

**THE APPOINTMENT OF PROJECT CONSULTANT
IN GREEN CONSTRUCTION PROJECTS:
A PROPER FRAMEWORK**

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**THE APPOINTMENT OF PROJECT CONSULTANT
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A PROPER FRAMEWORK**

by

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**Thesis submitted in fulfilment of the requirements
for the degree of
Master of Science**

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DECLARATION

I declare that this dissertation entitled ‘The Appointment of Project Consultants in Green Construction Projects’ is the result of my own research except as cited in the references. This dissertation has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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LIST OF ABBREVIATIONS

APCC	Australian Procurement and Construction Council
BIM	Building Information Modelling
BREEAM	Building Research Establishment Environmental Assessment Method
C&S	Civil and Structural
CIDB	Construction Industry Development Board
CIOB	The Chartered Institute of Building
CITP	Construction Industry Transformation Programme
CO ₂	Carbon Dioxide
EE	Energy Efficiency
FIDIC	The International Federation of Consulting Engineers
GBI	Green Building Index
GDP	Gross Domestic Product
GoM	Government of Malaysia
Green PASS	Green Performance Assessment System
GreenRE	Green Real Estate
HKCIC	Hong Kong Construction Industry Council
IEQ	Indoor Environmental Quality
KeTTHA	Ministry of Energy, Green Technology and Water
LEED	Leadership in Energy and Environmental Design
M&E	Mechanical and Engineering
OST	Open System Theory
PAM	Pertubuhan Arkitek Malaysia
PH JKR	Skim Penilaian Penarafan Hijau JKR

PWD	Public Works Department
QCIF	Queensland Construction Industry Forum
RE	Renewable Energy
RIBA	Royal Institute of British Architects
UNEP	United Nations Environment Programme
US EPA	United State Environmental Protection Agency
USGBC	United States Green Building Confederation
WCED	The World Commission for Environment and Development

**PELANTIKAN KONSULTAN PROJEK DI DALAM PROJEK PEMBINAAN
HIJAU: RANGKA KERJA YANG SESUAI**

ABSTRAK

Konsultan projek terdiri daripada mereka yang telah dilantik untuk menjalankan reka bentuk, perancangan, pemantauan dan pengurusan sesuatu projek berdasarkan peranan dan tanggungjawab tertentu seperti arkitek, juukur, jurutera dan perancang. Pilihan konsultan yang tidak efektif akan membawa kepada perkhidmatan yang lemah dan seterusnya akan memberi impak kepada prestasi sesuatu projek seperti kelewatan projek, konflik kepentingan, peningkatan kos, dan kemerosotan kualiti. Konsultan bertindak sebagai batu tambatan di dalam mencapai matlamat projek. Peningkatan kerumitan di dalam projek hijau, peranan dan tanggungjawab konsultan juga turut bertambah. Pelantikan konsultan projek merupakan satu aspek tidak langsung dalam projek pembinaan namun ianya penting dalam memastikan kejayaan sesuatu projek. Kebanyakan klien cenderung untuk mengabaikan kepentingan pelantikan yang efektif. Kajian ini memberi fokus kepada amalan pelantikan konsultan projek di dalam projek pembinaan hijau yang memberi penekanan kepada proses dan prosedur, kriteria pemilihan serta cabaran yang dihadapi. *'Open System Theory'* telah digunakan untuk mempamerkan hubungan di antara setiap aspek amalan pelantikan. Menggunakan kaedah kualitatif, pendekatan yang diambil adalah melalui dua peringkat iaitu Peringkat-1 dan Peringkat-2. Peringkat-1 bertindak sebagai kajian awal manakala Peringkat-2 adalah kajian yang lebih mendalam. Hasil kajian mendapati bahawa terdapat dua prosedur untuk melantik konsultan projek; sama ada pelantikan dari klien atau pelantikan dari arkitek. Ia juga didapati bahawa di dalam pelantikan arkitek, pemilihan secara

langsung lebih sesuai berbanding pelantikan konsultan projek lain di mana pemilihan secara terbuka lebih memberi manfaat kepada klien. Dari aspek kriteria pemilihan, konsultan projek perlu mempunyai latar belakang firma dengan kebolehan teknikal dan pengurusan yang baik, manakala bayaran terhadap perkhidmatan mereka dilihat sebagai kriteria yang kurang dititikberatkan. Di dalam amalan pelantikan, beberapa cabaran seperti pengetahuan para konsultan, kerumitan projek hijau dan kebolehan melantik konsultan yang mempunyai potensi rundingan terhadap bayaran dan kualiti yang memuaskan telah menjadi fokus, dan seterusnya memberi impak kepada kriteria pemilihan konsultan projek untuk dilantik bagi projek hijau. Dapatan kajian menyediakan garis panduan untuk semua pihak mengenai perkara-perkara yang melibatkan pelantikan konsultan dan seterusnya membolehkan pengawalan yang lebih baik terhadap aspek pengurusan di dalam projek hijau.

**THE APPOINTMENT OF PROJECT CONSULTANT IN
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ABSTRACT

Project consultants are those who are appointed to carry out the design, planning, monitoring, and managing of projects based on certain roles and responsibilities such as architects, surveyors, engineers and planners. Poor selection of a consultant team will lead to poor services and hence, impact the project's overall performance with issues such as project delay, conflict of interest, cost escalation, and quality impairment. Consultants act as anchors in achieving a project's goals. Hence with the increased complexity in green projects, consultants' roles and responsibilities have also expanded. The appointment of project consultants is one of the soft aspects in construction projects, but is significant in ensuring the success of it. Many clients tend to ignore the significance of effective consultants' appointment. This research focuses on exploring project consultants' appointment practices in green construction projects by highlighting the processes and procedures, selection criteria as well as challenges in the issue. The adaptation of the Open System Theory will showcase the relationship between each aspect in appointment practices. Using the qualitative method, a two-stage approach is adopted, i.e. Tier-1 and Tier-2 studies. Tier-1 acts as a preliminary study, whereas Tier-2 is an in-depth study. It is discovered that there are two procedures that can be taken to appoint a project consultant; either through appointment by the client, or by the architect. It is also found that in the architect's bidding method, direct selection is preferred compared to the other project consultants' method where open selection gives better benefits to the client. In terms of the selection criteria, consultants are expected to have excellent

firm background with technical and managerial abilities, whilst fee should be the least considered selection criteria. In appointment practices, few of these challenges such as knowledge of the consultants, green complexity and getting consultants with negotiation potential and quality are highlighted, thus impacting the selection criteria of consultants for green projects. The findings are expected to provide a guideline for all parties on matters involving consultants' appointment and hence, allow for better control in green projects' management

CHAPTER 1

INTRODUCTION

1.1 Introduction

This research delves into the practice of appointing main project consultants for green projects. The appointment of project consultants is crucial in ensuring the people selected as the project team can provide good services, hence leading to success in delivering the objectives of the green projects to the satisfaction of clients. This chapter introduces the research which includes the background of the research, problem statement, aim and objectives, research questions, scope of research, brief explanation on the research, and methodology of research. The outline of the whole thesis is also presented.

1.2 Background of the Study

The construction industry has always been within the circle of people, time and cost. It is characterized by a complex socio-culture where it involves the integration of multidisciplinary disciplines to achieve specific goals and project objectives. This multidisciplinary integration comprises of professionals in the form of consultants and contractors who come from various backgrounds and specialty to govern the aspects that are required in planning, designing, managing, building and maintaining the built environment. The construction industry is a risky industry where any project failure is extensively liable to the people involved in it due to inherent responsibility and ability. However, the industry is also very lucrative as the

success of each project does not only generate high profits, but also bring multiplier benefits in the long term. Mathur, Price, Austin, & Moobela (2007) stated that those who affect the project are those who are involved in the delivery of the project as well and those who determine the project's context. Project consultants play a major role in ensuring the success of construction projects' delivery. It is crucial that the role of consultants is highlighted and fully understood by all parties involved in construction projects.

The quality of services provided by consultants is significant to a project for 2 main reasons; time (Hwang & Leong, 2013) and cost (Kats, 2003; Tam, Hao, & Zeng, 2012). Consultants play a multifaceted part in a construction project where their involvement would affect the performance and quality of the end product itself. It is therefore understood that consultants are the ones responsible towards success of certain goals in construction (Kang, Kim, Son, Lee, & Limsawasd, 2013; Yudelson, 2009; GBI, 2008). Unfortunately, Ip (2008) stated that clients sometimes fail to recognise the important role and responsibility of consultants.

Projects are carried out by people. As skilled workforce is a must for the success of a project, this workforce must be cared for and preserved just like any other resources used in the construction industry (Glavinich, 2008). The basic assumption is that human endeavour can achieve the planned outcomes of a project (Thurm, Riedel, & Muller, 2015). In conventional construction, typical project consultants consist of an architect, surveyors, engineers, and planners (RIBA, 2001). These people are crucial for carrying out tasks and responsibilities to ensure that a project is delivered to the best of the client's interest and also achieve the project's objective. In terms of appointment procedures, the lead consultant is normally an architect who takes the lead in the management of a project, including the

appointment of other key project consultants (RIBA, 2016). The other consultants are bonded to the architect's instruction during the process of construction (PAM (Pertubuhan Arkitek Malaysia), 2010). The appointed consultants are expected to adhere to their code of ethics and deliver value for money outcomes that meet the required services, quality, time and cost performance (Australian Procurement and Construction Council, 2006). The construction industry expects these consultants to uphold their roles and tasks with minimal mistakes and error.

Green construction projects are defined as projects that are designed and constructed with green conscience in mind (Gambatese, Rajendran, & Behm, 2007). For this thesis, green construction projects will be dubbed as green projects, and discussion on green projects throughout this paper will refer to construction projects. Green projects are greater in terms of its complexity and difficulties (GreenBiz, 2005; Kats, 2003). Similar to conventional development projects, green projects are also expected to satisfy the three fundamental achievements; cost, quality and time, but with added concern in terms of environmental and social issues. Consultants are expected to have added knowledge on green aspects in order to perform efficiently in green projects. Effective project planning and management will aid the whole project's progress, thus enabling success. The project consultants' ability to plan and deliver outcomes will ensure the sustainability of a project's goals (Yudelson, 2009), for example achieving maximum capital and whole life costs (CIOB (The Chartered Institute of Building), 2010).

Mokhtar Azizi, Zainul Abidin, & Raofuddin (2015) stated that there are 7 common project consultants in a green project, i.e. architects, mechanical and engineering engineers, civil and structural engineers, quantity surveyors, landscape architects, town planners, and other environmental consultants such as green

building consultants. For instance, besides the common services architects have to offer, they are also expected to determine clients' green objective(s), develop the green plan, define green measures and manage green certification processes (Helena, 2012). Seah (2009) stressed that as one of the consultants in the construction industry, quantity surveyors must consider green costing, carbon footprint, life cycle assessment, Building Information Model (BIM) and others when servicing for green projects. An additional consultant required in green projects is a green building facilitator who specifically establishes a project's green building goals and sets tasks for the project consultants in order to comply to the green criteria (GBI, 2009).

All organisations should realize that hiring consultants requires well-thought preparation as it is a vital process to ensure project success (Hattan & Nazir, 1997). It is of utmost importance to any developer to select the right consultants (Sporrong, 2011). FIDIC (2011) stated that it is important for a client to make the right call in choosing the consultant since each project is unique and has its own challenges. In green projects, fees are not the only elements that are looked at before appointing consultants as there are extensive demands of other factors such as past track records. According to Mokhtar Azizi et. al (2015), the appointment of project consultants falls under the category of soft elements of a project. A soft element is defined in terms of construction projects as the element that is involved in the management and administration aspect of the project and incurs management-related costs or any hidden cost. Thus the appointment of project consultants can be considered as a soft element as it is related to the management and administration of a project and will incur management-related costs, i.e. consultant fees. According to Kats (2003), costs relating to soft elements are an area which has received less attention although their function is crucial. Cupido, Baetz, Pujari, & Chidiac (2010)

stated that this element is the one that ensures that the hard aspects, i.e. design and construction are able to be materialised. Having tangible guidelines in the appointment of project consultants would benefit the client, consultants and the green project industry. As there is a lacking in the exploration of appointment practices, especially for green projects, this creates a gap in fully understanding the management and administration issues in the construction industry. Previous research on green projects were majorly concerned about the hard aspects (Zuo & Zhao, 2014 ; Hwang & Leong, 2013 ; Godwin et.al., 2013; Qi et.al., 2010; Lam et. al., 2010; Sinha, 2009; Cole, 2000).

This research explores project consultant appointment practices to understand the underlying procedure and selection processes. Attention will be given to the challenges that may occur during the appointment process. The findings of the study shall provide better understanding on the appointment process which is crucial to ensure that only suitable and capable consultants are appointed for projects.

1.3 Problem Statement

The building industry is large, multifaceted, and slow to adopt change and as such, technical innovation and advances in building design are constrained by economic possibility and social expectations; in other words, their cost and perceived value (Cole, 2000). The implementation of green concepts is a new direction in the construction industry (Helena, 2012). Although green construction projects follow similar processes as conventional projects, project details are heavily skewed towards environmental and sustainability needs (Glavinich, 2008). The three common pillars of construction projects which are cost, quality and time will be

blended with the environmental and social aspects important to green projects. Green projects are expected to be more difficult and complex, thus will take a longer time to plan, design and manage compared to traditional projects (GreenBiz, 2005; Kats, 2003).

As a result of the construction shift towards green projects and buildings, a greater level of expertise and responsibility is required in the industry (Helena, 2012). Green projects require more dependency towards the people involved in order to achieve its goals and mission. Thus, there is the need to hire specialised consultants to prepare studies, reports, and designs for various green projects (Hattan & Nazir, 1997). Deciding on who will design, manage and construct a certain project is a crucial action to be taken at the early stages of project planning as it will have a direct impact on the outcome quality (RIBA, 2001). People-related problems are always an issue in both conventional and green projects (Hwang & Ng, 2013; Long, Young, & Lee, 2008; Assaf & Al-Hejji, 2006; Chan & Kumaraswamy, 1997; Odeyinka & Yusif, 1997). Bassioni, Price, & Hassan (2004) and Presley & Meade (2010) had categorised people as one of the drivers for performance in a construction project. Since green buildings are considered as a setting, it gives the same impact. In building green projects, people are categorised as clients, contractors, consultants or skilled workers. Most of the research in this industry has emphasised on the clients and contractors' role and participation in green projects. This research, however, chooses to focus on the importance of consultants in green projects. Robichaud & Anantatmula (2011) suggested that the financial success of green projects can be improved if a cross-discipline team of consultants is involved from the earliest stage and thus, proper planning of the project can occur.

Various factors may lead to delays in construction time. However, this paper focuses on the delay time caused by people-related factors. Ahmed, Azhar, Kappagntula, & Gollapudil (2003) and Alaghbari (2005) stated some possible consultant responsibility factors that may lead to a delay in construction projects; lack of experience, delayed and slow supervision in making decisions, incomplete documents and slowness in giving instructions. For green projects, green requirements should also be well addressed and reflected in the project schedule performance (Hwang & Leong, 2013). Green requirements would affect the schedule of procurement, construction and project closeout (Glavinich, 2008). In respect to green projects, delays and longer periods may be needed as consultants require more time to understand and implement green practices (GreenBiz, 2005; Kats, 2003). More time is also required to integrate the green requirements into the architectural and engineering designs (Kats, 2003). Delay issues in green projects, however, have yet to be aggressively highlighted in the available literature. Therefore, very minimal information is available and can be relied on. This highlights another problem in the appointment of project consultants; the impact of green projects' construction cost and time. This gives attention to the importance of effective appointment as one of the ways to reduce time and contain costs in building green projects.

Cost is always an issue in any construction projects. Cost is one of the reasons why the soft aspects need to be addressed in any green construction projects. Soft aspects refer to the management and administration of a project and at most times, the incurred cost is hidden. Colliver (2007) states that the financial risk associated with the implementation of green buildings lies within the soft costs, which are the costs involved in the designing, permitting and certifying of the project, along with any costs due to delays. Cupido et. al. (2010) stated that this

rather high soft cost is among the barriers evident in green projects. Based on the statements by these authors, it is imperative that the choice of key players involved in green projects, i.e. for design, permits, and others should be looked into to prepare the green industry for a better involvement by developers as this is where the relationship between consultant appointment and soft costs lies. Many developers are keen on seeing only the hard costs of projects rather than emphasizing soft cost issues that are hidden but still taken into account in the calculations of a project's overall cost.

Green buildings have been associated with higher costs compared to the conventional design (Mokhtar Azizi et al., 2015). It is also said that the higher costs of green buildings is not worth the expenditure since it has been perceived as costly compared to its conventional counterparts despite its environmental and health friendliness towards users. This is because green projects require more efficient use of key resources such as energy, water, materials and land (Kats, 2003). Tam et al. (2012) stated that the cost of designing green projects is higher and consumes more time compared to conventional projects due to its complexity. Stakeholders usually have their own interests in these projects which may cause different priorities and conflicts between them which may dramatically increase the complexity of the project (Blauert et. al.,2008). Green projects may benefit the owner in terms of monetary incentives, lower operating costs, and improved marketability. However, there is some significant risk exposure to consultants arising from disappointed clients (Hatem, 2010) because the opportunities and benefits associated with green building also results in increased expectations by the client. This condition may lead to disputes, claims and litigations (Metz & Cheatham, 2008). This statement highlights the relationship between cost and people in green projects. As said before,

clients have higher expectations in terms of benefits from choosing to build green projects such as cost reduction and value-for-money in terms of services offered by consultants. However, this brings negative impact to client as it might elevate the total cost. However, in Malaysia, management and administration costs for green projects are hidden and this creates a gap in understanding the soft aspects of green projects.

The dependency green projects on people emphasises the need for effective appointment of consultants. The appointment process shall not only highlight the individuals' skills, but must also create a good and effective team as work will be conducted among members with different skills and tasks. Having a set of practical appointment guidelines would enable a competitive strategy in offering services in which project consultants can improve and enhance certain areas. This in turn will aid them to distinguish themselves and give both clients and consultants a guideline towards going green by either appointing or be appointed. Situations and problems mentioned above have highlighted that a model simulated based on the aspects of proper appointment of consultants for green projects would give better benefits to the economy. Many developers fail to see that the appointment of consultants is crucial to ensure that their objective towards going green can be attained. This is where the problem lies where lack of exposure in terms of understanding the crucial need for the proper people to carry out projects may impact other significant problems which then may reduce the owners and clients' motivation to lean towards constructing green projects.

In Malaysia's current scenario, slow adaptation of green construction is due to the lack of awareness by construction practitioners on the need for the effective appointment of consultants (Esa & Marhani, 2011; Zainul Abidin, 2009). It is further

supported by Said, Osman, Shafiei, Razak, & Kooi (2009) whose study revealed that the level of knowledge and awareness of consultants, contractors and developers limits the implementation of green projects. According to Zainul Abidin (2009), the path to achieve green construction success is through awareness, interest knowledge, acceptance, demand, commitment, implementation, experience and improvement. Effective appointment is seen as one of the methods and this is where the current scenario is still lacking. Through literature reviews on a few authors (Mokthsim & Salleh, 2014; Suhaida, Tan, & Leong, 2013; Esa & Marhani, 2011; Zainul Abidin, 2009, 2010; Said et al., 2009), it is clearly mentioned and recommended that in order to actively pursue green construction, Malaysia has to go through a few advancements and people involved in the construction circle must be viewed as crucial in playing their roles in the industry. To begin this initiative, action should start from the very beginning of a project which is through the effective appointment of consultants.

Effective appointment of consultants in green projects is done by selecting consultants with adequate knowledge, broad experience, high skills and vast references so that these consultants are able to address the additional environmental requirements of green projects. Legally in Malaysia, the important consultants to be appointed are the principal submitting person (PSP) which is the Architect or Engineers (both mechanical and engineering and civil and structural engineers). Other primary consultants that involved in any construction is quantity surveyor and planner. According to FIDIC (2011), consultants' roles and services are to primarily plan, design, deliver and maintain the world's infrastructure and built-environment. In conventional construction projects, consultants must have a set of skills that allows them to achieve the objectives of the project. On top of that, green projects

require an additional skill which is to have knowledge in green principles. The roles and responsibilities of consultants hence need to be expanded to suit green projects' requirements. The consultants' general principles when appointed in a green project are to deliver value for money outcomes and to meet required services and quality according to the time and cost limits (Australian Procurement and Construction Council, 2006). Therefore, consultants nowadays are expected to have great command of 'green' services as well. According to Cooke-Davies (2001), it is people who deliver projects, not processes and systems. Hence it is argued (Dainty, Cheng, & Moore, 2003; Love & Holt, 2000) that there is a necessity for the green construction industry to define more appropriate selection criteria for the appointment of consultants to include the consultants' knowledge, skills and behaviour inputs which as a whole may contribute to excellent services. Good selection of a consultant team will have a major impact on the quality, overall project costs, and success of a project (FIDIC, 2011). The selection of proper consultants to form a team has been mentioned various times as a project success factor in conventional construction (Chan et.al.,2001; Appelbaum, 2000; Baker et.al.,1994; Martin, 1976). Green projects, with their increased level of complexity and difficulties, require better and enhanced selection of consultants to achieve sustainability. Despite the proved relevance of effective appointment and proper selection criteria for choosing the right and suitable project consultants, current practices in Malaysia have yet to reflect this fact. Thus, how do the project consultants are appointed in green projects in Malaysia?

One of the observable challenges due to the shift in the construction industry to greener practices is the limited pool of consultants who are well-versed in green projects. Malaysia's green initiative has long begun in early 1991. However,

implementation and application have only started to bloom during the establishment of the Green Building Index in 2009 (Suhaida et. al., 2013). This results in the consultants' limited knowledge in green construction and the low market demand for green projects. This may be due to the lack of awareness on the importance of being green and sustainable for the future. Although the knowledge base in green practices has begun to increase, it is still considered new and many consultants are still lacking in terms of knowledge and experience (RSMMeans, 2010; WBCSD, 2009). This is further supported by McGraw-Hill Construction (2012) which experienced difficulties in hiring consultants and employees with green skills. In the local scenario, Mokhtar Azizi et al. (2015) highlighted that green project professionals or consultants are one of soft cost elements that need to be seriously considered due to their impact to the total cost of a project. This creates a challenge against effective appointment as the clients' choice is very limited to a certain pool of consultants only. The limited pool represents consultants who they themselves are not ready to propel their services into green projects. Hence, challenges may impact the selection process of consultants and hence disrupt the ability to achieve effective appointment. It is then crucial for us to understand that there are other challenges that come in many forms and may affect the appointment practices. Hence, another question that rises is what are the difficulties commonly associated in the process of appointing project consultants? This research then sets to understand and fulfil the questions that arise from the previous discussion.

1.4 Aim and Objectives

Aim

The aim of this research is to develop a proposed framework on project consultants' appointment practices in Malaysian green construction project

Objectives

To achieve this aim, three objectives have been listed as below;

1. To establish the process and procedure of appointing project consultants for green projects.
2. To determine the criteria for selecting project consultants for green projects.
3. To identify the challenges in appointing project consultants and examine how they impact the appointment process.

1.5 Scope of Research

This study focuses on proposing a framework for project consultants' appointment practices including the process and procedures, the selection criteria and the challenges in appointing project consultants. The study will be based on the Malaysian setting i.e. green projects located in Malaysia. The appointment practices will focus on developer and architects and how they decide and select other main project consultants. The main project consultants stated above mainly refer to design consultants, i.e. quantity surveyor, design engineer and town planner. Contractor selection is not part of the research scope.

The Open System Theory is adapted to illustrate the consultants' appointment framework where the relationship between each appointment aspect is determined. Developers and architects who have been involved in green projects will be the study's focus respondents due to their dominant role in the design consultants' selection process and their extensive experience in appointment procedures. The limited pool of developers and architects available and the exploratory nature of the study prompted the need to use the qualitative approach. The respondents are mostly based in Kuala Lumpur, where most of the green projects are located.

1.6 Contribution of the Research

The research's contribution can be split into 3 aspects which are the benefits to client and architects, benefits to consultants, and benefit to the project. The first contribution is the benefits to clients and architects. The constructed framework would be useful for developers and architects to understand the elements involved in appointing the right and suitable project consultants for their green projects. The developers and architects will be able to plan, control and manage the appointment process in a much better way that will allow them to achieve the targeted benefits of green projects. The framework can also help them cater to challenges that happen during the appointment, and eliminate risks that may happen. For consultants, findings in this research help by giving early insight on the green project scenario, especially during the early phases of the project. The selection criteria, process and procedures, and challenges are found to be significant to the consultants as a 'kit' for them to expand their services in green projects. Preparation and better allotment of certain aspects in their firm may help them distinguish their firm from the others during the bidding process for green projects. Besides these two parties, the project

itself may benefit through effective appointment as it will improve the project's productivity, time and quality. Green projects with increased complexity and difficulties demand extra skills and care, thus emphasising the need for effective appointment.

1.7 Brief on Research Methodology

This research has adopted the qualitative method of study as an in-depth understanding of how project consultants for green projects are appointed in Malaysia is needed. The qualitative method enables the researcher to obtain a deeper and enhanced knowledge on the topic. A two-phased interview is employed in this research; Tier-1 and Tier-2 studies. In the Tier-1 study, a questionnaire designed for the interview uses the semi-structured style because it allows for better generation of information due to its flexibility (Robert Wood Johnson Foundation, 2016). Tier-1 acts as a preliminary study, whereas Tier-2 is an in-depth study. Being a continuation of Tier-1, Tier-2 which focuses on the study at a much deeper level adopts a structured style of interview. Tier-1 provides basic and early insights on the appointment issue. Attention is given on processes and procedures, as well as the selection criteria for the appointment of project consultants in green projects. Using the preliminary study findings, some modification and amendments are made especially in terms of respondents' background, reliability and validity of information and questionnaire design. The in-depth interviews (Tier-2 study) will be conducted with 14 respondents consisting of developers and architects. The methodology of this research will be further explained in Chapter 3.

1.8 Guide to the Thesis

This thesis is divided into six chapters excluding preliminary sections, appendixes and references. Chapter One focuses on the introduction of the research in which it highlights the basis of the research by covering the background of the research, research problems, theoretical background, research aim and objectives, research questions and outline of the thesis.

Chapter Two provides the literature review on project consultants' appointment process and practices in general, before highlighting the process used for green projects. The chapter explains the definitions of green construction projects together with its history and its relation to sustainability before delving to a lengthy discussion on the appointment process of main project consultants. This chapter provides the background understanding on the issue from the perspective of various past researches.

Chapter Three provides details on the methodology undertaken in this research. Aspects such as the design of the study, data collection method and type of analysis used are briefly explained here.

Chapter Four will then present the interview findings and results from the analysis conducted. A thorough discussion based on the literature reviewed together with the findings will be included here.

Chapter Five presents the conclusion which covers the aim and objectives achieved, limitations of study, and recommendation for further studies.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents information and discussion on literature related to the research topic. The next subchapter elaborates on the concepts of sustainability, sustainable development and sustainable construction. Evolution of the term ‘green’ and green construction is then focused on in terms of Malaysia’s stance. The chapter then delves into the topics of consultant appointment, processes and procedures, selection criteria and challenges faced in appointing consultants. Finally, the conceptual framework which adopts the Open System Theory is proposed. The elaboration and discussion in this chapter set the direction of the research.

2.2 Construction as a Sustainable Industry

The products of the construction industry are buildings and infrastructures that are important in preserving mankind by providing shelter, workplaces, and places for social gathering to ensure that the quality of living is enjoyed by all walks of life. The construction industry is complex as it involves multiple processes and people from multiple disciplines to achieve the end product. The increases in environmental degradation is partly due to the construction industry’s activities, thus prompting the demand and need for the industry to be sustainable (Tan, Shen, & Yao, 2011; Dickie & Howard, 2000; Hill & Bowen, 1997). Nonetheless, the industry cannot be 100% percent sustainable as the concept of development itself contradicts the essence of being sustainable. As such, the concept of sustainability in

construction is mainly to alleviate, not eradicate its impact to the environment. The concepts of sustainability, sustainable development and its relation to sustainable construction will be explained further next.

2.2.1 Sustainability and Sustainable Development

The rapid growth of modernization poses various environmental and societal issues which give rise to the importance of ‘sustainability’. The concern on environmental impacts rose in the early 1980’s due to the depletion of non-renewable resources, global warming and destruction of ecology and biodiversity (Kibert, 2008). ‘Sustainability’ has been introduced as a term synonymous with ensuring the continuance of present enjoyment and the capacity to protect various aspects of life. Various authors and researchers have attempted to provide the best definition for the term ‘sustainability’ despite its mild implementation in all sectors (Kibert, 2008). The word ‘sustainability’ itself is pictured as long term, durable, sound and systematic (Filho, 2000). Costanza & Patten (1995) stated that sustainability is a system in which one survives or persists. Sustainability ties with the economic, social and environmental systems which propel a community to have a healthy, productive and meaningful life; both present and future (Marshall & Toffel, 2005). Sustainability concerns the interactions, integrations and significant relationships among ecological, social, and economic factors (Shen et. al., 2010).

From the general understanding on sustainability, a new concept of sustainable development has been introduced. Hopwood, Mellor, & O’Brien (2005) stated that there are at least one hundred definitions used for sustainable development. The term ‘development’ means a process or evolution of an objective (Glavič & Lukman, 2007). Development is also seen as coherently related to growth and therefore, sustainable development would mean a continued growth of a system

or objective (Robinson, 2004). As stated by Mitcham (1995), development is the ‘modification of the biosphere and the application of human, financial, living and non-living resources to satisfy human needs and improve the quality of human life’. Development can also be portrayed as conservation since the goal and objectives of both agendas are subjected to people.

Sustainable development is a term introduced by The World Commission for Environment and Development (WCED), better known as the Bruntland Report in 1987 to satisfy the need to be ‘sustainable’ (WCED, 1987). The Bruntland Report defined sustainable development as the “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”. It is a holistic concept which concerns not only the environment, but is a matter of equity and social justice as well (Shaw & Kidd, 1996). Sustainable development is about the relationship between humans and the environment by capturing both the humans’ needs and the integrity of the environment’s biophysical aspects (Du Plessis, 2007). The highlight of sustainable development is on the humans’ responsibility on economic, environmental and natural processes (Glavič & Lukman, 2007).

Part of the ‘development’ aspect includes built environments. It is believed that 21st century cities have to be greener; hence, promoting and having a sustainable development agenda within the construction industry has been one of the arising issues in developed countries (GhaffarianHoseini et al., 2013). Hill & Bowen (1997) stated that humans depend on buildings; therefore every action towards having a building would affect humans’ financial and environmental aspects. This gives rise to the new term ‘sustainable construction’.

2.2.2 Sustainable Construction

The construction industry is related to the sustainable agenda as this industry has a significant impact on the environment (Poon, 2000). The industry contributes to global issues such as environmental pollution and ecological damage. The construction industry has a linkage with the national economy and societal growth as it provides a platform on which people can live, work and satisfy their social and other needs (Medineckienė, Turskis, & Kazimieras, 2010). Construction plays a major role as one tenth of the world's economy lies in it (Hill & Bowen, 1997). However, the industry is also dubbed as one of the highest contributors to environmental problems (UNEP, 2007), including the global depletion of natural resources (Riley, Pexton, & Drilling, 2003). Environmental issues such as emissions of hazardous elements, risks of environmental incidents, depletion of raw materials, exhaustion, contamination of land, biodiversity endangerment and atmospheric quality impairment are some examples of the impact unsustainable construction processes cause (Medineckienė et al., 2010). It is estimated that 20-25% of the world's energy is spent on the production of construction materials such as cement, steel and plastic (Becchio, Corgnati, Kindinis, & Pagliolico, 2009). For instance, 38 percent of the total amount of carbon dioxide in the United States are produced by buildings, where 17.5 percent is from commercial use and 21 percent from homes (Zhang, Platten, & Shen, 2011). In the European Union (EU), 40% of man-made waste is generated by the construction industry (Houvila & Koskela, 1998). Due to these concerns, the industry is urged to adopt sustainable construction concepts in order to control environmental problems.

Originally, the term 'sustainable construction' is proposed to describe the construction industry's responsibility to be sustainable. Kibert (1994) defined sustainable construction as 'to create a healthy built environment using resource-efficient, ecologically-base principles'. It is further supported by Dickie & Howard (2000) who said that everything build by the construction players today will influence the future generations' means to meet their needs. Sustainable construction is mostly and typically stated as the result of the creation and responsible management of a healthy built environment based on resource usage efficiency and ecological principles (Tan et al., 2011). Sustainable construction is a process which begins in the planning and design stages and continues throughout the whole process of construction up until managing the building's functions during its lifetime, and the after-product which concerns the recycling of resources to reduce waste (Wyatt, 1994). Zainul Abidin & Pasquire (2005) argued that to embed the concept of sustainable construction, one has to have awareness and knowledge before implementation and improvement can take place. They also argued that sustainable construction can be efficiently embedded when all stakeholders such as the government, developers, consultants and contractors commit, demand and practice sustainable principles.

The traditional design and construction focuses on cost, quality and performance objectives, while sustainable construction adds in the importance of the minimization of a few elements; resource depletion and environmental degradation (Kibert, 1994). Hence, the concept of sustainable construction relies on 3 main pillars; social well-being, economic stability and environmental protection (Zainul Abidin, 2009; Hill and Bowen, 2010). The fundamental concept of sustainable construction is to deliver long term affordability, quality and efficiency, and value to

clients and users whilst decreasing negative impacts and increasing economic sustainability (Majdalani et. al., 2006).

The green concept was introduced as a subset of sustainable construction due to both concepts' same aim and mission which focuses on ecological, social and economic issues (Kibert, 2008). The green concept is an essential component of sustainable construction, sustainable development and general sustainability (Lacroix & Stamatiou, 2007). Some confusion arises in understanding the green concept and sustainable construction concept. Zainul Abidin and Pasquire (2005) stated that green and sustainable construction has been used interchangeably by many scholars. According to Yanarella, Levine, & Lancaster (2009), the green concept normally emphasises on achieving environmental benefits rather than capturing all three benefits. It is because the scale in which the green concept applies may refer to individual products and buildings as it is the most tractable level for greening. Sustainable construction, on the other hand, demands a larger and more expansive scale. McDonald (1997) further supported this statement by saying that the green concept aims to reduce negative impacts on the environment, whereas the sustainability concept eliminates the negative impacts. The green concept is also a sub-element of sustainability construction in which it is viewed as having lesser concern on 'sustainability'. Elaboration on the green concept in construction is presented next.

2.3 Green Concept in Construction

Introduction of the green concept in the construction industry is seen as one of the actions and initiatives to decrease the adverse impact construction has on the environment. 'Green practices in construction' is a term used to refer to design and construction practices that have minimal impact to the environment (Gambatese et

al., 2007). For a building to be green, there are a few specific criteria that have to be fulfilled which include site planning and design, community, indoor air quality, energy, material, waste, water, commissioning and marketability (Green Space, 2016). Sinha (2009) further explained that green buildings consist of site planning, energy efficiency, materials efficiency, and water efficiency. An ideal green building should have five major features; integration with local ecosystems, proper selection of material, maximum use of passive design and renewable energy, optimised building hydrologic cycles, and full implementation of indoor environmental quality measures (Kilbert & Grosskopf, 2005). According to Low, Liu, & Wu (2009), the five criteria of the green concept reflects the environmental aspects that any green building should possess; (1) energy efficiency focuses on the approach that can be used in the building design and system selection to optimize energy efficiency, (2) water efficiency focuses on the selection of water use efficiency during construction and building operations, (3) environmental protection focuses on the design, practices and selection of materials that would reduce the environmental impacts of built structures, (4) indoor environmental quality (IEQ) focuses on the design strategies that would enhance the IEQ such as air quality, thermal comfort, acoustic control and day lighting, and (5) other green features which focus on the adoption of green practices and new technologies that are innovative and have potential environmental benefits.

Generally, there are two manners in which the construction industry considers a building to be green. One is through a green rating system which will be explained further, and another is through passive design. The passive design approach covers criteria such as natural endowments of the building site, reduced radiant heat through building envelopes and daylight and lighting systems (Abdul

Rahman, Abdul Samad, Bahaudin, & Ismail, 2009). Looking at this list, it is understandable that the criteria of the green concept in the construction industry lies basically in its environmental factors since being green puts more emphasis on tackling environmental issues. The section below discusses on green terminologies, its importance and criteria in the construction industry.

2.3.1 Terminologies Related to ‘Green’ in the Construction Industry

The term ‘green’ does not individually refer to buildings and spaces themselves, but refers to the processes or activities which embed certain principles favourable to the environment during the construction of said building or spaces (Presley & Meade, 2010). It is further expressed by Robichaud & Anantatmula (2011) that for a building to be ‘green’, every phase of the building process must incorporate environmental considerations such as energy efficiency, water efficiency, resource efficiency, indoor quality, waste and pollution control, efficient maintenance and the overall impact of the building to the environment.

There is a variety of terms used to define ‘green’ in the construction industry. Common terminologies associated with the green concept are as follows:

- a) Green construction - U.S. Environmental Protection Agency (EPA) (2008) defines green construction as ‘the practice of maximizing the efficiency with which buildings and their sites use resources – energy, water, materials – while minimizing building impacts on human health and the environment, throughout the complete building life-cycle – from planning, design, and construction to operation, renovation and reuse’. Green construction is further defined as the act of constructing a building or infrastructure with green conscience. Green construction falls under