enhance their knowledge/ skills base.

Grant (2004) elaborated that strategic assets such as education and training should be, enchanced to make sure that the role of the professions is in fact workable, dynamic and efficient. Zuhairuse et al. (2009a; 2009b) also opine that it is generally thought that the method to ensure high-quality performance of the workforce is via the development of education, training, and CPD. According to this conviction, the Malaysian construction industry began many initiatives to support its employees.

Verster et al. (2008), the Quantity Surveying profession in South Africa is experiencing change with a strong emphasis on improving education, research and training. It is proposed that to be seen as a learned society, a profession must ensure that the five pillars of a learned society are developed to its highest levels and on par with world-class professions. The five pillars

of a learned profession (education, research, training, mentorship and CPD) may assist the Quantity Surveying profession to develop its position as a learned society.

2.6.6 Procurement Options

The Quantity Surveyor may encourage the multi-procurement method to allow the client to manage the effects of time and cost, continuing to allow space for development, sustained design, contractor involvement and effective professional service. The method relies on generating timely procurement documents, on a provisional basis, referred to provisional design information. The Quantity Surveyor executes a very important duty in the implementation of the project. Thus, the introduction of useful contract conditions and the appropriate selection of a suitable procurement method that will allow the contracting parties to concentrate on the work at hand should obtain from pro-active, knowledge-based guidance to the client, taking all aspects and situation of the proposed project into account (Verster, 2004).

Frei (2009) also support that increased involvement in *alternative* procurement methods such as package deals, managed and cost plus contract, design and build contracts and turnkey offers.

2.6.7 Knowledge Management (KM)

Delong (2004) asserted that '*losing knowledge may have impacts that are very tangible and financially quantifiable, or impacts can be intangible and hard to measure*'. With the help of a KM system, knowledge is shared and stored and thus the risk of losing the knowledge can be minimised. Davis

et al. (2007), clients have an increased expectation of the service offered by quantity surveyors and this coupled with greater competition both internally (from the profession) and externally has resulted in a challenge to their professional status. To meet these challenges quantity surveyors need to enhance their professionalism and status in order that practitioners can maintain a competitive advantage. Knowledge is a key feature of the surveyor's portfolio and therefore effective knowledge management skills can help to improve their expertise.

Same as proposed by Grant (2004), the knowledge base is one of the important elements for sustainable competitive advantage. This could only be certified if the facility adds value to the market and market requirements. Prokesch (1997) also opined the ability of the Quantity Surveying profession to meet changing client needs and to grow the market for professional services depends on the knowledge base of the profession. Frei (2009), development and execution of knowledge management (KM) systems to develop, capture, employ and maintain the intangible knowledge assets of organisations.

2.6.8 Marketing Mix

Van der Merwe (1976) said that the image of the marketing is changing. Some observations indicate that many firms in Europe and the US are beginning to realise the need to market their services and are anxious to improve their marketing activities (Arditi and Davis, 1988). Marketing is beginning to achieve widespread acceptance as an essential part of doing business (Rwelamila and Lethola, 1998). Quantity surveying firms have traditionally placed many emphasis on implementation rather than on strategic

planning as they believed that only action will make things happen. These firms have to now realise the significance of planning and to make more efforts into planning. To accomplish a successful marketing approach, the firm has to offer not only a target market but also a marketing programme. This programme device how each of the seven marketing mix variables (i.e. the seven Ps) can be utilised as a guide to reach at the competitive position that the firm wants to engage in the target market. The seven Ps can be approached by professional Quantity Surveyor are product, price, place, promotion, people, physical evidence and process (Low and Kok, 1997).

2.6.9 Stay Competency through Practical

A competency-based review of professional quantity surveying is important for service excellence (Nkado and Mayer, 2001). Simpson (1996), respondents identified practical methods of gaining competencies. Mainly through Work Shadow, Foster Firm schemes, Year Out Period and Practical Work Experience. Also by Problem Based Learning, Simulated Exercises and Role Play.

2.6.10 Strategies for Developing Graduate Attributes

It is vital for develop graduate attributes in case to produce ‘better’ graduate quantity surveyors, more prepared for the workplace. Zou et al. (2005) found the identification of strategies that students think could help them attain the graduate attributes sought by the employers. Students placed significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way. For example, they asked for group-work opportunities to help them develop the teamwork skills that will be

fundamental in their professional lives. They also asked for more contact with industry, including site visits and guest lecturers.

2.7 Conclusion

In a nutshell, this chapter presented the critical review for the traditional and contemporary roles of Quantity Surveyors in the construction industry, threats to quantity surveying profession and the methods to improve performance of graduate Quantity Surveyors in the construction industry. Roles of Quantity Surveyors can be categorised into three major groups: Traditional Services, Non-Traditional Building Services and Non-Building Services which recommended by Smith (2004). As stated above, services in each category were the combination of different author's finding. The detail breakdown of services can be found in the pilot questionnaire (see Appendix A).

Twelve threats were carefully designed and produced as pilot questionnaire (see Appendix A). The designation of threats was actually based on the ten major threats. Two of the major threats: Conservatism/Inability to Change and Poor Marketing; had to further split into four individual threats due to the long content. So there are twelve threats in total.

Lastly, thirteen methods were carefully chosen and produced as pilot questionnaire (see Appendix A). Same as threats, the designation of the chosen methods was according to the ten main methods. Three of the ten main methods: Maintain and Develop Professional Expertise in Core Competencies,

Resources/ Invest in Necessary Technology and Procurement Methods; are also further split to six methods due to long paragraph. Thus there are thirteen methods in total.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The research objectives have been formulated to address the problem statement in Chapter 1. In Chapter 2, the literature review for this study has been discussed. In this chapter the research methodology used in the study is described. The primary research methodologies of this study included questionnaire and case study.

3.2 Methodology

Although there are many types of method available, yet only certain major research methods were chosen for conducting this research. The reason for adopting the former method is that it can reach a wide range of respondents, thus providing reliable statistical analysis (Lee, 2005).

3.2.1 Pilot Study

Naoum (1998, p.65-90) demonstrated that a pilot study provides a trial run for the questionnaire, which involves testing the wording of the question, identifying ambiguous questions, testing the technique to collect the data, etc. Thus, it is absolutely essential to do a complete pilot study to verify the completeness of the questionnaire in capturing the factors before distributing the questionnaire for this study.

Referred to a comprehensive literature review, a list of the roles of Quantity Surveyors, threats to Quantity Surveying profession and the possible methods to improve performance of graduate Quantity Surveyors was produced and designed as a pilot questionnaire. A pilot test was undertaken via three of the total sample of ten selected for this study in order to ensure that every question was stated appropriately that respondents could clearly understand the concepts and able to answer the questions. The three respondents agreed that the questionnaire was sufficient to capture the roles, threats and methods to improve. Therefore, we only did some correction on spelling in the questionnaire.

3.2.2 Questionnaire

A questionnaire survey is one of the most effective methods to involve a huge number of people in order to achieve better results, as suggested by McQueen and Knussen (2002) and Andi and Minato (2003). Questionnaire survey is known as a method which questioning individuals on a topic or topics and then describing their responses (Jackson, 2011, p.17). It can be delivered to the participant via personal (intercept, phone), or no personal (computer-delivered, mail-delivered) (Cooper and Schindler, 2008; p.223).

The final version of the questionnaire (see Appendix B) after the pilot test was developed to assess the perceptions of consultant, contractor and developer on the importance (RII), frequency of occurrence (FI) and severity (SI) of the identified roles, threats and methods. The questionnaire questions comprise five sections. The first section (Section A) requested background

information about the respondents. The second section of the questionnaire (Section B) focussed on the roles of Quantity Surveyors. The respondents were asked to indicate their response category on thirty-nine well recognised roles. The roles were categorised into three major groups: Traditional Services, Non-Traditional Building Services and Non-Building Services. A five-point Likert scale ranging from 1 (strongly not important) to 5 (strongly important) and a three-point Likert scale ranging from 1 (low frequency) to 3 (high frequency) were adopted to capture the relative importance index (RII) and frequency index (FI) of roles.

At the same time, third section (Section C) of the questionnaire concentrated on the threats to quantity surveying profession. Twelve threats were identified. The forth section (Section D) focussed on the methods to improve performance of graduate Quantity Surveyors. Thirteen methods were identified. Similar with the Section B, the respondents were asked to indicate their response on Section C and D by using the five-point Likert scale. This method was adopted to capture the relative importance index (RII) of threats and methods of graduate Quantity Surveyors' practice.

3.3 Survey Target

The sampling method used in this study was convenience and snowball sampling. This sampling comes under the class of non-probability sampling techniques. Sample elements are identified by convenience (friends) and through referral networks. This method of sampling is preferred when it is

hard to find respondents from sample elements selected at random (Sekaran, 2000, p.285-298).

The finalised questionnaires were distributed through my friends working in consultants, contractors and developer companies. My friends in turn distributed to their friends. This sampling method enables me to obtain a large number of completed questionnaires economically. The data collection exercises were held in Malaysia over a period of four months. One hundred and two sets were returned out of one hundred-fifty questionnaires. However three sets were eliminated because of defects and incomplete information.

3.4 Calculation of Relative Importance Index (RII) , Frequency Index (FI) and Severity Index (SI)

The five-point likert scale ranged from 1 (strongly not important) to 5 (strongly important) and three point likert scale ranged from 1 (low frequency) to 3 (high frequency) were adopted in this study within various groups (i.e. consultants, contractors and developers). Hence, relative importance index (RII), frequency index (FI), and severity index (SI) were used to transform the feedback from respondents.

The "importance index" (RII) was derived for each factor with the following formula (Lim and Alum, 1995; Abdul Kadir et. al. 2005).

$$RII = \frac{5N_1 + 4N_2 + 3N_3 + 2N_4 + N_5}{5(N_1 + N_2 + N_3 + N_4 + N_5)}$$

Where $\mathbf{N_1}$ is the number of respondents who answered "strongly important", $\mathbf{N_2}$ the number of respondents who answered "important", $\mathbf{N_3}$ the number of respondents who answered "neutral", $\mathbf{N_4}$ the number of respondents who answered "not important", and $\mathbf{N_5}$ the number of respondents who answered "strongly not important".

The respondents were asked to rate the frequency of occurrence for each factor according three ordinal scales: low (1), medium (2) or high (3). The "frequency index" (FI) for each factor was derived from the following formula (Lim and Alum, 1995; Abdul Kadir et. al. 2005):

$$FI = \frac{3N_1 + 2N_2 + N_3}{3(N_1 + N_2 + N_3)}$$

Where $\mathbf{N_1}$ is the number of respondents who answered "low", $\mathbf{N_2}$ the number of respondents who answered "medium", and $\mathbf{N_3}$ the number of respondents who answered "high".

Finally, an overall index, the multiplication of "importance index" (RII) by the "frequency index" (FI) was named the "severity index"(SI). The severity index was used to rank the overall implication of each factor (Lim and Alum, 1995; Abdul Kadir et. al. 2005).

"Severity index" = "Important index" x "Frequency Index"

3.5 Reliability Test

The reliability of the five-point likert scale was determined using Cronbach's alpha coefficient of Statistical Program for the Social Sciences (SPSS) software on the samples. As suggested by Pallant (2010, p.100), values for alpha above 0.70 are considered acceptable; however, values above 0.80 are preferable. Nunnally (1978, p.245) also recommends that instruments used in basic research have reliability of about 0.70 or better. He adds that increasing reliabilities much beyond. 0.80 is a waste of time with instruments used for basic research.

3.6 Kruskal-Wallis Test

The one way independent ANOVA has a non-parametric counterpart called the Kruskal-Wallis test (Kruskal and Wallis, 1952). This test is used when we wish to compare three or more sets of scores that come from different groups. Field (2005) mentions that this test can be useful way on non-normally distributed data or have violated some other assumption. Kruskal-Wallis test on SPSS will be implemented to get the output. This test is useful to identify the differences between the three different category respondents (consultants, contractor, and developers) in this research.

3.7 Mann-Whitney Test

Mann-Whitney test is very similar to that of Kruskal-Wallis test. It is used to test differences between two conditions and different participants. This test is the non-parametric equivalent of the independent *t*-test. (Field, 2005). This test will be run after the results of Kruskal-Wallis are identified. This test can used to identify the differences in between consultants and contractor, contractor and developer, consultants and developer.

3.8 Case Study

Three case studies were also presented to make this study more persuasive. A further explanation and analysis for the cases are given in Chapter 5.

3.9 Conclusion

The technique adopted for this study was based on a structured questionnaire survey of three principal target groups: consultants, contractors and developers within the Malaysian construction industry. The researcher used this sample of questionnaire (after pilot test) to collect the data from ninety-nine satisfactory completed responses. This questionnaire had both closed and open-ended questions.

In short, this chapter described the research methodology, including the sample, data collection instruments as well as strategies used to ensure the ethical standards, reliability and validity of the study.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The final version of questionnaire (after pilot test) were distributed and completed by ninety-nine respondents from consultants, contractors and developers. Details of questionnaire results are elaborated in this chapter.

4.2 Results from Questionnaire (Section A)

The demographic characteristics of the respondents are given in Table 4.1.

Table 4.1: Demographic characteristic of respondents

Demographic characteristics	Frequency	Percent
Working experience		
<5 years	70	70.7
5-10 years	12	12.1
11-20 years	11	11.1
>20 years	6	6.1
Position in workplace		
Director	4	4.0
Partner	2	2.0
Senior Quantity Surveyor	17	17.1
Quantity Surveyor	5	5.1
Junior Quantity Surveyor	50	50.5
Assistant Quantity Surveyor	2	2.1
Contract Executive	5	5.1
Assistant Contract Manager	2	2.1
Other	12	12.0
Nature of work		
Consultancy	50	50.5
Contractor	43	43.4
Developer	6	6.1
Member of any QS professional institution		
Yes	25	25.5
No	74	74.5
Highest academic qualification		
Certificate/diploma	18	18.2
Bachelor degree	67	67.6
Master degree	8	8.1
Advanced diploma	6	6.1
Where to obtain the QS qualification?		
Malaysia	83	83.8
Oversea	9	9.1
Twinning	7	7.1
University's syllabus met the needs of construction industry?		
Yes	92	92.9
No	7	7.1

As shown in the table 4.1, fifty respondents (50.5%) were from consultants, forty-three (43.4) from contractors and six (6.1%) from developers. Append below are the direct observations from the completed questionnaire returned by the respondents and its analysis. Table 4.1 shows the years of working experiences and the posts held by respondents. The range of personal experience and skill of the respondents in terms of number of years in the construction industry is between <5 - >20 years; this provides a diverse spread of personal experience in the sample. A total of twenty-eight (28) respondents (28.2%) are from Quantity Surveyor (QS) posts and above (senior Quantity Surveyor, partner and director), fifty (50) respondents (50.5%) occupy junior posts, and the remaining twenty-one (21) respondents (21.3%) consist of other positions (assistant Quantity Surveyor, contract executive, assistant contract manager, etc). Although there is 50.5% respondents occupy junior post, but based on academic background of the respondents, there is 75% of the respondents have a Bachelor Degree as their highest academic qualification so it is reasonable to assume that they have reasonable knowledge in quantity surveying.

4.3 Results from Questionnaire (Section B)

The adoption of relative importance index, RII, to identify the ranking assigned to each role, we were able to determine the most important roles of Quantity Surveyors in Malaysian construction industry based on the highest value and descending to the lowest.

Table 4.2: Relative importance index (RII) and ranking of the roles of Quantity Surveyors

Services performed by Quantity Surveyor	Consultant		Contractor		Developer	
	RII	Rank	RII	Rank	RII	Rank
Traditional services						
Procurement	0.832	5	0.781	6	0.800	8
Tendering	0.880	3	0.860	2	0.867	4
Contract administration	0.864	4	0.819	5	0.800	8
Specification preparation	0.764	8	0.730	8	0.800	8
Builders Quantities (refer to builder)	0.812	6	0.860	2	0.833	7
Bills of Quantities (refer to SMM)	0.920	1	0.893	1	0.900	1
Estimating/Cost planning	0.892	2	0.856	4	0.900	1
Non-Traditional Building Services						
Cost benefit analysis	0.708	14	0.707	12	0.867	4
Due diligence reports	0.636	21	0.619	21	0.633	19
Premises Audits	0.600	27	0.567	32	0.533	33
Post Occupancy Evaluation	0.576	32	0.581	29	0.533	33
Facilities management	0.584	29	0.577	31	0.567	27
Quality management	0.648	20	0.693	15	0.667	18
Value management	0.728	11	0.684	16	0.767	12
Project management	0.720	13	0.772	7	0.700	16
Risk management	0.672	16	0.707	12	0.633	19
Commercial management	0.608	25	0.642	20	0.733	15
Change management	0.616	23	0.586	26	0.500	35
Environmental Management	0.604	26	0.586	26	0.500	35
Insurance valuation, premiums and alternative selection	0.684	15	0.651	19	0.600	23
Expert witness	0.624	22	0.586	26	0.567	27
Arbitration/mediation	0.660	18	0.619	21	0.500	35
Tax advice/taxation	0.588	28	0.563	35	0.500	35
Construction Planning	0.656	19	0.730	8	0.867	4
Life Cycle Costs	0.668	17	0.656	18	0.767	12
Feasibility study	0.796	7	0.674	17	0.800	8
Financial management	0.752	9	0.707	12	0.900	1
Land surveying	0.544	34	0.614	24	0.767	12
Non-Building Services						
Research/Publishing	0.580	30	0.563	33	0.600	23
Civil works	0.728	12	0.716	10	0.633	19
Infrastructure works	0.740	10	0.712	11	0.700	16
Marine works	0.580	30	0.577	30	0.633	19

Transport	0.536	35	0.595	25	0.600	23
Ship Building	0.536	35	0.530	36	0.600	23
Aeronautical	0.512	37	0.493	39	0.533	30
Mining	0.512	37	0.535	37	0.567	27
Manufacturing	0.508	39	0.563	33	0.533	30
Petrochemical/ Oil and gas	0.560	33	0.526	38	0.467	39
Computer and Information Technology Literacy	0.616	23	0.628	23	0.533	30

Based on these ranking, a clear depiction of the roles as perceived by consultants, contractors and developers can be shown. In the Traditional Services category, it is obvious that these seven services are very important to these three groups but their ranking may not be in the same order. The consultants, contractors and developers all have indicated that the preparation of the *Bills of Quantities* as the highest rank i.e. 1st place. This means that the function of *Bills of Quantities* preparation is the common most important role among all despite their differences in working culture.

When come to Non-Traditional Building Services and using the top ten roles as the basis for comparison, it is starting to show the differences in their requirements by each group. In Non-Traditional Building Services category, consultants perceived *Feasibility study* (7th) and *Financial management* (9th); contractors perceived *Project management* (7th) and *Construction planning* (8th); and the developers perceived *Financial management* (1st), *Cost benefit analysis* (4th), *Construction planning* (4th) and *Feasibility study* (8th) as their main requirements. The results show that different organisations have different specialisation. The consultants need the Quantity Surveyor to be able to prepare a business case, project execution plan and financial plan; the contractors require them to be good in monitoring

construction project progress; and the developers want them to be strong in financial plan, costing and business strategy.

In Non-Building Services category, *Infrastructure works* (10^{th}) was selected by consultants; *Civil works* (10^{th}) was selected by contractor; and none of the above roles was selected by developer. This again shows that each group has particular specialisation. The consultants require the Quantity Surveyor to be able to specialise in the measurement and design–of roads, railway, bridges, canal; the contractors need them to be good in the measurement of telecommunication, water supply, and power station; and the developers do not want the Quantity Surveyor to put their concentration on Non-Building Services area.

Table 4.3: Frequency index (FI) and ranking of the roles of Quantity Surveyors

Services performed by Quantity Surveyor	Consultant		Contractor		Developer	
	F.I	Rank	F.I	Rank	F.I	Rank
Traditional services						
Procurement	0.800	5	0.752	7	0.833	5
Tendering	0.893	1	0.822	4	0.889	1
Contract administration	0.873	3	0.814	5	0.833	5
Specification preparation	0.773	6	0.752	7	0.778	8
Builders Quantities (refer to builder)	0.767	7	0.837	3	0.778	8
Bills of Quantities (refer to SMM)	0.893	1	0.899	1	0.889	1
Estimating/Cost planning	0.873	3	0.884	2	0.889	1
Non-Traditional Building Services						
Cost benefit analysis	0.627	13	0.713	12	0.889	1
Due diligence reports	0.553	20	0.628	19	0.556	22
Premises Audits	0.520	23	0.566	26	0.500	32
Post Occupancy Evaluation	0.487	31	0.550	28	0.556	22
Facilities management	0.487	31	0.566	26	0.556	22
Quality management	0.567	18	0.698	14	0.611	18
Value management	0.647	12	0.659	16	0.611	18
Project management	0.660	11	0.775	6	0.667	11
Risk management	0.593	16	0.659	17	0.611	18
Commercial management	0.507	25	0.612	20	0.667	11
Change management	0.500	26	0.527	32	0.500	32
Environmental Management	0.500	26	0.519	34	0.556	22
Insurance valuation, premiums and alternative selection	0.587	17	0.605	21	0.667	11
Expert witness	0.500	26	0.519	35	0.556	22
Arbitration/mediation	0.560	19	0.512	36	0.556	22
Tax advice/taxation	0.500	26	0.527	31	0.556	22
Construction Planning	0.553	20	0.729	11	0.778	8
Life Cycle Costs	0.600	15	0.589	23	0.667	11
Feasibility study	0.727	8	0.597	22	0.667	11
Financial management	0.680	9	0.705	13	0.833	5
Land surveying	0.473	34	0.566	25	0.667	11
Non-Building Services						
Research/Publishing	0.493	30	0.519	33	0.556	22
Civil works	0.667	10	0.744	9	0.611	18
Infrastructure works	0.613	14	0.744	9	0.667	11
Marine works	0.507	24	0.550	28	0.556	22

Transport	0.480	33	0.628	18	0.556	22
Ship Building	0.433	36	0.504	37	0.444	35
Aeronautical	0.420	39	0.442	39	0.444	35
Mining	0.433	36	0.488	38	0.389	38
Manufacturing	0.427	38	0.566	24	0.444	35
Petrochemical/ Oil and gas	0.473	35	0.527	30	0.389	38
Computer and Information Technology Literacy	0.553	20	0.659	15	0.500	32

With regards the above ranking, it is attractive to do the comparison with the roles as perceived by consultants, contractors and developers in terms of frequency based on the top ten ranking.

In Traditional Services category, based on the frequency of its requirement, it is no doubt that the consultants, contractors and developers have similar expectation from the Quantity Surveyor but with slight variation in their ranking. Although they belong to different groups, the result show a similar trend as reflected in the RII where the preparation of the *Bills of Quantities,* occupy the highest frequency. This means that the preparation of the *Bills of Quantities* is not only the most vital role but also the most demanding service in the construction industry by all the three groups.

While in Non-Traditional Building Services category, the consultants selected *Feasibility study* (8^{th}) and *Financial management* (9^{th}). For the contractors, they selected *Project management* (6^{th}). For the developers, they selected *Cost benefits analysis* (1^{st}), *Financial management* (5^{th}) and *Construction planning* (8^{th}). From the findings, it shows that different types of organisations have the different frequency of its usage to suit the working

requirement and this may have an impact on the severity index as described below.

In Non-Building Services category, the consultant respondents ranked *Civil works* (10^{th}). The contractor respondents ranked *Civil works* (9^{th}) and *Infrastructure works* (9^{th}) as the same place. For the developer respondents, non-building services are not important to be provided by the Quantity Surveyor.

Table 4.4: Severity index (SI) and ranking of the roles of Quantity Surveyors

Services performed by Quantity Surveyor	Consultant		Contractor		Developer		Overall	
	S.I	Rank	S.I	Rank	S.I	Rank	S.I	Rank
Traditional services								
Procurement	0.666	5	0.588	7	0.667	7	0.631	6
Tendering	0.786	2	0.707	4	0.770	3	0.777	2
Contract administration	0.755	4	0.666	5	0.667	7	0.710	4
Specification preparation	0.591	7	0.549	8	0.622	10	0.574	7
Builders Quantities (refer to builder)	0.623	6	0.720	3	0.648	9	0.666	5
Bills of Quantities (refer to SMM)	0.822	1	0.803	1	0.800	1	0.812	1
Estimating/Cost planning	0.779	3	0.756	2	0.800	1	0.770	3
Non-Traditional Building Services								
Cost benefit analysis	0.444	14	0.504	12	0.770	3	0.492	12
Due diligence reports	0.352	21	0.388	21	0.352	22	0.368	20
Premises Audits	0.312	23	0.321	26	0.267	32	0.313	24
Post Occupancy Evaluation	0.280	32	0.320	27	0.296	28	0.299	32
Facilities management	0.284	31	0.326	25	0.315	26	0.305	30
Quality management	0.367	20	0.484	14	0.407	18	0.419	16
Value management	0.471	12	0.451	16	0.469	15	0.462	13
Project management	0.475	11	0.599	6	0.467	16	0.527	8
Risk management	0.399	17	0.466	15	0.387	20	0.424	15
Commercial management	0.308	25	0.393	20	0.489	14	0.354	22
Change management	0.308	25	0.309	31	0.250	35	0.309	26
Environmental Management	0.302	27	0.304	32	0.278	29	0.302	31
Insurance valuation, premiums and alternative selection	0.401	15	0.394	19	0.400	19	0.398	19
Expert witness	0.312	23	0.304	33	0.315	26	0.309	26
Arbitration/mediation	0.370	18	0.316	30	0.278	29	0.341	23
Tax advice/taxation	0.294	28	0.297	34	0.278	29	0.295	33
Construction Planning	0.363	20	0.532	10	0.674	6	0.450	14
Life Cycle Costs	0.401	15	0.386	22	0.511	12	0.401	17
Feasibility study	0.578	8	0.403	18	0.533	11	0.400	18
Financial management	0.511	9	0.499	13	0.750	5	0.509	9
Land surveying	0.257	34	0.347	24	0.511	12	0.309	26
Non-Building Services								
Research/Publishing	0.286	30	0.292	35	0.333	24	0.292	34
Civil works	0.485	10	0.533	9	0.387	20	0.500	10
Infrastructure works	0.454	13	0.530	11	0.467	16	0.498	11
Marine works	0.294	28	0.317	29	0.352	22	0.308	29

Transport	0.257	34	0.374	23	0.333	24	0.310	25
Ship Building	0.232	36	0.267	37	0.267	32	0.250	37
Aeronautical	0.215	39	0.218	39	0.237	36	0.218	38
Mining	0.222	37	0.261	38	0.220	38	0.233	39
Manufacturing	0.217	38	0.318	28	0.237	36	0.258	36
Petrochemical/ Oil and gas	0.265	33	0.277	36	0.181	39	0.265	35
Computer and Information Technology Literacy	0.341	22	0.414	17	0.267	32	0.367	21

SI is an overall index (see explanation in Chapter 3). The findings from Table 4.4 on the Traditional Services, Non-Traditional Services and Non-Building Services categories based on the top ten severity index shall provide a very good indicator of the skills and knowledge of the Quantity Surveyors in the Malaysian construction industry required by each group as summarised in the following table.

According to the ranking of Table 4.4, the ten most severe roles of Quantity Surveyors as perceived by consultants were: (1) *Bills of Quantities* (SI=0.822); (2) *Tendering* (SI=0.786); (3) *Estimating/Cost planning* (SI=0.779); (4*) Contract administration* (SI=0.755); (5) *Procurement* (SI=0.666); (6) *Builders Quantities* (SI=0.623); (7) *Specification preparation* (SI=0.591); (8) *Feasibility study* (SI=0.578); (9) *Financial management* (SI=0.511); and (10) *Civil works* (SI=0.485). Ten most severe roles of Quantity Surveyors as perceived by contractors were: (1) *Bills of Quantities* (SI=0.803); (2) *Estimating/Cost planning* (SI=0.756); (3) *Builders Quantities* (SI=0.720); (4) *Tendering* (SI=0.707); (5) *Contract administration* (SI=0.666); (6) *Project management* (SI=0.599); (7) *Procurement* (SI=0.588); (8) *Specification preparation* (SI=0.549); (9) *Civil works* (SI=0.533); and (10) *Construction planning* (SI=0.532). While the ten most severe roles of Quantity Surveyors as perceived by developers were: (1) *Bills of Quantities*

(SI=0.800); (1) *Estimating/Cost planning* (SI=0.800); (3) *Tendering* (SI=0.770); (3) *Cost benefit analysis* (SI=0.770); (5) *Financial management* (SI=0.750); (6) *Construction planning* (SI=0.674); (7) *Procurement* (SI=0.667); (7) *Contract administration* (SI=0.667); (9) *Builders Quantities* (SI=0.648); and (10) *Specification preparation* (SI=0.622).

Apparently, this result shows that these three groups selected the same variable, *Bills of Quantities* preparation as the most important role in the Malaysian construction industry. This is same with the results of RII and FI which *Bills of Quantities* was in the 1st place as well. Referring to the SI ranking of each group, it is obvious that these three groups concurred with the roles in Traditional Services category since all of them were in top ten SI ranking. This result is consistent with the results of RII and FI.

Furthermore, consultant respondents perceived *Feasibility study* and *Financial management* in Non-Traditional Building Services as the top ten SI roles; these two roles were within top ten ranking of RII and FI list also. Contractors perceived *Project management* and *Construction planning* in Non-Traditional Building Services within the top ten ranking of the SI; *Project management* which was ranked in top ten lists of RII and FI but *Construction planning* managed to be within the top ten SI ranking due to the contribution of RII. This shows *Construction planning* is needed in overall performance by contractor. For developers, they perceived *Cost benefit analysis*, *Financial management* and *Construction planning* as important roles in overall performance. This result is consistent with the results of RII and FI.

In addition, consultants and contractors perceived the same role, *Civil works* as the top ten SI ranking in Non-Traditional Building Services category. For consultants, *Civil works* managed to be within the top ten SI ranking due to the contribution of FI. This shows *Civil works* is required in overall performance by consultant. For contractors, *Civil works* managed to be within top ten SI ranking because of this role was ranked in both top ten lists of RII and FI. This indicates *Civil works* is a vital role for them. Once again, developers showed that the non-building services are not necessary to be provided by the Quantity Surveyor. This result is consistent with the results of RII and FI.

From the above observations, it can be seen that, in order for the Quantity Surveyor to be of value and stay competitive in construction industry under the various potential employers, they must acquire the various skills and knowledge as required by each category of employer as shown by the individual top ten SI listed above. The Quantity Surveyors have to be well equipped with the knowledge and skills in the traditional services during undergraduate. They could then later on in their working life pursue further studies so as to equip themselves with the necessary additional knowledge and skills in one or more of the of the non-traditional QS services.

The last column in this table presents the overall SI ranking for all respondent groups. Overall SI ranking here is essential for the development of the syllabus for the university. This is because some subjects here such as *Specification Preparation* and *Risk Management* are not emphasised in Universities. Hence universities can refer and make use of the top fifteen

overall SI ranking as the guideline to develop their course structure and they are: (1) *Bills of Quantities* (SI=0.812); (2) *Tendering* (SI=0.777); (3) *Estimating/Cost planning* (SI=0.770); (4) *Contract Administration* (SI=0.710); (5) *Builders Quantities* (SI=0.666); (6) *Procurement* (SI=0.631); (7) *Specification Preparation* (SI=0.574); (8) *Project Management* (SI=0.527); (9) *Financial Management* (SI=0.509); (10) *Civil Works* (SI=0.500); (11) *Infrastructure Works* (SI=0.498); (12) *Cost Benefit Analysis* (SI=0.492); (13) *Value Management* (SI=0.462); (14) *Construction Planning* (SI=0.450); and (15) *Risk Management* (SI=0.424). It is useful to ensure that future graduates stay relevant in the construction industry.

Table 4.5: The Cronbach's Alpha test for roles

Cronbach's Alpha	Cronbach's Alpha based on Standardise items	N of items
.963	.961	39

The value for Cronbach's alpha was reported to be 0.963 as shown in Table 4.5. This indicating that the data collected from the survey questionnaire was internally consistent and the scale was consistent with the sample.

Table 4.6: The results of the Kruskal-Wallis One-Way ANOVA test for roles

Services performed by Quantity Surveyor	Overall Mean Score	Rank	Consultant (N=50)	Rank	Contractor (N=43)	Rank	Developer (N=6)	Rank	Chi-Square Value	Kruskal Wallis Sig p
Traditional services										
Procurement	4.04	6	4.16	5	3.91	6	4.00	8	2.573	0.276
Tendering	4.35	3	4.40	3	4.30	2	4.33	4	0.736	0.692
Contract administration	4.20	4	4.32	4	4.09	5	4.00	8	2.998	0.223
Specification preparation	3.76	7	3.82	8	3.65	8	4.00	8	0.563	0.755
Builders Quantities (refer to builder)	4.17	5	4.06	6	4.30	2	4.17	6	1.263	0.532
Bills of Quantities (refer to SMM)	4.54	1	4.60	1	4.47	1	4.50	1	0.801	0.670
Estimating/Cost planning	4.38	2	4.46	2	4.28	4	4.50	1	1.241	0.538
Non-Traditional Building Services										
Cost benefit analysis	3.62	12	3.60	13	3.53	12	4.33	4	5.039	0.080
Due diligence reports	3.14	22	3.18	21	3.09	22	3.17	19	0.065	0.968
Premises Audits	2.91	28	3.00	27	2.84	32	2.67	30	1.203	0.548
Post Occupancy Evaluation	2.88	31	2.88	32	2.91	29	2.67	30	0.626	0.731
Facilities management	2.90	30	2.92	29	2.88	30	2.83	27	0.130	0.937
Quality management	3.34	17	3.24	20	3.47	15	3.33	18	2.344	0.310
Value management	3.56	14	3.64	11	3.42	16	3.83	12	1.430	0.489
Project management	3.71	9	3.60	13	3.86	7	3.50	16	2.409	0.300
Risk management	3.42	16	3.36	16	3.53	12	3.17	19	1.708	0.426
Commercial management	3.15	21	3.04	25	3.21	20	3.67	15	2.319	0.314
Change management	2.98	25	3.08	23	2.93	26	2.50	35	2.067	0.356
Environmental Management	2.95	26	3.02	26	2.93	26	2.50	35	1.370	0.504

Table 4.6: The results of the Kruskal-Wallis One-Way ANOVA test for roles (continue)

Insurance valuation, premiums and alternative selection	3.32	19	3.42	15	3.26	19	3.00	23	0.833	0.659
Expert witness	3.02	24	3.12	22	2.93	26	2.83	27	0.963	0.618
Arbitration/mediation	3.16	20	3.30	18	3.09	22	2.50	35	3.313	0.191
Tax advice/taxation	2.86	33	2.94	28	2.81	33	2.50	35	0.883	0.643
Construction Planning	3.49	15	3.28	19	3.65	8	4.17	6	5.366	0.068
Life Cycle Costs	3.34	17	3.34	17	3.28	18	3.83	12	1.669	0.434
Feasibility study	3.72	8	3.98	7	3.37	17	4.00	8	9.119	0.010**
Financial management	3.71	9	3.76	9	3.53	12	4.50	1	5.151	0.076
Land surveying	2.94	27	2.72	34	3.07	24	3.83	12	5.086	0.079
Non-Building Services										
Research/Publishing	2.87	32	2.90	30	2.81	33	3.00	23	0.129	0.937
Civil works	3.59	13	3.64	11	3.58	10	3.17	19	1.645	0.439
Infrastructure works	3.63	11	3.70	10	3.56	11	3.50	16	0.463	0.793
Marine works	2.91	29	2.90	30	2.88	30	3.17	19	0.348	0.840
Transport	2.83	34	2.68	35	2.98	25	3.00	23	2.488	0.288
Ship Building	2.69	36	2.68	35	2.65	37	3.00	23	0.696	0.706
Aeronautical	2.53	39	2.56	37	2.47	39	2.67	30	0.249	0.883
Mining	2.63	38	2.56	37	2.67	36	2.83	27	0.723	0.697
Manufacturing	2.65	37	2.54	39	2.77	35	2.67	30	1.390	0.499
Petrochemical/ Oil and gas	2.70	35	2.80	33	2.63	38	2.33	39	0.888	0.642
Computer and Information Technology Literacy	3.08	23	3.08	23	3.14	21	2.67	30	1.309	0.520

* The mean difference is significant at the 0.05 level

** The mean difference is significant at the 0.01 level

The table 4.6 also provides the results of the Kruskal-Wallis One-Way ANOVA test for a k independent sample, and shows that only one out of thirty-nine variables has statistically significant difference of view between the groups at the five percent significant level. This significant variable is *Feasibility Study* ($_X^2$= 9.119, p=0.010<0.05). From the findings here, it implies that the data in Objective 1 is very relevant and highly consistent with the literature review sourced from Smith (2004) and additional roles provided by other authors (see Chapter 2). This is because there was only one difference among thirty-nine roles after subsequent analysis by the various approaches. A further analysis was carried out using Mann-Whitney U test on Feasibility Study to identify which among the three contributed to this observation.

Table 4.7: Mann-Whitney U Test: Mean Rank of Feasibility study

	Nature of work	N	Mean Rank	Sum of Ranks
Feasibility study	Consultant	50	54.31	2715.50
	Contractor	43	38.50	1655.50
	Total	93		
	Contractor	43	24.00	1032.00
	Developer	6	32.17	193.00
	Total	49		
	Consultancy	50	28.56	1428.00
	Developer	6	28.00	168.00
	Total	56		

Table 4.8: Mann-Whitney U Test: Test statistics of Feasibility study

	Feasibility study		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	709.500	86.000	147.000
Wilcoxon W	1655.500	1032.000	168.000
Z	-2.947	-1.384	-.084
Asymp. Sig. (2-tailed)	.003	.166	.933
Exact Sig. [2*(1-tailed Sig.)]		.200[a]	.949[a]

The Mann-Whitney U test of two independent samples is applied to the factor (*Feasibility study*) at the five percent significance level as shown in Table 4.7 and Table 4.8. In terms of *Feasibility study*, the initial observation shows a big gap between the ranking of consultant and contractor. In table 4.7, it shows mean rank and sum of ranks for the two groups tested. In this case, the consultant and contractor respondents had the highest variance of mean rank among three categories. The Mann-Whitney U test in Table 4.8 also shows that consultant/ contractor contributed to the differences between the groups in opinion at the five percent significance level (U= 709.50, p=0.003<0.05).

This indicates that consultants and contractors had extreme variance perception on *Feasibility Study*. Consultants and developers are normally involved in the initial part of the project to determine the feasibility of implementing a project; they need to be involved in preparation of impact analysis, regulatory analysis, risk analysis, technical/engineering analysis, economic analysis, financial analysis, and financial mechanism analysis.

Therefore, they need to specialise in Feasibility Study and carry out this task effectively and efficiently.

However, contractor is mostly involved in the implementation part. They are dealing with site planning, administration and control matters. Thus they had the different perception on this item.

In view of this, it also shows that consultant and developer have more expectation than contractor on *Feasibility Study* from Quantity Surveyors to suit their working culture. This means that various type of organisations have various expectation and requirement for Quantity Surveyors to work in their company.

4.4 Results from Questionnaire (Section C)

The results of RII and ranking of the threats to quantity surveying profession are presented in following Table 4.9.

Table 4.9: Relative importance index (RII) and ranking of the threats to quantity surveying profession

Threats	Consultant		Contractor		Developer		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Intensive or severe fee competition.	0.712	1	0.688	4	0.733	1	0.703	1
Professional insurance premiums have increased even QS is relatively low risk compared to other professions in the industry.	0.608	8	0.619	12	0.600	5	0.612	11
The development of CAD and automatically generated quantities result redundancy of QS roles.	0.616	6	0.637	9	0.633	4	0.626	7
The quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation.	0.588	11	0.670	7	0.533	9	0.620	8
Inability to change and re-engineer processes.	0.604	9	0.633	10	0.567	7	0.614	10
Competition from other professions providing substantially similar construction and property based services to clients.	0.600	10	0.693	3	0.600	5	0.640	6
The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction.	0.632	5	0.698	2	0.533	9	0.655	5

Table 4.9: Relative importance index (RII) and ranking of the threats to quantity surveying profession (continue)

QS profession as a whole was poorly marketed and that the piece-meal approaches adopted by individual firms were of no real benefit to the profession as a whole.	0.612	7	0.642	8	0.533	9	0.620	8
QS content easily although they are aware of the need to improve the way their services.	0.640	3	0.716	1	0.533	9	0.671	3
The quality of graduates is deteriorating particularly in terms of core skills in measurement and construction knowledge.	0.700	2	0.684	5	0.667	3	0.691	2
QS still do not function well in their basic or traditional functions, such as QS estimating, evaluation of variations and finalising of accounts.	0.576	12	0.623	11	0.567	7	0.596	12
Clients today began looking for new ways of managing contracts.	0.640	3	0.679	6	0.733	1	0.663	4

Table 4.9 presents twelve variables considered by survey respondents for the threats to quantity surveying profession. The analysis initially deals with ranking the variables based on their RII score values to identify their level of importance. Out of twelve factors, five factors are rated to be the five most important threats by the survey groups.

The consultant respondents ranked *intensive or severe fee competition* (RII=0.712) 1st, followed by *the quality of graduates is deteriorating particularly in terms of core skills in measurement and construction knowledge* (RII=0.700), *Quantity Surveyor content easily although they are aware of the need to improve the way their services* (RII=0.640), *clients today began looking for new ways of managing contracts* (RII=0.640) and *the client increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction* (RII=0.632). Similarly, the developer respondents follow similar perceptions by *intensive or severe fee competition* (RII=0.733) 1st, *clients today began looking for new ways of managing contracts* (RII=0.733) 1st, followed by *the quality of graduates is deteriorating particularly in terms of core skills in measurement and construction knowledge* (RII=0.667), *the development of CAD and automatically generated quantities result redundancy of Quantity Surveyor's roles* (RII=0.633), *professional insurance premiums have increased even Quantity Surveyor is relatively low risk compared to other professions in the industry* (RII=0.600) and *competition from other professions providing substantially similar construction and property based services to clients* (RII=0.600). This shows that these two groups selected

important variables that revolve around the issues of *intensive or severe fee competition* and *clients today began looking for new ways of managing contracts*, all of which are very much associated with the price and contract management offered by Quantity Surveyors.

The contractor respondents seem to have a diverse view by choosing *Quantity Surveyor content easily although they are aware of the need to improve the way their services* (RII=0.716) to be the most important threat (ranked 1st), followed by *the clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction* (RII=0.698), *competition from other professions providing substantially similar construction and property based services to clients* (RII=0.693), *intensive or severe fee competition* (RII=0.688) and *the quality of graduates is deteriorating particularly in terms of core skills in measurement and construction knowledge* (RII=0.684). The results suggest that the contractors in Malaysia currently have to face with Quantity Surveyors' attitude problem.

The overall RII ranking in last column of the above table presents the overall results of all respondents. With referring to the top six important threats, such as *Intensive or severe fee competition* (RII=0.703), *the quality of graduates is deteriorating particularly in terms of core skills in measurement and construction knowledge* (RII=0.691), *QS content easily although they are aware of the need to improve the way their services* (RII=0.671), *clients today began looking for new ways of managing*

contracts (RII=0.663), *the clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction* (RII=0.655), *competition from other professions providing substantially similar construction and property based services to clients* (RII=0.640). By understanding these threats and where they are coming from, it will definitely help the graduate Quantity Surveyor to neutralise them to stay employable in the construction industry, not in particular type of organisations but under a diverse type of employer or organisation.

Table 4.10: The Cronbach's Alpha test for threats

Cronbach's Alpha	Cronbach's Alpha based on Standardise items	N of items
.780	.779	12

The value for Cronbach's alpha was reported to be 0.780 (see Table 4.10) which greater than 0.70 for the scale to be reliable. This indicating that the data collected from the survey was interrelated and that the scale was consistent with the sample.

Table 4.11: The results of the Kruskal-Wallis One-Way ANOVA test for threats

Threats	Overall Mean Score	Rank	Consultant (N=50)	Rank	Contractor (N=43)	Rank	Developer (N=6)	Rank	Chi-Square Value	Kruskal Wallis Sig p
Intensive or severe fee competition.	3.52	1	3.56	1	3.44	4	3.67	1	1.315	0.518
Professional insurance premiums have increased even QS is relatively low risk compared to other professions in the industry.	3.06	11	3.04	8	3.09	12	3.00	5	0.092	0.955
The development of CAD and automatically generated quantities result redundancy of QS roles.	3.13	7	3.08	6	3.19	9	3.17	4	0.508	0.776
The quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation.	3.10	8	2.94	11	3.35	7	2.67	10	6.239	0.044*
Inability to change and re-engineer processes.	3.07	10	3.02	9	3.16	10	2.83	8	1.149	0.563
Competition from other professions providing substantially similar construction and property based services to clients.	3.20	6	3.00	10	3.47	3	3.00	5	6.047	0.049*

Table 4.11: The results of the Kruskal-Wallis One-Way ANOVA test for threats (continue)

The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction.	3.27	5	3.16	5	3.49	2	2.67	10	6.119	0.047*
QS profession as a whole was poorly marketed and that the piece-meal approaches adopted by individual firms were of no real benefit to the profession as a whole.	3.10	8	3.06	7	3.21	8	2.67	10	2.464	0.292
QS content easily although they are aware of the need to improve the way their services.	3.35	3	3.20	3	3.58	1	3.00	5	4.922	0.085
The quality of graduates is deteriotating particularly in terms of core skills in measurement and construction knowledge.	3.45	2	3.50	2	3.42	5	3.33	3	0.010	0.995
QS still do not function well in their basic or traditional functions, such as QS estimating, evaluation of variations and finalising of accounts.	2.98	12	2.88	12	3.12	11	2.83	8	2.165	0.339
Clients today began looking for new ways of managing contracts.	3.31	4	3.20	3	3.40	6	3.67	1	1.556	0.459
* The mean difference is significant at the 0.05 level										
** The mean difference is significant at the 0.01 level										

Table 4.11 also summarises the results of the Kruskal-Wallis One-Way ANOVA test for a k independent sample, and presents that three out of twelve variables have statistically significant difference of opinion between the groups at the five per cent significance level. These measures are: *the quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation* ($_X^2$=6.239, p=0.044<0.05); *competition from other professions providing substantially similar construction and property based services to clients* ($_X^2$=6.047, p=0.049<0.05); and *the clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction* ($_X^2$=6.119, p=0.047<0.05). This implies that the data in Objective 2 is relevant and consistent with the Literature Review in Chapter 2 since there were three differences among twelve threats. A further analysis was carried out using Mann-Whitney U test on the three differences to identify which among the three contributed to this observation.

Table 4.12: Mann-Whitney U Test: Mean Rank of threats

The quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation.	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	41.52	2076.00
	Contractor	43	53.37	2295.00
	Total	93		
	Contractor	43	26.12	1123.00
	Developer	6	17.00	102.00
	Total	49		
	Consultancy	50	28.89	1444.50
	Developer	6	25.25	151.50
	Total	56		
Competition from other professions providing substantially similar construction and property based services to clients.	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	40.98	2049.00
	Contractor	43	54.00	2322.00
	Total	93		
	Contractor	43	25.55	1098.50
	Developer	6	21.08	126.50
	Total	49		
	Consultancy	50	28.34	1417.00
	Developer	6	29.83	179.00
	Total	56		
The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction.	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	42.33	2116.50
	Contractor	43	52.43	2254.50
	Total	93		
	Contractor	43	26.37	1134.00
	Developer	6	15.17	91.00
	Total	49		
	Consultancy	50	29.31	1465.50
	Developer	6	21.75	130.50
	Total	56		

Table 4.13: Mann-Whitney U Test: Test statistics of threats

	The quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation.		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	801.000	81.000	130.500
Wilcoxon W	2076.000	102.000	151.500
Z	-2.267	-1.599	-.550
Asymp. Sig. (2-tailed)	.023	.110	.583
Exact Sig. [2*(1-tailed Sig.)]	-	.151[a]	.614[a]
	Competition from other professions providing substantially similar construction and property based services to clients.		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	774.000	105.500	142.000
Wilcoxon W	2049.000	126.500	1417.000
Z	-2.471	-.781	-.223
Asymp. Sig. (2-tailed)	.013	.435	.823
Exact Sig. [2*(1-tailed Sig.)]	-	.483[a]	0.846[a]
	The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction.		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	841.500	70.000	109.500
Wilcoxon W	2116.500	91.000	130.500
Z	-1.934	-1.929	-1.160
Asymp. Sig. (2-tailed)	.053	.054	.246
Exact Sig. [2*(1-tailed Sig.)]	-	.074[a]	0.291[a]

The Mann-Whitney U test of two independent samples is applied to the three selected threats (*the quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation, competition from other professions providing substantially similar construction and property based services to clients and the clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction*) at the five per cent significance level. The Table 4.12 shows the mean ranks of these three threats. Consultant and contractor respondents (consultant/contractor) had the highest variance of mean rank on the *competition from other professions providing substantially similar construction and property based services to clients*.

As shown in Table 4.13, consultant/ contractor contributed to the differences between the groups in opinion at the five percent significance level (U= 801.000, p=0.023<0.05) for the *quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation*. In terms of *competition from other professions providing substantially similar construction and property based services to clients*, consultant/ contractor also contributed to the differences between the groups in opinion at the five percent significance level (U= 774.000, p=0.013<0.05).

From the above findings, the consultant and contractor had extreme variance perception which is similar to Mann-Whitney U test result in section B.

In terms of *IT utilisation*, consultants and developers are using the IT applications (e.g. Buildsoft Take Off System, CostX, CAD) frequently in order to carry out their administration or paperwork efficiently. Both of these groups have invested a lot in IT applications and using them frequently. As a result, Quantity Surveyors in consultants and developers have many opportunities to learn them. On the other hand, contractors are not using IT applications as much as consultants and developers in relation to the above soft wares. Contractors are responsible in the implementation part of a construction project. Many contractors are working with their experience and using IT soft wares related to project planning and control. Therefore, quantity surveyors in contractor companies seldom deal with IT applications related to QS as compare with others. This is the main cause that the Quantity Surveyors seldom have the chance to be exposed to such soft wares. Therefore, quantity surveying profession in contractor companies are at a disadvantage compared with others and this issue can be a threat to Quantity Surveyors employability in other organisations.

For *competition from other professions*, consultants and developers are optimistic as both of them need each other in any of their future development and this is not a serious issue to them. Quantity Surveyors working under the Contractors are more pessimistic with their future growth. Since contractors are dependent upon the jobs available from the employer or developers and the economic situations of the country as they are the first to be impacted compare to other professions, this will interrupt the Quantity Surveyors' personal development and also affect their growth.

So Quantity Surveyors working under contractors are more exposed to this threat than consultants and developers.

4.5 Results from Questionnaire (Section D)

The results of RII and ranking of the methods to improve performance of graduate Quantity Surveyors as provided in Table 4.14.

Table 4.14: Relative importance index (RII) and ranking of the methods to improve performance of graduate Quantity Surveyors

Methods	Consultant		Contractor		Developer		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
QS shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise.	0.840	2	0.795	1	0.867	2	0.822	1
QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement).	0.860	1	0.786	2	0.733	10	0.820	2
All construction professionals need to utilise and gain expertise in CAD (eg. AutoCAD, Microstation, ArchiCAD, etc).	0.780	9	0.781	4	0.800	6	0.782	5
Investment in information technology (IT) and information communication technology (ICT) to improving productivity and performance.	0.812	3	0.786	2	0.733	10	0.796	3
The specialist automated quantities software like CostX, Eclipse, and Buildsoft Take Off System (BTOS) are the necessary technology to be applied.	0.776	10	0.707	13	0.700	13	0.741	12
QSs need to diversify their scope of services to better meet industry/client demands and to secure their long term future.	0.812	3	0.758	5	0.800	8	0.788	4
Through the process of education, training, research, training and Continuing Professional Development (CPD) to ensure high-quality performance of the workforce.	0.804	6	0.758	5	0.733	10	0.780	6

Table 4.14: Relative importance index (RII) and ranking of the methods to improve performance of graduate Quantity Surveyors (continue)

The QS needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement.	0.784	8	0.730	9	0.900	1	0.768	8
Increased involvement in *alternative* procurement methods such as managed and cost plus contract, package deals, turnkey offers and design and build contracts.	0.740	13	0.740	7	0.867	2	0.747	11
Development and implementation of knowledge management (KM) systems to capture, develop, maintain and employ the intangible knowledge assets of organisations.	0.748	12	0.716	11	0.767	9	0.735	13
The seven Ps (i.e. product, price, place, promotion, people, physical evidence and process) shall be adopted by QS and used as a guide to arrive at the competitive position that the firm wants to occupy in the target market.	0.756	11	0.735	8	0.833	4	0.752	10
Practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning).	0.792	7	0.716	11	0.833	4	0.762	9
Implement strategies for developing graduate attributes. Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g group-work, site visit and guest lecturers).	0.808	5	0.721	10	0.800	6	0.770	7

As presented in Table 4.14, the thirteen variables considered by survey respondents for the methods to improve graduate Quantity Surveyors' performance. The analysis primarily deals with ranking the variables based on their RII score values to determine their level of importance. Out of thirteen factors, five factors are rated to be the five most important methods by the survey groups.

The consultant respondents ranked *Quantity Surveyor today have to adapt to changes in work patterns (e.g. with the advancement of technologies, it has brought E-Tendering into the equation of procurement)* (RII=0.860) 1st, followed by *Quantity Surveyor shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise* (RII=0.840), *investment in information technology (IT) and information communication technology (ICT) to improving productivity and performance* (RII=0.812), *Quantity Surveyors need to diversify their scope of services to better meet industry/client demands and to secure their long term future* (RII=0.812) and *implement strategies for developing graduate attributes*. *Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g. group-work, site visit and guest lecturers)* (RII=0.808). Likewise, the contractor respondents ranked *Quantity Surveyor shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise* (RII=0.795) 1st, followed by *Quantity Surveyor today have to adapt to changes in work patterns (e.g. with the advancement of technologies, it has brought E-Tendering into the equation of procurement)* (RII=0.786), *investment in*

information technology (IT) and information communication technology (ICT) to improving productivity and performance (RII=0.786), *all construction professionals need to utilise and gain expertise in CAD (eg. AutoCAD, Microstation, ArchiCAD, etc)* (RII=0.781), *Quantity Surveyors need to diversify their scope of services to better meet industry/client demands and to secure their long term future* (RII=0.758) and *through the process of education, training, research, training and Continuing Professional Development (CPD) to ensure high-quality performance of the workforce* (RII=0.758). This shows that these two groups selected important variables that revolve around the methods of *Quantity Surveyor have to adapt to changes in work patterns, Quantity Surveyor shall have sufficient professional expertise and skills in the core competencies, investment in information technology (IT) and information communication technology (ICT), Quantity Surveyors need to diversify their scope of services*, all depends on the Quantity Surveyors' efforts and attitude to improve themselves.

Once again, the developer respondents seem to have a diverse view by choosing the *Quantity Surveyor needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement* (RII=0.900) as 1st place, followed by *Quantity Surveyor shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise* (RII=0.867), *increased involvement in alternative procurement methods such as managed and cost plus contract, package deals, turnkey offers and*

design and build contracts (RII=0.867), *the seven Ps (i.e. product, price, place, promotion, people, physical evidence and process) shall be adopted by Quantity Surveyor and used as a guide to arrive at the competitive position that the firm wants to occupy in the target market* (RII=0.833) and *practical methods are important to gain competencies (e.g. Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning)* (RII=0.833). These results suggest that the developers in Malaysia are currently looking for QS with multi-procurement method and marketing strategy skills to improve their performance. The results here also show that it is natural for the three different customer segments (consultants, contractors, developers) to have different emphasis in the proposing methods of improving the Quantity Surveyor graduates since their needs are different.

The last column in the table is the overall RII ranking for methods. The graduate Quantity Surveyors can employ the top six important methods: (1) *QS shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise* (RII=0.822); (2) *QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement)* (RII=0.0.820); (3) *Investment in information technology (IT) and information communication technology (ICT) to improving productivity and performance* (RII=0.796); (4) *QSs need to diversify their scope of services to better meet industry/client demands and to secure their long term future* (RII=0.788); (5) *All construction professionals need to*

utilise and gain expertise in CAD (eg. AutoCAD, Microstation, ArchiCAD, etc) (RII=0.782); and (6) *through the process of education, training, research, training and Continuing Professional Development (CPD) to ensure high-quality performance of the workforce* (RII=0.780) to improve their performance in a variety of specialisation instead of particular field.

Table 4.15: The Cronbach's Alpha test for methods

Cronbach's Alpha	Cronbach's Alpha based on Standardise items	N of items
.898	.899	13

Based on Table 4.15, the value for Cronbach's alpha was reported to be 0.898 indicating that the data collected from the survey was interrelated and that the scale was consistent with the sample.

Table 4.16: The results of the Kruskal-Wallis One-Way ANOVA test for methods

Methods	Overall Mean Score	Rank	Consultant (N=50)	Rank	Contractor (N=43)	Rank	Developer (N=6)	Rank	Chi-Square Value	Kruskal Wallis Sig p
QS shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise.	4.11	1	4.20	2	3.98	1	4.33	2	2.247	0.325
QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement).	4.10	2	4.30	1	3.93	2	3.67	10	6.774	0.034*
All construction professionals need to utilise and gain expertise in CAD (eg. AutoCAD, Microstation, ArchiCAD, etc).	3.91	5	3.90	9	3.91	4	4.00	6	0.030	0.985
Investment in information technology (IT) and information communication technology (ICT) to improving productivity and performance.	3.98	3	4.06	3	3.93	2	3.67	10	2.351	0.309
The specialist automated quantities software like CostX, Eclipse, and Buildsoft Take Off System (BTOS) are the necessary technology to be applied.	3.71	12	3.88	10	3.53	13	3.50	13	3.795	0.150
QSs need to diversify their scope of services to better meet industry/client demands and to secure their long term future.	3.94	4	4.06	3	3.79	5	4.00	6	3.466	0.177
Through the process of education, training, research, training and Continuing Professional Development (CPD) to ensure high-quality performance of the workforce.	3.90	6	4.02	6	3.79	5	3.67	10	2.637	0.268

Table 4.16: The results of the Kruskal-Wallis One-Way ANOVA test for methods (continue)

The QS needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement.	3.84	8	3.92	8	3.65	9	4.50	1	6.187	0.045*
Increased involvement in *alternative* procurement methods such as managed and cost plus contract, package deals, turnkey offers and design and build contracts.	3.74	11	3.70	13	3.70	7	4.33	2	3.049	0.218
Development and implementation of knowledge management (KM) systems to capture, develop, maintain and employ the intangible knowledge assets of organisations.	3.68	13	3.74	12	3.58	11	3.83	9	1.288	0.525
The seven Ps (i.e. product, price, place, promotion, people, physical evidence and process) shall be adopted by QS and used as a guide to arrive at the competitive position that the firm wants to occupy in the target market.	3.76	10	3.78	11	3.67	8	4.17	4	2.170	0.338
Practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning).	3.81	9	3.96	7	3.58	11	4.17	4	7.080	0.029*
Implement strategies for developing graduate attributes. Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g group-work, site visit and guest lecturers).	3.85	7	4.04	5	3.60	10	4.00	6	7.380	0.025*
* The mean difference is significant at the 0.05 level										
** The mean difference is significant at the 0.01 level										

Table 4.16 provides the results of the Kruskal-Wallis One Way ANOVA test for a k independent sample, and shows that four out of thirteen threat variables have statistically significant difference of opinion between the groups at the five per cent significant level. These measures are: *Quantity Surveyor today have to adapt to changes in work patterns (e.g. with the advancement of technologies, it has brought E-Tendering into the equation of procurement)* (x^2=6.774, p=0.034<0.05); *the Quantity Surveyor needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement* (x^2=6.187, p=0.045<0.05); *practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning)* (x^2=7.080, p=0.029<0.05); *and implement strategies for developing graduate attributes* ((x^2=7.380, p=0.025<0.05). This means that the data in Objective 3 is relevant and consistent with the Literature Review in Chapter 2 since there were only four differences among thirteen methods. A further analysis was carried out using Mann-Whitney U test on the four differences to identify which among the three contributed to this observation.

Table 4.17: Mann-Whitney U Test: Mean Rank of methods

QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement).	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	52.60	2630.00
	Contractor	43	40.49	1741.00
	Total	93		
	Contractor	43	25.38	1091.50
	Developer	6	22.25	133.50
	Total	49		
	Consultancy	50	29.60	1480.00
	Developer	6	19.33	116.00
	Total	56		
The QS needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement.	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	50.34	2517.00
	Contractor	43	43.12	1854.00
	Total	93		
	Contractor	43	23.29	1001.50
	Developer	6	37.25	223.50
	Total	49		
	Consultancy	50	27.33	1366.50
	Developer	6	38.25	229.50
	Total	56		
Practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning).	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	52.54	2627.00
	Contractor	43	40.56	1744.00
	Total	93		
	Contractor	43	23.73	1020.50
	Developer	6	34.08	204.50
	Total	49		
	Consultancy	50	28.11	1405.50
	Developer	6	31.75	190.50
	Total	56		
Implement strategies for developing graduate attributes. Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g group-work, site visit and guest lecturers).	Nature of work	N	Mean Rank	Sum of Ranks
	Consultant	50	53.36	2668.00
	Contractor	43	39.60	1703.00
	Total	93		
	Contractor	43	24.06	1034.50
	Developer	6	31.75	190.50
	Total	49		
	Consultancy	50	28.60	1430.00
	Developer	6	27.67	166.00
	Total	56		

Table 4.18: Mann-Whitney U Test: Test statistics of methods

	QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement).		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	795.000	112.500	95.000
Wilcoxon W	1741.000	133.500	116.000
Z	-2.354	-.544	-1.608
Asymp. Sig. (2-tailed)	.019	.587	.108
Exact Sig. [2*(1-tailed Sig.)]	-	.623[a]	.152[a]
	The QS needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement.		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	908.000	55.500	91.500
Wilcoxon W	1854.000	1001.500	1366.500
Z	-1.373	-2.434	-1.644
Asymp. Sig. (2-tailed)	.170	.015	.100
Exact Sig. [2*(1-tailed Sig.)]	-	.022[a]	.123[a]
	Practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning).		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	798.000	74.500	130.500
Wilcoxon W	1744.000	1020.500	1405.000
Z	-2.337	-1.829	-.584
Asymp. Sig. (2-tailed)	.019	.067	.559
Exact Sig. [2*(1-tailed Sig.)]	-	.097[a]	.614[a]

	Implement strategies for developing graduate attributes. Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g group-work, site visit and guest lecturers).		
	Consultant/ Contractor	Contractor/ Developer	Consultant/ Developer
Mann-Whitney U	757.000	88.500	145.000
Wilcoxon W	1703.000	1034.500	166.000
Z	-2.624	-1.358	-.142
Asymp. Sig. (2-tailed)	.009	.175	.887
Exact Sig. [2*(1-tailed Sig.)]	-	.223[a]	.908[a]

The Mann-Whitney U test of two independent samples is applied to the selected four factors at the five per cent significance level as shown in Table 4.17 and 4.18. With regards to *Quantity Surveyor today have to adapt to changes in work patterns (e.g. with the advancement of technologies, it has brought E-Tendering into the equation of procurement)*, the test showed it is the consultants/contractors respondent group contributed to the difference at the five per cent significance level (U=795.000, p=0.019). For the *practical methods are important to gain competencies (e.g. Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning)*, the test reveals that the consultants/contractors respondent group contributed to the difference at the five per cent significance level (U=798.000, p=0.019). In terms of *implement strategies for developing graduate attributes*, the test reveals once again that the consultants/contractors respondent group contributed to the difference at the five per cent significance level (U=757.000, p=0.009). For *the Quantity Surveyor needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained*

design, development, effective professional service and contractor involvement, the test shows that contractors/developers respondent group contributed to the difference at the five per cent significance level (U=55.500, p=0.015).

According to above results, it is noticeable that consultants and contractors had the highest variance of mean rank for three methods out of four methods. Overall results indicate that consultants are taking more initiative than contractors to improve their quantity surveying practice. Consultants are implementing many strategies for developing graduate attributes. Besides, consultants also encourage their graduate Quantity Surveyors in adapting to changes in work pattern and applying practical methods to improve competencies. Apparently, contractors think these methods are not that important to them thus they seldom use it to develop graduate Quantity Surveyors' practice.

Expectedly, contractors and developers had highest variance of mean rank in terms of *QS need to promote multi-procurement method*. Since developers are responsible in administration procedure, they are facing the selection of procurement method more frequent than contractors who responsible on project and site. Consequently, contractors and developers had diverse view in order to train and improve graduate Quantity Surveyors' practice.

4.6 Results from Questionnaire (Section E)

As the final part of survey questionnaire, respondents offered some advices and comments due to open-ended question, which were summarised as the following items:

- Quantity Surveyor still plays as an important role in any construction industry, but no doubt that the role of Quantity Surveyor could possibly be replaced by others someday, irrespective of the future scenario, the skills that a Quantity Surveyor should have as follows:

    - Quantity Surveyors shall improve their skills in terms of Information Technology or new software system to enhance their services;
    - Quantity Surveyors should have better knowledge or well in their core competencies (e.g. costing, contract and construction technology) to advance their performance;
    - Quantity Surveyors today must be multitasking and able to fulfil the clients' need.

Referring to above summary, the comments may not seem to be something new especially on the comment that Quantity Surveyors could be replaced by others and this may not happen in the actual practice due to the fact that Architects and engineers cannot take over the scope of works as Quantity Surveyors easily. Different professions have various strength and specialisation. Architects and engineers may not have the skills or time to

prepare contract document as Quantity Surveyors. This is the same with the multitasking issue, Quantity Surveyors may take over some of the scope of work of others such as legal, public relation and project monitoring as there are restriction imposed if they wanted to cross the other professional boundaries such as design which practiced by architects and engineers.

Under Quantity Surveyors requirement to improve their IT skills and have better knowledge during their university days, these comments may not be valid as IT skills and knowledge provided by the university to graduates are basic and fundamental concept only and not specialised soft-wares to suit the commercial requirements which are so diverse. With these exposures in University to graduate, they need to go out to work in the industry and gain the necessary experience from the actual practice in using the special soft-wares provided.

4.7 Conclusion

This chapter has produced detailed analysis of all sections of questionnaire. The Cronbach's Alpha test for section B (objective 1), section C (objective 2) and section D (objective 3) were reported greater than 0.700. This indicates the data collected from the survey was interrelated and reliable.

Firstly, the core or traditional roles (e.g. prepare the Bills of Quantities, tendering, estimating/cost planning) are the most important and frequent services performed by Quantity Surveyors and confirmed by the overall SI

ranking in section B. Secondly, intensive or severe fee competition is the major threat facing by Quantity Surveyors' profession in section C according to the overall RII ranking. Thirdly, the respondents agreed that the most effective method to improve the graduate Quantity Surveyor's practices is to acquire sufficient professional expertise and skills in the core competencies and continue to develop this expertise as shown by the overall RII ranking in section D. Lastly, respondents offered some comments based on their own view in section E and the reasons for not adopting it.

As seen from the findings from section B and D, the results have shown that the current industry's requirement and expectation from the graduates. This confirmed that the core roles or traditional services are necessary and frequent practice in Quantity Surveyors' profession; the graduate must have adequate fundamental knowledge to equip themselves to work in the commercial industry. The graduate must obtain the adequate basic knowledge from university and continue develop their knowledge based on the experience they gain from practical in the industry. By this method, they can provide their good quality services and stay competitive in the industry. This is a good solution to solve the threat of intensive or severe fee competition in section C. The severe fee competition would affect the number of new businesses the Quantity Surveying firm employing these graduate Quantity Surveyors can secure. Therefore, if the graduate Quantity Surveyors could provide the skills and service to the existing firm, the firm will be able to secure continued work from the industry players and this will ensure that the graduate Quantity Surveyor's stay relevant.

Furthermore, the contractors have been identified as the source of the diverse perception compared with the consultants and developers by using the Kruskal Wallis test and Mann-Whitney test. It is obvious that the contractors have their unique views on every issue based on the detailed discussion early in this chapter. This unique characteristic of the contractors has affected the answer provide by them. The results from these tests also indicate that contractors have different demand and requirement to graduate compared with consultants and developers.

CHAPTER 5

CASE STUDIES

5.1 Introduction

In this chapter, three cases were studied in order to improve the quality of the feedback for the roles, threats and methods identified among the categories (consultants, contractors and developers) in Chapter 4. The combination of questionnaires and case studies in this research are desirable in order to develop a more focus analysis of the objectives and to strengthen the quality of the results.

5.2 Description of Companies

One consultant, one contractor and one developer have been selected to identify the results among the categories (consultants, contractors and developers) as discussed in Chapter 4. These three companies have been chosen as case studies because they are established and reputable companies in Malaysian construction industry. Thus their feedback is valid and reliable for this research. The three companies to be conducted in this research were:

Company A: This company was established in 1976 is affiliated to an international Quantity Surveyors and Construction Cost Consultants with a staff strength of 2,800 based in over 90 offices in over 26 countries, worldwide. This company is one of the earliest local and fully Malaysian

staffed Quantity Surveying practices to be set up in Malaysia. Today, this company is one of the largest Quantity Surveying and Construction Cost Consultancy practices in Malaysia and operates throughout Malaysia from four main offices situated at Kuala Lumpur, Penang, Johor Bahru and Kota Kinabalu. The following picture - Picture 5.1 shows one of the projects which were serviced by this company.

Picture 5.1: Upgrading of Facilities. Subang International Airport, Malaysia.

Company B: This is a joint venture company between two Malaysia largest engineering construction groups. Both of these engineering construction groups are among Malaysia's largest infrastructure companies having built highways, ports, airports etc. The joint venture of these construction groups form a successful partnership having effectively undertaken Stormwater Management and Road Tunnel (SMART), the worlds' first dual purpose flood diversion and

double deck motorway tunnel in Kuala Lumpur, Malaysia. The picture of SMART - Picture 5.2 is shown as follow:-

Picture 5.2: Award-winning SMART project, Kuala Lumpur city, Malaysia.

Company C: One of the largest listed property development companies in Malaysia by market capitalisation. This company is involved in a diversified range of property services, which includes property development, property investment, construction and property management in Malaysia. This company is focussed on establishing itself as an award-winning premier lifestyle developer with a niche in residential and commercial development. One of the completed projects by this company is showed as Picture 5.3 below:-

Picture 5.3: Idaman Residence, Kuala Lumpur city, Malaysia.

5.3 Objective 1: To identify the traditional and contemporary roles of Quantity Surveyors

By interviewing the key staff of Company A, B and C several times, during the duration of this study, these case studies are undertaken to verify the feedback from survey questionnaire in chapter 4. From these case studies, all of them commented that the Quantity Surveyors employed by them are practicing their roles similar with the results of top ten as reflected by the SI in chapter 4. However, there are few minor additional suggestions coming from Company A, B and C.

Company A

This company requires that the additional role to be performed by the Quantity Surveyor relates to the requirements and computation of the Green Building Index (GBI). A Green building focuses on increasing the efficiency of resource

use (e.g. energy, water, and materials) while reducing building impact on human health and environment during the building's lifecycle. Recently, many green building are designed and operated to reduce the overall impact of the built environment on its surroundings. Therefore, as the largest Quantity Surveying firm in Malaysia, they expected that the graduate Quantity Surveyors be able to provide consultation on GBI and involved in green building project to meet the demand of market.

Company B

This company also commented that the additional roles to be performed by the Quantity Surveyor and they are similar to Company A and in addition to that, this company requires the Quantity Surveyor to work as Adjudicator if there is any construction dispute.

Company C

This company opined that Commercial management is one of the necessary services to be provided by the Quantity Surveyors although it is out of the top ten SI result as listed in Chapter 4. They encouraged the Quantity Surveyors to know more about Commercial management and apply it in construction industry, from budgets and forecasts to cost-value comparison and partnering. This will give extra benefit and advantages to the Quantity Surveyors who want to strengthen their career in developer's organisation.

5.4 Objective 2: To determine the threats to quantity surveying profession

On this issue, the feedback from the key staff of Company A, B and C that the Quantity Surveyors employed by them are practicing their roles similar with the results of top five as reflected by the RII in chapter 4. Once again, there are few additional comments provided by Company A, B and C.

Company A

This company commented that fee against the professional guideline is a threat but may be dependent on the size and reputation of the organisation. In relation to the size, they think this threat normally brings more impact to small and medium quantity surveying firms as compared with the big firms. This is because the small and medium firms are not financially strong as compared with the large firm. Next is the reputation, it depends on the employees' performance. Employers expect the Quantity Surveyors to be able to carry out their task to meet clients' requirement in order to build up the company's reputation. However, current Quantity Surveyors' qualifications are not standardised. Therefore, some of them are capable to perform to industry's expectation and the rest are not. This will affect the growth and reputation of the firm. This threat is more critical towards the quantity surveying firm rather than Quantity Surveyors personally.

Company B

This company mentioned that threats are not only originated from external but also from internal. The quality of service delivered by staffs is a main internal factor. Since this company is service-based, their growth is dependent on their

staffs' performance. Thus Quantity Surveyors are key players; they must able to provide quality services to meet the client's requirement. However, currently many Quantity Surveyors do not have strong basic knowledge. Hence, this company requires that Quantity Surveyors must have good basic knowledge and able to develop it to provide the quality service to meet the clients' demand and stay relevant in industry.

Company C

This company emphasised that salary variance is a serious issue which occurred between consultant, contractor and developer. Good Quantity Surveyors might move to company which providing better salary. Thus, good Quantity Surveyors who work in consultant might be affected because the offer in consultant is lower than contractor and developer. This might become a threat to consultant.

5.5 Objective 3: To propose the methods to improve performance of graduate Quantity Surveyors

This study shows that Company A, B and C agreed on the major proposed methods in chapter 4 as shown in the top five of the RII. At the same time, Company A, B and C did provide valuable feedback on the additional requirements to improve the graduate Quantity Surveyors' performance.

Company A

This company provides in-house and external training to their staffs to enable them to improve on their knowledge and skill in this specific area. With this

training, their staffs can deliver the professional and quality services as required by the company. Therefore, this additional ICT requirement must be added to the skill of graduate Quantity Surveyors so that they can be useful in such organisation.

Company B

Procurement method is important. Procurement method is a Conflict and Dispute Reduction Mechanism for construction industry in Malaysia. The chosen procurement method will affect the project in terms of functionality, quality, time and cost. However, not many contractors are utilising these methods due to lack of resources and expertise in this area. This method is needed but the graduate Quantity Surveyors are weak in this part. Therefore, the graduates have to learn more about procurement method and help to promote this method in their practice. This can help to increase the level of usage of procurement method among contractor companies.

Company C

ICT is an essential method. This company mentioned that this technology is necessary to be used to improve their productivity and profitability of the construction industry. Thus, they are making effort to increase the level of ICT usage by training more graduate Quantity Surveyors to adopt this technology.

5.6 Conclusion

This chapter represents the results of three cases: Company A (consultant), Company B (contractor) and Company C (developer). Analyses of these cases show the additional roles of graduate Quantity Surveyors to meet the consultant, contractor and developer's requirement.

In relation to Objective 1, Company A, B and C concurred with the findings of the feedback from the general questionnaire. However, Company A and B suggested that Green Building Index service and adjudicator to be added as necessary additional services to be provided by the Quantity Surveyors.

In Objective 2, Company A, B and C also agreed with the findings from the questionnaire in Chapter 4. On this area, there are also few comments provided on the threat in quantity surveying profession. Company B commented that Quantity Surveyors need to offer quality service to satisfy client and stay competitive in industry. Thus graduate must have well basic knowledge and develop it to execute in actual practice. Besides, Company C also commented that salary variance which occurred in different organisation is a possible threat to consultant because consultant's offer usually is lesser than offer from contractor and developer.

In Objective 3, ICT is a key skill to be acquired to enhance Quantity Surveying practice in the long run.

In summary, company A, B and C had provided valuable information to produce more accurate data. Each of them has the similar perception on roles, threats and methods as the results of individual group (consultant, contractor and developer) in Chapter 4. Company A, B and C showed that the data in survey questionnaire is valid since they were similar and agreed that the data in survey questionnaire is complete. There were only few minor suggestions given by them to improve the quality of the analysis of the feedback from the general public.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Introduction

The conclusion of this study is based on the analysis and discussion carried out in Chapter 4 and 5. This chapter summarises the results which were obtained from the planned research methodology as executed. The research outcome with findings and recommendations will be given to graduate Quantity Surveyors to help them focus on the relevant current areas to enhance their skills and knowledge in order to stay relevant and competent in the construction industry. However, there are some research limitations and suggestions regarding future areas of research are provided in this chapter.

6.2 General Summary

This study explored the issue related to the roles of Quantity Surveyors, the threats in their profession and the methods to improve performance of graduate Quantity Surveyors. Specifically, a thorough literature review has revealed that plenty of studies related to their roles, threats and methods were carried out. Nevertheless, little information was available on the requirements and expectations of the Quantity Surveyors within the current construction industry. For this reason, this study was carried out to identify the roles of Quantity Surveyors expected by employers in the current changing construction environment. These findings not only identified the knowledge

and skills required from Quantity Surveyors to stay competent in the construction industry but it also helps in identifying and the development of university's Quantity Surveying course structure. Through the survey questionnaire and three case studies, an in-depth understanding of Quantity Surveyors' roles, threats and methods to improve performance of graduate were established.

6.3 Research Conclusion

The three objectives as stated in Chapter 1 are:

(1) To identify the traditional and contemporary roles of Quantity Surveyors,
(2) To determine the threats in quantity surveying profession, and
(3) To propose the methods to improve performance of graduate Quantity Surveyors.

This study has identified the requirements for each of them and a summary are as follows for ease of reference:

In objective 1, the results of the analysis showed that the core or traditional roles (e.g. prepare the Bills of Quantities, tendering, estimating/cost planning) are the most important and frequent services performed by Quantity Surveyors and confirmed by the overall SI ranking. These results are further supported by case studies. To improve the quality of results, Green Building Index (GBI) service and adjudicator are suggested to be added as necessary additional services to be provided by them.

In objective 2, intensive or severe fee competition is the major threat in quantity surveying profession according to the findings from RII ranking. The three case studies provide further confirmation with this finding and in addition, there are few proposals raised to improve the quality of the results. They confirmed that Quantity Surveyors must have basic knowledge and be able to further develop it during their actual practice. This is to ensure that the Quantity Surveyors can offer quality service to satisfy client and stay competitive in industry.

In objective 3, the most effective method to improve the performance of graduate Quantity Surveyors is to acquire sufficient professional expertise and skills in the core competencies and continued to develop this expertise as shown by the overall RII ranking. The case studies showed that Information Communication Technology (ICT) is a key skill to be acquired to enhance Quantity Surveying practice in the long run.

According to the results from the comparison and analysis of the feedbacks from the respondents, is confirmed the individual roles of Quantity Surveyors meet the consultant, contractor and developer's requirements. There were few additional suggestions provided by case studies to reinforce the above results.

6.4 Research Recommendation

With regards to above, it is no doubt that basic functions are the most wanted skills and knowledge expected by construction industry despite the evolving construction environment.

According to the findings, the respondents believed that the core roles or traditional services are necessary and frequently practiced by the Quantity Surveyors. They need to have adequate fundamental knowledge to equip and enable themselves to work in the commercial industry. The Quantity Surveyors must get the adequate basic knowledge from university and continue developing their knowledge by attending postgraduate studies and gain their experience from the practices in the industry to take up these additional roles, such as, GBI and adjudicator. Via this method, they can provide good quality services and stay competitive in the industry and this is confirmed by the case studies. Thus, this is a good solution to the threat of intensive or severe fee competition.

Similar with the role and threat, the result revealed that the current construction industry required the Quantity Surveyor to have enough skills and knowledge in core competencies and to continue developing it to meet the market's demand. This again indicates the importance of core or basic skills and knowledge.

In essence, to become a professional Quantity Surveyor, the graduates must have solid basic knowledge to able to practice the core and traditional services. This is the 'must' level before they want to improve their skills due to

market's demand. They need to develop their skills through the training and experience to perform the additional or variety roles to fulfil the construction industry's requirement.

Moreover, as mentioned earlier, universities can refer and make use of the top fifteen overall SI ranking of roles as the guideline to develop their course structure. It is useful to ensure that future graduates stay relevant in the construction industry. It will definitely help to improve the graduate Quantity Surveyors' performance to stay employable in the construction industry, not in particular type of organisations but under a diverse type of employer or organisation.

6.5 Limitation of the Research

The limitation of this research was the geographical spread of the respondents. Majority of the respondents were from west Malaysia while small percentages of respondents were from east Malaysia. Therefore, the geographical distributions of the respondents were imbalanced and insufficient coverage. Besides, it took longer time as researcher originally expected to collect the respondents' feedback. Some people simply refuse to participate in surveys. Some of them may feel they can't spare the time to participate in a survey, others may see a survey questionnaire as a nuisance. This affected the research's progress. Anyhow, the well-designed questionnaire of this study has achieved the aim and objectives. It does provide a basic frame for graduate Quantity Surveyors and universities to improve their current practice and

current course structure. It also inspires the researchers to be interested in this topic for their future study.

The next limitation is the demographic characteristics of respondents. Very big percentages (70%) of the respondents have less than 5 years working experience, 50% of them were employed as junior Quantity Surveyors, and 75% of the respondents are not members of any QS professional institution. The unbalance spreads for the respondents' background might leave the limited implication on this study.

6.6 Suggestions for Future Study

This research mainly focuses on the roles of Quantity Surveyors and the recommendations for their future improvement. It is suggested that researchers, in their future study should look into the following topics:

- Requirement and expectation from different position of the organisation on graduates Quantity Surveyors;
- Future roles for professional Quantity Surveyors;
- Graduate Quantity Surveyors' ethical requirements to be expected by their employer.

In summary, this research has identified the roles of Quantity Surveyors, the threats in quantity surveying profession and methods to improve graduate Quantity Surveyors' performance. Recommendations also provided by researcher for graduates in order to suit themselves in the evolving

construction industry. This research outcome also provides a guideline for the university to review and improve the Quantity Surveying course's syllabus so that the graduate could stay relevant and competitive in the industry.

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APPENDIX A

RESEARCH SURVEY

I am currently undertaking Master of Science by research at University Tunku Abdul Rahman (UTAR). The research title is ***The Roles of Graduate Quantity Surveyors in the Malaysian Construction Industry.***

This questionnaire consists of five (5) sections:

Section A : Demographics

Section B : Traditional and contemporary roles of graduate Quantity Surveyors

Section C : Threats to graduate Quantity Surveyors' practice

Section D : Methods to improve graduate Quantity Surveyors' practice

Section E : Other

1 Section A : Demographics

1.1 Name: _____

1.2 Contact No.: _____ Email address: _____

1.3 Company name: _____

1.4 Please indicate the duration of your working experiences as a Quantity Surveyor.

☐ < 5 years ☐ 5 - 10 years ☐ 11 - 20 years ☐ > 20 years

1.5 Please indicate the position in your work place.

☐ Director ☐ Partner

☐ Senior Quantity Surveyor ☐ Junior Quantity Surveyor

☐ Other (please state): _____

1.6 Please indicate your nature of work.

☐ Consultancy ☐ Contractor ☐ Developer

1.7 Are you a member of any QS professional institution?

☐ Yes (please state the name of institutes and membership):

Institute: _____ Membership _____

Institute: _____ Membership _____

Institute: _____ Membership _____

☐ No (proceed to question 1.8)

1.8 Please indicate your highest academic qualification.

☐ Certificate/diploma ☐ Bachelor degree

☐ Master degree ☐ Other (please state):

☐ Doctoral degree _____

1.9 Where did you obtain your basic quantity surveying qualification? Name of University?

☐ Malaysia ☐ Oversea ☐ Twinning

_____ _____ _____

1.10 Do you think the syllabus taught during undergraduate study in your University met the needs of the construction industry?

☐ Yes ☐ No

2	**Section B : Traditional and contemporary roles of graduate Quantity Surveyors**								
	An in-depth literature review has revealed a large array of services which may be offered by graduate quantity surveyor in various contexts. Please rate using the following likert scales on the importance and frequency of services performed by graduate QS	1 = Strongly not important, 2 = Not important, 3 = Neutral, 4 = Important, 5 = Strongly important					1 = Low frequency, 2 = Middle frequency, 3 = High frequency		
2.1	**Traditional Services**								
2.1.1	Procurement	1	2	3	4	5	1	2	3
2.1.2	Tendering	1	2	3	4	5	1	2	3
2.1.3	Contract administration	1	2	3	4	5	1	2	3
2.1.4	Specification preparation	1	2	3	4	5	1	2	3
2.1.5	Builders Quantities (refer to builder)	1	2	3	4	5	1	2	3
2.1.6	Bills of Quantities (refer to SMM)	1	2	3	4	5	1	2	3
2.1.7	Estimating/Cost planning	1	2	3	4	5	1	2	3
2.2	**Non-Traditional Building Services**								
2.2.1	Cost benefit analysis	1	2	3	4	5	1	2	3
2.2.2	Due diligence reports	1	2	3	4	5	1	2	3
2.2.3	Premises Audits	1	2	3	4	5	1	2	3
2.2.4	Post Occupancy Evaluation	1	2	3	4	5	1	2	3
2.2.5	Facilities management	1	2	3	4	5	1	2	3
2.2.6	Quality management	1	2	3	4	5	1	2	3
2.2.7	Value management	1	2	3	4	5	1	2	3
2.2.8	Project management	1	2	3	4	5	1	2	3
2.2.9	Risk management	1	2	3	4	5	1	2	3
2.2.10	Contract and Commercial management	1	2	3	4	5	1	2	3
2.2.11	Change management	1	2	3	4	5	1	2	3
2.2.12	Environmental Management	1	2	3	4	5	1	2	3
2.2.13	Insurance valuation, premiums and alternative selection	1	2	3	4	5	1	2	3
2.2.14	Expert witness	1	2	3	4	5	1	2	3
2.2.15	Arbitration/mediation	1	2	3	4	5	1	2	3
2.2.16	Tax advice/taxation	1	2	3	4	5	1	2	3
2.2.17	Construction Planning	1	2	3	4	5	1	2	3
2.2.18	Life Cycle Costs	1	2	3	4	5	1	2	3
2.2.19	Feasibility study	1	2	3	4	5	1	2	3
2.2.20	Financial management	1	2	3	4	5	1	2	3
2.2.21	Land surveying	1	2	3	4	5	1	2	3
2.3	**Non-Building Services**								
2.3.1	Research/Publishing	1	2	3	4	5	1	2	3
2.3.2	Civil works	1	2	3	4	5	1	2	3
2.3.3	Infrastructure works	1	2	3	4	5	1	2	3
2.3.4	Marine works	1	2	3	4	5	1	2	3
2.3.5	Transport	1	2	3	4	5	1	2	3
2.3.6	Ship Building	1	2	3	4	5	1	2	3
2.3.7	Aeronautical	1	2	3	4	5	1	2	3
2.3.8	Mining	1	2	3	4	5	1	2	3

2.3.9	Manufacturing	1	2	3	4	5	1	2	3
2.3.10	Petrochemical/ Oil and gas	1	2	3	4	5	1	2	3
2.3.11	Computer and Information Technology Literacy	1	2	3	4	5	1	2	3

3	**Section C: Threats to graduate Quantity Surveyors' practice**					
	The following have been identified as threats to graduate Quantity Surveyors' practice. Please rate using the following likert scale:	1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree				
3.1	Intensive or severe fee competition.	1	2	3	4	5
3.2	Professional insurance premiums have increased even QS is relatively low risk compared to other professions in the industry.	1	2	3	4	5
3.3	The development of CAD and automatically generated quantities result redundancy of QS roles.	1	2	3	4	5
3.4	The quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation.	1	2	3	4	5
3.5	Inability to change and re-engineer processes.	1	2	3	4	5
3.6	Competition from other professions providing substantially similar construction and property based services to clients.	1	2	3	4	5
3.7	The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction.	1	2	3	4	5
3.8	QS profession as a whole was poorly marketed and that the piece-meal approaches adopted by individual firms were of no real benefit to the profession as a whole.	1	2	3	4	5
3.9	QS are content easily although they are aware of the need to improve the way their services.	1	2	3	4	5
3.10	The quality of graduates is deteriotating particularly in terms of core skills in measurement and construction knowledge.	1	2	3	4	5
3.11	QS still do not function well in their basic or traditional functions, such as QS estimating, evaluation of variations and finalizing of accounts.	1	2	3	4	5
3.12	Clients today began looking for new ways of managing contracts.	1	2	3	4	5

4	**Section D: Methods to improve graduate Quantity Surveyors' practice**					
	The following have been proposed as methods to improve graduate Quantity Surveyors' practice. Please rate using the following likert scale:	1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree				
4.1	QS shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise.	1	2	3	4	5
4.2	QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement).	1	2	3	4	5
4.3	All construction professionals need to utilise and gain expertise in CAD (eg. AutoCAD, Microstation, ArchiCAD, etc).	1	2	3	4	5
4.4	Investment in information technology (IT) and information communication technology (ICT) to improving productivity and performance.	1	2	3	4	5

4.5	The specialist automated quantities software like CostX, Eclipse, and Buildsoft Take Off System (BTOS) are the necessary technology to be applied.	1	2	3	4	5
4.6	QSs need to diversify their scope of services to better meet industry/client demands and to secure their long term future.	1	2	3	4	5
4.7	Through the process of education, training, research, training and Continuing Professional Development (CPD) to ensure high-quality performance of the workforce.	1	2	3	4	5
4.8	The QS needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement.	1	2	3	4	5
4.9	Increased involvement in *alternative* procurement methods such as managed and cost plus contract, package deals, turnkey offers and design and build contracts.	1	2	3	4	5
4.10	Development and implementation of knowledge management (KM) systems to capture, develop, maintain and employ the intangible knowledge assets of organisations.	1	2	3	4	5
4.11	The seven Ps (i.e. product, price, place, promotion, people, physical evidence and process) shall be adopted by QS and used as a guide to arrive at the competitive position that the firm wants to occupy in the target market.	1	2	3	4	5
4.12	Practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning).	1	2	3	4	5
4.13	Implement strategies for developing graduate attributes. Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g group-work, site visit and guest lecturers).	1	2	3	4	5

5 Section E: Other

5.1 Please comment generally on the topic or offer any useful advice that may assist the researcher in this project (eg. Future roles of QS etc.).

Appreciation

Thank you very much for your valuable input and time. Please return the completed questionnaire to Ms. Chong Bee Ling at chongbl@utar.edu.my or fax to (603) 4107 9803. If you have any comments or questions in relation to this questionnaire, please do not hesitate to contact the reseracher at (012) 677 9833 (mobile) or email (as above).

APPENDIX B

RESEARCH SURVEY

I am currently undertaking Master of Science by research at University Tunku Abdul Rahman (UTAR). The research title is ***The Services Required by the Malaysian Construction Industry from Quantity Surveyors and Their Implications to Quantity Surveying Graduates.***

This questionnaire consists of five (5) sections:

Section A : Demographics

Section B : Traditional and contemporary roles of Quantity Surveyors

Section C : Threats to Quantity Surveying profession

Section D : Methods to improve performance of graduate Quantity Surveyors

Section E : Other

1 Section A : Demographics

1.1 Name: _____

1.2 Contact No.: _____ Email address: _____

1.3 Company name: _____

1.4 Please indicate the duration of your working experiences as a Quantity Surveyor.

☐ < 5 years ☐ 5 - 10 years ☐ 11 - 20 years ☐ > 20 years

1.5 Please indicate the position in your work place.

☐ Director ☐ Partner

☐ Senior Quantity Surveyor ☐ Junior Quantity Surveyor

☐ Other (please state): _____

1.6 Please indicate your nature of work.

☐ Consultancy ☐ Contractor ☐ Developer

1.7 Are you a member of any QS professional institution?

☐ Yes (please state the name of institutes and membership):

Institute: _____ Membership _____

Institute: _____ Membership _____

Institute: _____ Membership _____

☐ No (proceed to question 1.8)

1.8 Please indicate your highest academic qualification.

☐ Certificate/diploma ☐ Bachelor degree

☐ Master degree ☐ Other (please state):

☐ Doctoral degree _____

1.9 Where did you obtain your basic quantity surveying qualification? Name of University?

☐ Malaysia ☐ Oversea ☐ Twinning

_____ _____ _____

1.10 Do you think the syllabus taught during undergraduate study in your University met the needs of the construction industry?

☐ Yes ☐ No

2	**Section B : Traditional and contemporary roles of Quantity Surveyors**									
	An in-depth literature review has revealed a large array of services which may be offered by Quantity Surveyor in various contexts. Please rate using the following likert scales on the importance and frequency of services performed by QS	1 = Strongly not important, 2 = Not important, 3 = Neutral, 4 = Important, 5 = Strongly important					1 = Low frequency, 2 = Middle frequency, 3 = High frequency		
2.1	**Traditional Services**								
2.1.1	Procurement	1	2	3	4	5	1	2	3
2.1.2	Tendering	1	2	3	4	5	1	2	3
2.1.3	Contract administration	1	2	3	4	5	1	2	3
2.1.4	Specification preparation	1	2	3	4	5	1	2	3
2.1.5	Builders Quantities (refer to builder)	1	2	3	4	5	1	2	3
2.1.6	Bills of Quantities (refer to SMM)	1	2	3	4	5	1	2	3
2.1.7	Estimating/Cost planning	1	2	3	4	5	1	2	3
2.2	**Non-Traditional Building Services**								
2.2.1	Cost benefit analysis	1	2	3	4	5	1	2	3
2.2.2	Due diligence reports	1	2	3	4	5	1	2	3
2.2.3	Premises Audits	1	2	3	4	5	1	2	3
2.2.4	Post Occupancy Evaluation	1	2	3	4	5	1	2	3
2.2.5	Facilities management	1	2	3	4	5	1	2	3
2.2.6	Quality management	1	2	3	4	5	1	2	3
2.2.7	Value management	1	2	3	4	5	1	2	3
2.2.8	Project management	1	2	3	4	5	1	2	3
2.2.9	Risk management	1	2	3	4	5	1	2	3
2.2.10	Contract and Commercial management	1	2	3	4	5	1	2	3
2.2.11	Change management	1	2	3	4	5	1	2	3
2.2.12	Environmental Management	1	2	3	4	5	1	2	3
2.2.13	Insurance valuation, premiums and alternative selection	1	2	3	4	5	1	2	3
2.2.14	Expert witness	1	2	3	4	5	1	2	3
2.2.15	Arbitration/mediation	1	2	3	4	5	1	2	3
2.2.16	Tax advice/taxation	1	2	3	4	5	1	2	3
2.2.17	Construction Planning	1	2	3	4	5	1	2	3
2.2.18	Life Cycle Costs	1	2	3	4	5	1	2	3
2.2.19	Feasibility study	1	2	3	4	5	1	2	3
2.2.20	Financial management	1	2	3	4	5	1	2	3
2.2.21	Land surveying	1	2	3	4	5	1	2	3
2.3	**Non-Building Services**								
2.3.1	Research/Publishing	1	2	3	4	5	1	2	3
2.3.2	Civil works	1	2	3	4	5	1	2	3
2.3.3	Infrastructure works	1	2	3	4	5	1	2	3
2.3.4	Marine works	1	2	3	4	5	1	2	3
2.3.5	Transport	1	2	3	4	5	1	2	3
2.3.6	Ship Building	1	2	3	4	5	1	2	3
2.3.7	Aeronautical	1	2	3	4	5	1	2	3
2.3.8	Mining	1	2	3	4	5	1	2	3

2.3.9	Manufacturing	1	2	3	4	5	1	2	3
2.3.10	Petrochemical/ Oil and gas	1	2	3	4	5	1	2	3
2.3.11	Computer and Information Technology Literacy	1	2	3	4	5	1	2	3

3	**Section C: Threats to Quantity Surveying profession**					
	The following have been identified as threats to Quantity Surveying profession. Please rate using the following likert scale:	1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree				
3.1	Intensive or severe fee competition.	1	2	3	4	5
3.2	Professional insurance premiums have increased even QS is relatively low risk compared to other professions in the industry.	1	2	3	4	5
3.3	The development of CAD and automatically generated quantities result redundancy of QS roles.	1	2	3	4	5
3.4	The quantity surveying profession is perhaps more conservative than other professions in terms of IT utilisation.	1	2	3	4	5
3.5	Inability to change and re-engineer processes.	1	2	3	4	5
3.6	Competition from other professions providing substantially similar construction and property based services to clients.	1	2	3	4	5
3.7	The clients' increasing need for a one-stop service such as total project management or design and build contracting due to the increasing complexity of modern construction.	1	2	3	4	5
3.8	QS profession as a whole was poorly marketed and that the piece-meal approaches adopted by individual firms were of no real benefit to the profession as a whole.	1	2	3	4	5
3.9	QS are content easily although they are aware of the need to improve the way their services.	1	2	3	4	5
3.10	The quality of graduates is deteriotating particularly in terms of core skills in measurement and construction knowledge.	1	2	3	4	5
3.11	QS still do not function well in their basic or traditional functions, such as QS estimating, evaluation of variations and finalizing of accounts.	1	2	3	4	5
3.12	Clients today began looking for new ways of managing contracts.	1	2	3	4	5

4	**Section D: Methods to improve performance of graduate Quantity Surveyors**					
	The following have been proposed as methods to improve performance of graduate Quantity Surveyors. Please rate using the following likert scale:	1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree				
4.1	QS shall have sufficient professional expertise and skills in the core competencies and continue to develop this expertise.	1	2	3	4	5
4.2	QS today have to adapt to changes in work patterns (eg. with the advancement of technologies, it has brought E-Tendering into the equation of procurement).	1	2	3	4	5
4.3	All construction professionals need to utilise and gain expertise in CAD (eg. AutoCAD, Microstation, ArchiCAD, etc).	1	2	3	4	5
4.4	Investment in information technology (IT) and information communication technology (ICT) to improving productivity and performance.	1	2	3	4	5

4.5	The specialist automated quantities software like CostX, Eclipse, and Buildsoft Take Off System (BTOS) are the necessary technology to be applied.	1	2	3	4	5
4.6	QSs need to diversify their scope of services to better meet industry/client demands and to secure their long term future.	1	2	3	4	5
4.7	Through the process of education, training, research, training and Continuing Professional Development (CPD) to ensure high-quality performance of the workforce.	1	2	3	4	5
4.8	The QS needs to promote the multi-procurement method to enable the client to control the effects of time and cost, continuing to allow space for sustained design, development, effective professional service and contractor involvement.	1	2	3	4	5
4.9	Increased involvement in *alternative* procurement methods such as managed and cost plus contract, package deals, turnkey offers and design and build contracts.	1	2	3	4	5
4.10	Development and implementation of knowledge management (KM) systems to capture, develop, maintain and employ the intangible knowledge assets of organisations.	1	2	3	4	5
4.11	The seven Ps (i.e. product, price, place, promotion, people, physical evidence and process) shall be adopted by QS and used as a guide to arrive at the competitive position that the firm wants to occupy in the target market.	1	2	3	4	5
4.12	Practical methods are important to gain competencies (e.g Practical Work Experience, Foster Firm schemes, Work Shadow, Year Out Period, Simulated Exercises, Role Play and Problem Based Learning).	1	2	3	4	5
4.13	Implement strategies for developing graduate attributes. Graduate places significant emphasis on assignments and activities that had real-life relevance or that were authentic in some way (e.g group-work, site visit and guest lecturers).	1	2	3	4	5

5 Section E: Other

5.1 Please comment generally on the topic or offer any useful advice that may assist the researcher in this project (eg. Future roles of QS etc.).

Appreciation

Thank you very much for your valuable input and time. Please return the completed questionnaire to Ms. Chong Bee Ling at chongbl@utar.edu.my or fax to (603) 4107 9803. If you have any comments or questions in relation to this questionnaire, please do not hesitate to contact the reseracher at (012) 677 9833 (mobile) or email (as above).