THE ATTITUDINAL COMMITMENT OF CONTRACTORS FOR SITE ENVIRONMENTAL PRACTICES IN MALAYSIA

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THE ATTITUDINAL COMMITMENT OF CONTRACTORS FOR SITE ENVIRONMENTAL PRACTICES IN MALAYSIA

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AC	Attitudinal Commitment
CC	Continuance Commitment
CFA	Confirmatory Factor Analysis
CIDB	Construction Industry Development Board of Malaysia
CIMP	Construction Industry Master Plan
CIRIA	Construction Industry Research and Information Association
CITP	Construction Industry Transformation Program
CO_2	Carbon Dioxide
DOE	Department of Environment
EP	Environmental Practices
EPU	Economic Planning Unit
ETP	Economic Transformation Program
EQA	Environmental Quality Act
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EQA	Environmental Quality Act
FA	Factor Analysis
GBI	Green Building Index
GHG	Greenhouse Gas
G1-G7	Contractor Grade 1- Grade 7
KeTTHA	Ministry of Energy, Green Technology and Water Malaysia
NC	Normative Commitment
NO_2	Nitrogen Dioxide
PCA	Principal Component Analysis
PM_{10}	Particulate Matter
QUAL	Qualitative Method
QUAN	Quantitative Method
RMK11	Eleventh National Plan
SC	Sustainable Construction
SD	Sustainable Development
SEPs	Site Environmental Practices
SM	Site Management
SO2	Sulfur Dioxide
TM	Top Management

KOMITMEN ATTITUDINAL KONTRAKTOR TERHADAP AMALAN PERSEKITARAN TAPAK BINA DI MALAYSIA

ABSTRAK

Penglibatan langsung pihak kontraktor di tapak bina meletakkan mereka sebagai pihak utama yang mempengaruhi prestasi alam sekitar bagi sesebuah projek. Walaubagaimanapun, peningkatan tahap kebimbangan isu alam sekitar di tapak bina menunjukkan bahawa komitmen terhadap aspek ini perlu diperkukuhkan. Oleh kerana firma kontraktor terdiri daripada Pengurusan Atasan (TM) dan Pengurusan Tapak (SM), komitmen yang selaras di antara mereka adalah sangat penting bagi mengukuhkan tindakan pihak kontraktor terhadap perlindungan alam sekitar. Kajian ini bermatlamat untuk menghasilkan rangka kerja Komitmen Attitudinal kontraktor terhadap Amalan Persekitaran Tapak Bina (SEPs), melalui pencapaian empat objektif kajian, iaitu, mengkaji tahap amalan SEPs, menilai tahap Komitmen Attitudinal TM dan SM, menyiasat faktor-faktor yang mempengaruhi Komitmen Attitudinal dan menunjukkan kesinambungan hubungan Komitmen Attitudinal di antara TM dan SM. Dua fasa kajian iaitu (QUAN-QUAL) telah digunakan untuk mendapatkan hasil kajian yang lebih kukuh dan menyeluruh. Di Fasa 1, tahap perlaksanaan SEPs disiasat dan Komitmen Attitudinal TM dan SM dinilai. Melalui persampelan secara rawak, sejumlah 194 respon diperolehi daripada syarikat kontraktor Gred G1-G7 dari Semenanjung Malaysia. Fasa 2 melibatkan temu bual bersama 16 TM dan SM daripada syarikat G7 yang dikenal pasti melalui persampelan terpilih. Dalam fasa ini, elemen-elemen utama yang mempengaruhi Komitmen Attitudinal diselidiki dan hubungan Komitmen Attitudinal dengan TM dan SM ditunjukkan. Secara keseluruhan, hasil kajian melaporkan, pertama, terdapat pelbagai pendekatan perlaksanaan SEPs di Malaysia, namun kontraktor didapati cenderung kepada ‘sengaja reaktif’. Kedua, terdapat perbezaan tahap komitmen di antara TM dan SM. Komitmen mereka lebih dipengaruhi oleh faktor ekonomi (Continuance Commitment (CC)), tetapi, kurang

dipengaruhi oleh ikatan emosi (Affective Commitment (AC)) terhadap alam sekitar. Ketiga, empat aspek utama telah didapati mempunyai pengaruh terhadap Komitmen Attitudinal TM dan SM, iaitu; faktor berkaitan pengurusan tapak, faktor berkaitan organisasi, sokongan dan tekanan luaran dan faktor peribadi. Akhir sekali, kajian ini memperlihatkan hubungan penting di antara TM dan SM dalam usaha bagi memastikan tindakan SEPs dikoordinasikan dengan baik yang sejurusnya membawa kepada penghasilan rangka kerja Komitmen Attitudinal terhadap SEPs. Kesimpulannya, rangka kerja Komitmen Attitudinal terhadap SEPs yang dihasilkan menyumbang kepada pengukuhan tindakan kontraktor, bagi memastikan komitmen yang berterusan terhadap perlindungan alam sekitar di tapak.

THE ATTITUDINAL COMMITMENT OF CONTRACTORS FOR SITE ENVIRONMENTAL PRACTICES IN MALAYSIA

ABSTRACT

Direct involvement of contractors at construction site positioned them as the main party to influence the project environmental performance. However, the increasing concern of environmental issues at construction site indicated that commitment on this aspect need to be fortified. As the contractor firms consist of Top Management (TM) and Site Management (SM), their synchronized commitment is vital to strengthen their action towards environmental protection. This study aims to develop a framework of the contractors' Attitudinal Commitment for Site Environmental Practices (SEPs) through the attainment of four research objectives, i.e. exploring the level of SEPs, assessing the Attitudinal Commitment of TM and SM, investigating the factors influencing the Attitudinal Commitment and demonstrating the connection of Attitudinal Commitment between the TM and SM. Two phases of investigations, i.e. (QUAN-QUAL) were employed in order to obtain more conclusive and comprehensive findings. In Phase 1, the level of SEPs implementation are explored and the Attitudinal Commitment of TM and SM are assessed. Through random sampling, a total of 194 responses were obtained from construction firms of grade G1-G7 from Peninsular Malaysia. Phase 2 involved interviews with 16 TM and SM from G7 firms that are identified through selective sampling. In this phase, key elements influencing the Attitudinal Commitment are investigated and the connection of the Attitudinal Commitment between TM and SM are demonstrated. Overall, the findings reported that, first, there are various approaches of SEPs implementation in Malaysia, however the contractors inclined towards being 'deliberately reactive'. Second, there are disparity of commitment level between TM and SM. Their commitment are largely influenced by economic factors (Continuance Commitment (CC)), but with least influence by emotional attachment (Affective Commitment (AC)) to the environment. Thirdly, four main aspects are found to have influence on TM and SM

Attitudinal Commitment, i.e. site management related factors, organizational related factors, external support and pressure, and personal factors. Lastly, this study demonstrates the important connection between TM and SM in ensuring SEPs actions are amicably coordinated, thus, leading to the development of the proposed Attitudinal Framework for SEPs. In conclusion, the developed Framework of Attitudinal Commitment for SEPs contributes to the strengthening of contractors' action, to ensure continuous commitment for environmental protection at construction site.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter discusses about the background of the study and justifies the problem and gaps for the research. Following this, the research aim and objectives are established. In later sections, the research scope and the brief methodology of the research are also presented. This chapter concludes with the brief outline of all chapters included in this thesis.

1.2 Research Background

As outlined in the Eleventh National Plan (RMK11), enhancing the well-being of the public remained as the national priority. The effort to improve the living standard of all Malaysians includes the improvement of various economic sectors such as healthcare, housing, education, manufacturing, transportation, communication and etc. Construction sector assumes important role in developing the infrastructure in need by these sectors. In line with the national commitment to build a better Malaysia for all Malaysian, the growth of the public and private development projects for housing, public amenities and infrastructural development in various rural and urban areas become more aggressive in the present and the future.

The aggressive nature of construction project development in Malaysia has resulted many negative side effects. The huge amount of Greenhouse gas (GHG) and dust released during the construction site operation has affected the local air quality. In the context of addressing global warming issues, processes which release GHG should be

effectively mitigated. The massive amount of construction waste generated containing hazardous and toxic waste has contaminated the land and cause water and air pollution. The use of heavy or unsuitable equipment and machineries, prolong working hours has emit excessive noise which adversely affect the people's health (e.g. stress, sleep disturbance and high blood pressure). The effort to provide adequate shelters, facilities and infrastructures were blemished with conventional and unsustainable development process. As a consequence, people's comfort and living quality are being compromised. The negative effect of the recurring construction problem has loaded further challenge on the government in the attempt to produce healthy and productive citizen by year 2020 and beyond. Obviously, the construction industry's 'build first clean up later' attitudes need prudent resolution without delay. The citizens need a healthier environment. Thus it is the responsibility of the construction industry to provide greener construction site and minimize the impact on the surrounding environment.

Ideally, the client should require the project to indicate the measurers for environmental performance, the design team should take steps to ensure sustainable design is included, the contractor have a duty to minimize the environmental impact at the construction site and the end user should operate the facility with environmentally responsible. However, many studies report that the efforts to protect the environment in all aspects are still minimal in Malaysia and being taken very lightly (Ping et. al, 2009; Zolfagharian et. al, 2012; Samari et. al, 2012). As a result, deforestation, soil erosion, water pollution, ground water contamination, air pollution, noise pollution, shortage of energy and natural resources, construction waste generation, landscape alteration, site hygiene problem, risk of public health and social disruption becomes a recurring environmental problems encountered by the nation. While Malaysia's construction sector is said to have a multiplying effect on the global economy, the aggressive and dangerous

construction process have induced harmful effect on the local, regional and global environment (Anderson et. al, 2015) and would further deteriorate if it is not urgently addressed (Zolfagharian et. al, 2012; Bilec et.al, 2006).

The reported environmental damages to the environment in various scales and types prove that construction practices in Malaysia are still not sustainable. The fundamental purpose of building construction, which has long forgotten, is to create harmonious living conditions for people in many generations, i.e. in a sustainable way. As the project initiator and executor, the construction practitioners seem still not able to find the balance between the need to properly construct infrastructures and to protect the environment and people. In addressing these issues, Zainul Abidin (2010a) and Sim and Putuhena (2015) emphasize that each of the multidisciplinary players of the construction project play crucial role within their sphere of responsibilities. They need to understand the process of sustainable construction sufficiently to be able to ensure that their individual action and decisions add as little as possible to the total burden on the environment (Parkin, 2000).

However, although each of the construction practitioners involvement may have significant impact on the environment, Son et. al (2011) highlighted that the involvement of contractors are regarded as having greater influence than others. As the project executor (Robin and Poon, 2009), they pose huge obligation to create and operate a healthy built environment (Kibert, 1998). Their physical presence at construction site (Toole, 2002; Singh, 2010), their know-how knowledge about construction methods (Son et. al, 2011) are highly significant towards operating a construction process that is ‘green’ and sustainable. It is to ensure that the project that they are developing does not just produce a sustainable building but has practiced a sustainable approach in their construction process.

Many researchers agree that Malaysian contractors are still content with their common construction practices which are not sustainable. According to Papargyropoulou et . al (2011), in a study investigating the contractors' awareness and commitment to sustainable waste management, they report that the contractors have limited knowledge and understanding on the right method of managing construction waste. Besides sending the debris to landfill, these contractors just dispose their waste through burning or burying them illegally at construction site. Their low level of awareness on the adverse impact of construction waste on the environment made them become complacent about the importance of managing waste. Dunphy et.al (2007) regarded these contractors as environmentally 'non-responsive organization'. They usually take sustainability aspect for granted and just concentrate on 'business as usual'.

In a similar study on waste management practices, Begum et. al (2009) found that although the contractors are aware of the right waste management strategies, not all of them are willing to implement it. The finding coincides with Samari et. al (2013) who conclude the unwillingness of the construction company to participate in green practices as the major obstacle for sustainable development path in Malaysia. The reason being environmental protection measures are viewed as an added cost and time than as an opportunity for improvement (Sim and Putuhena, 2015). The clashes between cost and environment are the common dilemma that limits the application of environmental measurers among the local contractors and even in the overseas (Shen and Tam, 2002; Liyin et. al, 2006) and make them more reluctant (Papargyropoulu et. al, 2011; Samari et. al, 2013). According to Begum and Pereira (2009), the contractors are not willing to pay for construction waste collection services if it is more than RM200. They prefer to self-dispose the waste at their convenient methods. Wong and Yeoh (2004) audit on Malaysian cultural dimension may be best to explain this. According to them, Malaysian are

generally risk-averse society. Thus, they have tendency to ignore the importance of environmental protection if they find there are risks associated with the practices.

Passive culture among contractors is another challenges highlighted in Zainul Abidin (2010b) and Sim and Putuhena (2015) in picturing the dilemma of Malaysia construction industry towards progressing in the path of sustainability. These contractors prefer to rely on initiatives led by others Papargyropoulou (2011), i.e government bodies and Construction Industry Development Board of Malaysia (CIDB). They seldom invest their own effort and time to minimize environmental impact during construction phase. Although many are content with their conventional construction methods which are not sustainable, Begum et. al (2009) and Papargyropoulu (2011) reported that there are some proactive Malaysian contractors who practice sound environmental practices. Regardless of their company capacity, these contractors show positive attitude and behavior spending their effort and time to implement environmental practices. Their effort and contribution in reducing negative impact on the environment and people should be an exemplary. Such initiative may inculcate and spur the motivation for others to follow, creating a *positive domino* effect in the ecosystem of construction industry in Malaysia.

The various approaches of environmental practices as reported in previous works lead to further investigation on the current commitment of the contractors and their influencing factors. As highlighted by Zainul Abidin (2010b), commitment is a significant step before implementation. Thus is it important to understand the current state and construct of the contractors commitment in great in depth, thus lukewarm implementation can be address accordingly.

1.3 Research Problems

In this section, the research problems and gaps are discussed based on three aspects; i.e. the need to improve the non-environmental friendly construction site operation in Malaysia through Site Environmental Practices (SEPs), lack of understanding on the Contractors' Attitudinal Commitment for SEPs and the need to ensure Top and Site Management Attitudinal Commitment for SEPs are synchronised.

The implementation of environmental practices at construction site are very crucial. Their advantages have being much highlighted by many authors with reference to construction site operation in oversea countries like US, UK, Finland, China and Korea (Ahn and Pearce, 2007; CIRIA, 2000; Terio and Kahkonen, 2011; Tan et. al, 2011Son et. al, 2011). By ensuring construction site operations fully integrate environmental consideration, the harmful effect on the environment can be minimised and people's daily convenience can be enhanced. On the economic sides, these practices will benefits the nation and the people in short and long term. However, in Malaysia, studies shows that the environmental practices at the construction site still need improvement (Begum et. al, 2008; Chan et. al, 2008). The prevailing environmental issues as reported in each year (such as inefficient waste management, water pollution, air pollution due to uncontrolled dusty site condition, sedimentation) (see Table 2.1, p 19), explain the lack of commitment from the contractors in achieving sustainability. This call for the Malaysian contractors to adopt a more environmental friendly site operation i.e. Site Environmental Practices (SEPs). In Malaysia, many studies have being conducted to address environmental problems caused during site operation, however, most of the previous studies focus on single issues such as issues on waste (see Begum et. al, 2007; 2009; Nagapan et. al, 2013), energy and gas emission by (Zaid and Graham, 2015). Although Yusof et. al (2015) and Yusof et. al (2016) investigated the level of pro-environmental practices of the client,

architect, engineer as well as the contractors in Malaysia, they also confine environmental practices to waste management and energy efficiency practices practiced within these firms. However, Yusof et. al (2015) highlighted that for improvement to be made, current level of practices must first be evaluated. Considering the various environmental effect caused during construction site operation (six environmental issues highlighted in Table 2.1, p. 19 , this motivates to search for an answer to the first research question *(RQ1); i.e. what is the current level of environmental practices in Malaysia construction site?*

Despite of the important of environmental practices in enhancing the environmental sustainability, its promotion remain a huge challenge (Yusof et. al, 2015). While many efforts are being suggested to promote environmental concern among the construction practitioners, such as legal framework, standard guideline for environmental management, financial scheme, technology (Hill, and Bowen, 1997; Sakr et. al, 2010; Tam et. al, 2004; Lam et. al, 2011; Gluch et. al, 2012; Sim and Putuhena, 2015), others also believe that these effort cannot be achieved without the commitment of the people as the main supporting drivers (Hussey and Skoyles, 1974; Kulatunga et. al, 2002; Cole, 2000; Zainul Abidin et. al, 2013; Du Plessis, 2007). However, according to Teo and Loosemore (2001) the importance of 'human factor' have often been ignored. Issues of commitment, one of the important human factor (Du Plessis, 2007), that often crops as problematic towards ensuring effective and continuous implementation of environmental practice. As the main players who execute construction site operation, the contractors' commitment is very important be it from the Top Management Level (Tam et. al, 2006; Qi et. al, 2010) or Site Management level (Teo and Loosemore, 2001). Although commitment is a very critical element in the path of sustainable construction as highlighted in Du Plessis (2007), little is actually known on the comprehensive construct of commitment, i.e. the framework. The classic theory of commitment divide the

commitment construct into two important perspective, the attitudinal and behavioral perspective of commitment. This study focuses on the Attitudinal Commitment which investigates in a greater depth to discover the level of contractor's attitudinal commitment which will lead various approaches of environmental practices (behavioral commitment) as theoretically discussed in Keogh and Polonsky (1998) and Du Plessis (2007). As the importance of commitment on socially environmental practices have been much discussed in other field of studies (see Keogh and Polonsky, 1998; Cantor et, al, 2012; Raineri and Paille, 2016), less is known about its construct in relation to sustainable construction studies. This lead to the next research question *(RQ2), what is the framework of Attitudinal Commitment of Contractors for SEPs?*

As the complexities of the contractors organization is observed, few scholars highlight the importance of active involvement of both top and site management level for an effective implementation of environmental practices (Yeo and Quazi, 2006; Sim and Putuhena, 2015). Top Management involve in the strategic planning and overall management of the company performance while Site Management heavily involved in the mobilization and coordination of construction work operation. Contradiction in environmental involvement between the two could create a clash in terms of long term environmental strategic goal and what is being implemented at site (Gluch et. al, 2012). Through the lens of commitment theory, the connection between the two managerial attitudinal commitments is important to be established to ensure their responses toward environmental practices can be synchronized and SEPs are continuously improved. This thus leads to another important question *(RQ3) on; how Attitudinal Commitment are affected at different level of construction organizations' management?*

1.4 Research Aim and Objectives

This research aim to develop model of attitudinal commitment for Site Environmental Practices (SEPs).

The objective of this research are:

i. To explore the level of Site Environmental Practices implemented by the Contractors in Malaysia.
ii. To assess the Attitudinal Commitment of Top and Site Management commitment for SEPs.
iii. To investigate the factors influencing the Attitudinal Commitment of SEPs among Top and Site Management for SEPs.
iv. To demonstrate the connection of Attitudinal Commitment between Top and Site Management for SEPs.

1.5 Research Scope

This research concern the Site Environmental Practices carried out by the Malaysian Contractors. In early stage of this research the current level of Site Environmental Practices by contractors in Malaysia is explored. The respondents are the contractors in Malaysia ranging from the Grade 1 to Grade 7. Knowing the level of SEPs will provide a strong justification on whether the current level of commitment is imbued with the environmental value.

The studied level of SEPs among contractors will be then subsequently followed with the assessment of attitudinal commitment of contractors to implement SEPs. At this phase, the attitudinal commitment was assessed on Top and Site Managers. In order to

understand their attitudinal commitment, the three dimensional commitment model is adopted, i.e. Attitudinal Commitment (AC), Normative Commitment (NC) and Continuance Commitment (CC). Owing to the distinctive job scope inherently observed for Top and Site Managers, it is with the intention of this thesis to explore the construct of commitment as perceived by both management levels (Top and Site Management).

The last phase of this research investigates the factors that may influence or impedes contractors' commitment at both managerial levels (Top and Site Management). The influencing factors are the factors that positively influence Top and Site managers to implement SEPs at site. The influencing factors include the internal or external factors relate to construction organization.

1.6 Brief of Research Methodology

To achieve the research aim and objectives, a mix methodology approach (quantitative-qualitative) is employed. The two-phase investigation are needed to increase understanding, expand knowledge and explore the commitment phenomenon for SEPs which little research are being done particularly in the context of construction industry in Malaysia.

The first phase involve a survey with registered G1 and G7 contractors in Peninsular Malaysia. The aim is to obtain wide opinion of the contractors on the implementation of SEPs and their commitment towards the practices. The findings are analyzed and tested through statistical software, i.e. SPSS 22. The second phase involve interviews with 16 Top and Site Management of the G7 companies. The interview aims to investigate factors influencing TM and SM Attitudinal Commitment in more in-depth. The interview findings are analyzed via Thematic Analysis. Both findings of quantitative

and qualitative are integrated to produce a Framework of Attitudinal Commitment for SEPs.

1.7 Structure of Thesis

The thesis is structured into chapters. Each chapters are summarized as below.

Chapter 1: Introduction

This chapter forms the introduction to the research by providing the background of the research, problem statement, presenting the aim and objectives, the scope as well as the brief of methodology employed for the research. This chapter ends with explaining the overall structure of the thesis.

Chapter 2: Literature Review

This chapter presents the literature review. The main focus is to explain the conceptual framework of contractor's commitment for Site Environmental Practices (SEPs). It covers five parts. The first part describes the relationship between construction industry and the quality of environment in Malaysia, followed by explanation on the key concept of Sustainable Construction, the progress of sustainability in Malaysia Construction Industry. The third part presents the elements of SEPs and their important in achieving environmental sustainability. The fourth section discusses on the role of the contractors and their involvement in SEPS and this relates to the last sections, i.e. on the understanding of the concept of commitment. Finally, the conceptual framework of the contractor's commitment for SEPs is presented.

Chapter 3: Research Methodology

This chapter discussed the philosophical stance that be the basis for designing the overall research framework. Justification of the data collection method used and the techniques employed are also presented.

Chapter 4: Phase 1: Survey

This chapter presents the key findings of the survey. The chapter is structured according to the background information of the respondents, implementation of SEPs, the construct and level top and site management commitment and factors influencing commitment.

Chapter 5: Phase 2: Interview

This chapter presents the key findings of the interview. It begins with description of the respondents followed by the three main discussion, i.e. 1) the current approach taken to minimize the environmental impact, 2) the components of commitment construct and 3)the various factors affecting commitment.

Chapter 6: Discussion

This chapter integrate the main findings of the two quantitative and qualitative findings. It was structure into three main area of discussion, i.e. the classification of approaches for environmental practices, the nature of multi-construct of commitment and the factors affecting commitment for SEPs.

Chapter 7: Conclusion and Recommendation

The final chapter conclude the thesis presenting the summary of the achievement of the research objective and its significant contributions. It also discuss the limitation of the research and suggestion on the area for future research. Lastly, the final conclusion for the research is presented.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Discussion of this chapter is divided into five main sections. The aim is to discuss the conceptual framework on contractors' commitment for Site Environmental Practices (SEPs) in Malaysia construction industry. This chapter begins with describing the relationship between construction industry and the quality of environment in Malaysia. The second part of this chapter discusses on the key concept of Sustainable Construction and how it can be adopted in construction project. Discussion is further focused on the significant of environmental sustainability and its progress in Malaysia Construction Industry. The third part of the chapter presents the elements of SEPs and their important in achieving environmental sustainability. The fourth section discusses on the role of the contractors and their involvement in SEPS and this relates to the last sections, i.e. on the understanding of the concept of commitment. Finally, the conceptual framework of the contractor's commitment for SEPs is presented.

2.2 Construction Industry and the Environment

Construction industry and the environment are intrinsically linked (Ding, 2005). The following discussion provides an overview of the Malaysia construction industry and its importance and highlight its negative 'side effects' that are taking toll on the environment.

2.2.1. Malaysian Construction Industry and Economic Development

Construction industry is crucial for the growth of Malaysian economy. The Malaysia Productivity Corporation (MPC) reported that the contribution of the construction sector to the country's Gross Domestic Product (GDP) surged from RM29.5 billion in 2013 to RM33 billion in 2014 (MPC, 2015), giving it a share of 4% of the country's total GDP (Bank Negara Malaysia (BNM), 2014). This percentage is expected to grow by 5.5% by the year of 2020 (Economic Planning Unit (EPU), 2015) (refer to Figure 2.1).

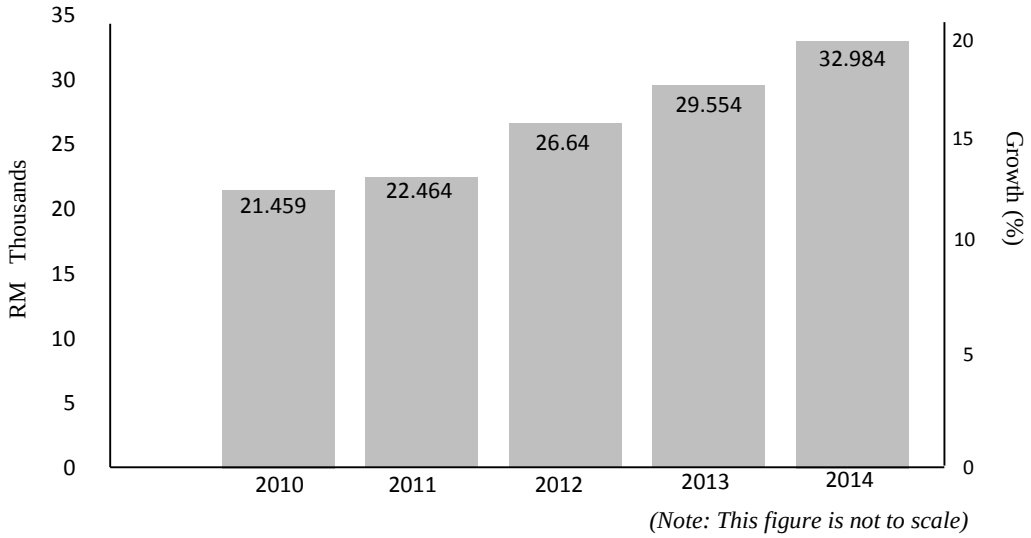

Figure 2.1 GDP Performance of the Malaysia Construction Sector 2011-2014 (MPC, 2015)

Since the predominant move from agricultural based in the 1970s, to manufacturing in the mid-1980s and to modern services in the 1990s, the construction sector has consistently contribute to the growth of the national and social development. Despite facing uncertainty in the global financial market, the performance of Malaysia construction industry remained robust and expected to continue to record high growth (BNM, 2014). Construction sector has two-times multiplier effect. The interdependence

of the supply and demand within construction sectors has created extensive backward and forward linkages with other 120 sectors (Department of Statistic Malaysia (DOSM), 2005; Ibrahim et. al, 2010; CIDB, 2015a). These industries rely on construction sectors for their growth and sustainability.

The contribution of construction industry in uplifting the social development of the Malaysian citizen and strengthening the national economic is undeniably important. People are nation most important assets to navigate the growth of Malaysia beyond 2020. Since 1970s, their wellbeing and prosperity have become the main development philosophy of Malaysian government. Envisioned with the theme 'anchoring growth on people' the current Eleventh Malaysia Plan 2016-2020 (RMK11) aims to guide the national development towards building better Malaysian. To improve the people's quality of life and manifest the plans in RMK11, a total of RM30.1 billion has been allocated for development expenditure which include physical development projects in broad area of Peninsular as well as in Sabah and Sarawak (The Star, 2015a). These development projects involve various sectors such as healthcare, education, housing, tourism, communication, infrastructure and many more.

The role of the private sector is also important in ensuring the people continue to cherish in economic prosperity, despite facing the global and domestic economic challenges. Comparing to their modest role in the period 2001-2011, BNM (2013) reported that the private sector's contribution grew in the final quarter of 2011. The growth of their investment is coherent with the objective of the Economic Transformation Programme (ETP) launched in 2010 that is to elevate the private sector as the main driver of the national economy (PEMANDU, 2010). In construction sector, they are the dominant investor for all construction subsector i.e residential, non-residential, civil engineering and special trade since 2008 until 2013 (DOSM, 2014; Olanrewaju and

Abdul-Aziz, 2015). DOSM (2016) reported that the figures for value of work done by the private project owner remain proportional until early 2016. Their massive investment has benefitted and strengthened the construction sector through various implementation of development projects such as the catalytic projects under the ETP and other property and commercial development projects pioneered by the private developers.

In short, the contribution of the construction industry to the economic advancement is indeed very important. The demand for development from both the public and private sectors, has resulted in massive ongoing construction project at various geographical location of Malaysia each year (DOSM, 2016). The progress in this industry, although beneficial the nation economically and socially, has various side effect to the environment if not managed effectively. This is discussed next.

2.2.2. The Relationship between the Construction Industry and Environmental Quality

The relationship between construction sector and environmental degradation are constantly being discussed by many researchers. Numerous studies on the environmental impact assessment of construction project affirmed that the sector have caused significant adverse impact on the 1) ecosystem, 2) natural resources, and 3) public health (Li, Zhu and Zhang, 2010; Zolfagharian et. al, 2012; Okunlola, Shola and Olatunde, 2015) and unfortunately, these impact are direct and irreversible (Shen et. al, 2007; Zainul Abidin, 2010a). Examples of these impact are deforestation, the loss of flora and fauna, the release of greenhouse gasses and water pollution.

Recent studies reported that buildings all over the world are responsible for 30-45% of energy use. In China, the sector account for 45.5% of the overall energy consumption (Zhaojian and Yi, 2006). Likewise in Malaysia, it is reported that buildings consumed 40% of the total annual energy (Abdul Karim, 2013). As the share of the global

construction spending is expected to increase in the Asian countries (due to urbanization) compared to the Westerners, the trend of the energy used for building would also projected to rise (Anderson et. al, 2015). There are two forms of energy consumed during the building's life cycle, i.e. the embodied and the operating energy. Embodied energy is the energy that is being used during the extraction, manufacture, production, transportation of the building materials and component and construction phase. Operating energy refers to energy consumed during the building operational phase. The environmental impact could be resulted from the daily use of the building which include electricity, water-heating, ventilation, heating and cooling (Anderson et. al, 2015). Compared to the building operational phase, the embodied energy used at the earlier stage contribute a lower share of total environmental impact (Ramesh et. al, 2010). However, the embodied energy can be 20-50 times of the annual operating energy (Treloar et. al, 2001) or as much as 67% of use phase over a 25-year period (Yohanis and Norton, 2002). It is resulted from the recurring embodied energy (Ramesh et. al, 2010) used for repairing works such repainting, re-carpeting, replacement of lamps and systems and major renovation works (Yohanis and Norton, 2002) throughout the 50-years of its service life (Junnila et. al, 2006).

Within each phase, building at the same time released considerable amount of greenhouse gas (GHG) emission. Globally, the building sector is reported to release 40% of GHG emission (International Energy Agency (IEA), 2012). If no mitigating actions are taken by 2005 to 2050, the emission rate is expected to grow from 60% to 90% (Urge-Vorsatz, 2012). Due to the increasing demand in the national energy demand, Malaysia carbon emission has increased by +235.6% from 1990 to 2005 (Zaid et. al, 2014) which 30% of them are resulted from the building sector (Malaysian Composite Industry (MIGHT), 2014 cited in Yusof et. al, 2016). According to Ali (2008), the huge amount of carbon quantities trapped in the atmosphere has created an imbalance in the natural carbon

cycle and result in additional warming of the earth. Consistent with the global warming trend, Malaysia has experienced an increase in temperature, changes in weather, including major wind patterns, increase amount of rain downpour and frequency of severe storm as well as extreme weathers (The Star, 2015b). The recent big floods that swamps several districts in the east coast of Malaysia in late 2014 was the worst natural disaster ever recorded in the country. It has destroyed and damaged more than 10,000 houses, affected more than 540,000 thousand victims and has caused damages on the public property cost of RM2.85 billion (Sulaiman, 2015).

Through its life cycle, construction is also a major contributor of the environmental pollution (Godfried, Pearce and Kibert, 1998). Land, air, water and noise are the most common sources of pollution that arise during the process of extracting the resources, manufacturing, transportation, construction and during building services. According to Junnila et. al (2006), construction and demolition works are the main sources of Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) emission. The Construction Industry Research and Information Association (CIRIA) (2010) reported that the PM_{10} that have penetrated deeply into the lung can cause respiratory illness such as asthma. Concrete, oil and chemicals waste, sewage and domestic waste are other types of pollutant that can pose risk on the people and the surrounding environment. These pollutants if not properly managed will seep into the waterways and destruct the ecosystem of the aquatic life as well as pollute the human drinking source. Noise or any unwanted sound is another hazard that can disturb everyone nearby including the wildlife (CIRIA, 2010). In a densely populated city like Hong Kong, many residents are inevitably affected by the noise of construction site which only one kilometer from the other (Law and Wong, 2014). For instance, in Malaysia, there have been many reports on issues of dissatisfaction with the construction project development relating to environmental problem. The unsustainable

ways construction process are reported to have severely affecting the environment and cause nuisance on the public and nearby residents' everyday life. Table 2.1 shows examples of a few complaints by the public highlighted by the local newspapers.

Table 2.1 Examples of dissatisfaction arising from construction activities

	News Headline	**Category of the environmental problem**	**Sources and Year**
1	Tropical mangrove swamp has become a construction dumpsite	Construction waste	The Star Online, September 2011
2	Residents up in arms over stretch of construction debris on road to Tambun	Construction waste	The Star Online, May 2014
3	Gravel road remains a dumping ground	Construction waste	The Star Online, July 2012
4	All dusty in USJ 15	Air pollution	The Star Online, September 2012
5	Wanting the dust to settle	Air Pollution	The Star Online, March 2013
6	Construction dust has them fuming	Air Pollution	The Star Online, December 2006
7	Construction works irk Taman Putri folk	Air Pollution Water Pollution	The Star Online, September 2014
8	Muddy nightmare	Water Pollution	The Star Online, December 2014
9	*Buat kerja sampai malam* (Working until late evening)	Noise Pollution	Utusan Online, November 2008
10	*Tiada lagi kedamaian* (No longer peace)	Noise Pollution Air Pollution	Utusan Online, August 2010
11	*Minta DBKL pantau lori tak ikut peraturan* (Ask DBKL to monitor the lorry drivers who did not follow guidelines)	Noise Pollution Air Pollution	Utusan Online, October 2012
12	*Pemandu lori masih degil* (Lorry drivers still stubborn)	Air Pollution Noise Pollution	Utusan Online, October 2012
13	*Telan habuk hari-hari* (Everyday inhale dust)	Air pollution	Utusan Online, Februari 2015

Construction sector is also the major contributor of solid waste (Yuan and Shen, 2011). In 2008, the European Union (EU) recorded that the construction waste that is generated from the construction related activities were one third (37.56%) of all waste produced by economic activities (Eurostat, 2013 in Yusof et. al, 2016). In China, the sector produced 40% of the overall solid waste (Wang et. al, 2004 in Yuan, 2013). Since the last

two decades, the extensive development projects in Malaysia have also led to the increase of construction waste generation (Begum et. al, 2007; Nasaruddin et. al, 2008). CIDB (2015c) reported that the waste produced by the construction and demolition works alone had account more than 30% of the total waste generated in Malaysia. Illegal dumping is the most pressing issues of the mismanagement of construction waste in Malaysia. The news headlines No.1 until No.3 in Table 2.1 are the example of illegal dumping problem which happened in various areas of Malaysia. For many developing countries, where urbanization are rapidly progressed, the increase of the discarded material through construction, renovation and demolition works have further caused adverse impact to the environment (Jaillon et al. 2009; Manowong 2012) that include land depreciation, resources deterioration, generation of waste, greenhouse gas emission, dust and noise (Yuan, 2013).

Given these points, the relationship between the need for rapid urban development and environmental quality in Malaysia appears to be a negative one. The 'side effects' of the unsustainable ways of construction practices had prevailed the fundamental objective of construction project development. Due to the large time gap between the cause and effect of the construction process (Parkin, 2000), the consequences of the smaller action is only apparent until the larger or cumulative effect is felt (Parkin, 2000; Li et. al, 2010). Thus, it is important for the problem to be resolved prudently by the construction sector with no delay (Du Plessis, 2007). In doing so, Zainul Abidin (2007) suggested that there is a need to strike a balance between improving the quality and the well-being of the people's life and preserving the natural resources and the local environment through integrating the concept of sustainable construction.

2.3 Sustainable Construction and Environmental Concern

Sustainable Construction (SC) is a concept that emerged from sustainable development. Its application is gaining momentum in Malaysia Construction Industry, which sets crucial direction for the industry in its attempt to improve the environmental quality locally and globally. With that motivation, the following subsections review the key concept of SC, how it can be adopted in construction project, the components that entails and its progress in Malaysia.

2.3.1. The Definition and Concept

Having realized the negative impacts of the construction development on environmental quality, the industry has been called to adopt a development process that is attentive to the environmental needs. In the context of sustainability, 'sustain' does not mean that 'nothing ever changes' because to not develop is also unsustainable (Zainul Abidin, 2010a). The word 'sustainable' in Parkin (2000) is described as the 'capability to continue'. Parkin (2000) further elaborated that something that has the quality of being sustainable means it has the intrinsic capacity to keep itself going indefinitely. In this research, sustainability implies to the process of built environment (construction process) which should be environmental-friendly to ensure the output does not undermine the generation now and the future.

Sustainable Development (SD) is dubbed as the path to operate the built environment in a way that matches the quality of the environmental sustainability (Parkin, 2000). SD is defined as development process that "……meets the need of the present without compromising the ability of future generation the meet their own need" (WCED, 1987, p.8). The new development philosophy introduced in the Brundtland Report have prompted many country to absorb the idea within their industry including in the

construction industry. Through sustainable development, stemmed the concept of SC which focuses on how the construction industry can contribute in a positive and proactive manner towards environmental protection (Zainul Abidin, 2009).

The first call for construction practices to adhere to sustainability was made during the Rio Earth Summit in 1992. The plan to promote sustainability in the construction sector was generally included in the seventh chapter of the Agenda 21 under the heading of *Promoting Sustainable Human Settlement Development* (UN, 2007). In 1996, Habitat II, the second international agenda has again highlighted the significant role of the construction sector for sustainable development. In the fourth chapter of the agenda, the sector is said to have been responsible for the substantial amount of resources use and waste generated during the development phase. Thus, a specific direction and paradigm change for the construction sector is indeed indispensable. In the early 1990s a number of work programme, international conferences and other activities were initiated by the International Council for Building (CIB), as the leading international organization for research collaboration in building and construction. These programs have become the platform for the experts to discuss on environmental issues and to find consensus on resolution towards a more sustainable built environment. In response to the earlier international agenda (e.g. Brundtland, Rio and Habitat), the Agenda 21 for Sustainable Construction was initiated in 1999. This agenda is intended to be a global intermediary between other general agendas particularly for the built environment. The framework for sustainable construction introduced in the agenda is to link the global concept of sustainable development and the construction sector. It also enables appropriate measures are coordinated at the local construction context (CIB, 1999; CIB and UNEP-IETC, 2002).

The earliest definition of SC is by Charles Kibert who defined it as the obligation of the construction sector 'to *create and operate a healthy built environment based on*

resource-efficient and ecological principle (Du Plessis, 2007). Other two definitions cited in Du Plessis (2007) described SC as an environmental friendly process; 1) 'a way of building which aim at reducing the negative health and environmental impact caused by construction process or by building or by built environment' (Lanting, 1998) and 2) 'sustainable construction, in its own processes and products during their service life, aims at minimizing the use or energy and emission that are harmful for the environment and health..' (Huovila and Richter, 1997). A more holistic definition of SC was accorded by CIB and UNEP-IETC (2002) as 'a holistic process aiming to restore and maintain harmony between the natural and built environment, and create settlement that affirm human dignity and encourage economic equity'. In the Habitat II (1996, p.13 cited in Ofori, 1998), it explains that, participants who are committed to SC '… *will make efficient use of resources within carrying capacity of the ecosystem and take into consideration the precautionary principle approach, and by providing the people.. with equal opportunities for a healthy, safe and productive life in harmony with nature and their cultural heritage and spiritual and cultural values and which ensures economic and social development and environmental protection*….'. The latter two definitions govern the three pillars of SC, i.e. environmental responsibilities, social awareness and economic profitability than the single view of SC (i.e. the environment) as implied in the earlier definition.

In essence, the term SC delineates the sustainability approaches or solution that the construction practitioners can partake (technical and non-technical approaches, i.e. the environment, social and economic) in addressing the complex problem of construction and environment. It also conjures the obligation that the construction stakeholders should be expected to adhere to at every construction development stage. Last but not least, SC also serves as an important guideline or standard of development that shape the mindset

of every players on the need to properly construct a building for better outcome of built environment now and the future.

2.3.2. The Integration of Sustainability in the Project Development Phase

In achieving the significant impact of SC, many researchers agreed that the concept should be integrated throughout the lifecycle of the construction project, i.e. from the initiation to the demolition of the building (Hill and Bowen, 1997; Ofori, 1992; Vangeas, 2003; Du Plessis, 2007; Zainul Abidin, 2010a) because each stage of development contributes in different ways to sustainability (Vanegas, 2003). Figure 2.2 depicts the phases of implementing sustainability in the construction projects. There are four stages as proposed by Vanegas (2003): sustainability in planning, design, construction and operational phase.

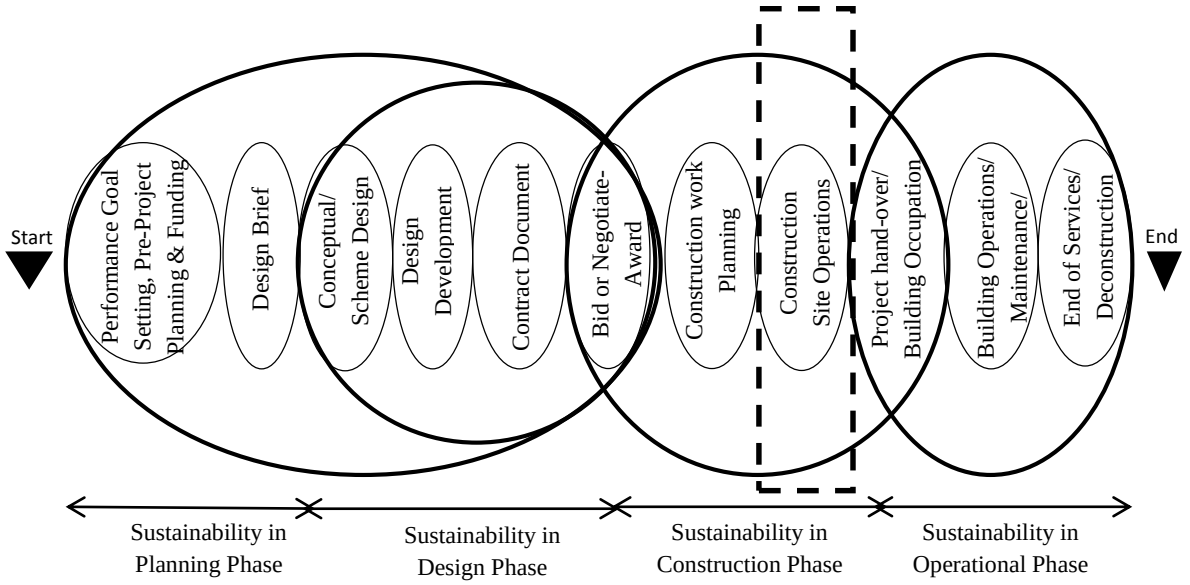

Figure 2.2 Phases of implementing sustainability (adapted from Vanegas, 2003)

'Sustainability in the planning phase' involves a systemic analysis of the attributes, characteristics and qualities of the project from a sustainability perspectives.