

SUSTAINABLE CONSTRUCTION FOR MIXED DEVELOPMENT PROJECTS
IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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ABSTRAK

Malaysia adalah dalam memerlukan komitmen untuk meneruskan pembangunan dengan cara yang lebih mampan dari awal, dan bukan model yang lebih konvensional dan mahal untuk 'membina dahulu, membersihkan kemudian' dalam memastikan persekitaran berharga Malaysia dan endowmen semula jadi dipelihara dan dilindungi untuk generasi masa kini dan akan datang. Walaupun isu mengenai perlindungan alam sekitar telah diperkenalkan di Malaysia sejak tahun 1960-an, ia hanya baru-baru ini bahawa pembinaan yang mampan telah menjadi pusat perhatian di kalangan pemegang kepentingan pembinaan di Malaysia. Tujuan kajian ini adalah untuk menilai pembinaan yang mampan untuk projek-projek pembangunan bercampur di dalam industri pembinaan Malaysia dengan mengenal pasti projek-projek pembinaan yang mampan prinsip dan pelaksanaan dalam menyampaikan projek-projek pembangunan bercampur, memeriksa amalan semasa pembinaan yang mampan dalam projek-projek pembangunan bercampur Malaysia, menilai masalah pembinaan mampan dalam projek-projek pembangunan bercampur Malaysia dan menyiasat faktor-faktor kejayaan kritikal yang menyumbang kepada pembinaan yang mampan dalam projek-projek pembangunan bercampur Malaysia melalui kajian literatur dan kajian soal selidik 130 responden yang terdiri daripada Pengurus projek, Jurutera tapak, Mechanical Engineers, Electrical Engineers, Juruukur Bahan, Pegawai keselamatan, Juruukur Tanah dan subkontraktor. Keputusan dianalisis melalui Statistical Package for Sosial dan Sains (SPSS) Versi 22.0 menunjukkan bahawa prinsip-prinsip pembinaan yang mampan adalah projek yang baik menguruskan merupakan satu aspek yang menyeluruh penting dalam menyampaikan projek-projek pembangunan bercampur, baik dalam tern panjang dan jangka pendek dan bangunan tidak perlu menggunakan yang tidak seimbang jumlah sumber, termasuk wang, tenaga, air, bahan-bahan dan tanah semasa pembinaan, penggunaan atau pelupusannya. Amalan semasa pembinaan yang mampan adalah amalan tidak mematuhi undang-undang kemampunan kerajaan yang berbeza, termasuk keperluan alam sekitar dan tanggungjawab sosial untuk meningkatkan daya saing perniagaan dan projek tidak mempunyai nilai seumur hidup melalui reka bentuk hijau dan promosi terbaik perolehan amalan pembinaan. Walaupun masalah untuk pelaksanaan projek-projek pembinaan yang mampan adalah mahal, kos yang tinggi untuk membeli teknologi, kos pembelajaran dan menggunakan tenaga kerja mahir dan keengganan untuk menukar kepada pembinaan yang mampan dalam menyampaikan projek-projek pembangunan bercampur dan faktor-faktor kejayaan yang paling kritikal adalah pelaburan awal, sokongan daripada pihak berkepentingan projek dan usaha pelaksanaan dasar. Dapatan kajian ini adalah sangat besar kerana ia adalah selain daripada agenda untuk pembangunan mampan diselia oleh Malaysia melalui keperluan untuk mengamalkan penggunaan lestari dan konsep pengeluaran dan membincangkan pengaruh mereka ke atas arahan dan amalan dalam industri pembinaan.

ABSTRACT

Malaysia is in a need of commitment to pursue development in a more sustainable manner from the start, rather than a more conventional and costly model to 'grow first, clean up later' in ensuring that Malaysia's precious environment and natural endowment are conserved and protected for present and future generations. Although the issue on environment protection was introduced in Malaysia since 1960s, it is only recent that the sustainable construction has become the center of attention amongst construction stakeholders in Malaysia. The aim of this study is to appraise sustainable construction for mixed development projects in the Malaysian construction industry by identifying the sustainable construction projects principles and implementation in delivering mixed development projects, examining current practice of sustainable construction in the Malaysian mixed development projects, assessing the problems of sustainable construction in the Malaysian mixed development projects and investigating critical success factors that contribute to sustainable construction in Malaysian mixed development projects via literature review and questionnaire survey on 130 respondents consisting of Project Managers, Site Engineers, Mechanical Engineers, Electrical Engineers, Quantity Surveyors, Safety Officers, Land Surveyors and subcontractors. The results analysed through Statistical Package for Social and Science (SPSS) Version 22.0 demonstrate that the sustainable construction principles are good project manage is a vital overarching aspect in delivering mixed development projects, both in long term and short term and building should not use a disproportionate amount of resources, including money, energy, water, materials and land during construction, use or disposal. The current practice of sustainable construction are practice is not in compliance with different governmental sustainability legislations, including environmental requirement and social responsibility to improve business competitiveness and projects do not possesses whole life value through green design and the promotion of best practice construction procurement. While problems for implementation are sustainable construction projects are expensive, high cost in purchasing technology, the learning curve cost and employing skilled labor and unwillingness to change to sustainable construction in delivering mixed development projects and most critical success factors are initial investment, support from project stakeholder and policy implementation efforts. The findings of this study is very substantial as it is apart of the agenda for sustainable development overseen by Malaysia via the needs to adopt the sustainable consumption and its production concept and to discuss their influence on the directions and practices in the construction industry.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The expansion of the built environment will destroy or disturb natural habitats and wildlife on over 70 percent of the earth's land surface by 2032, where developing countries like Malaysia account for 23 percent of global construction activities (UN Report, 2002). Studies show that such expansion in the urbanization of human kind involves rapid development and large consumption of natural resources (Asmah *et. al.*, 2015). As a developing country, Malaysia had realized the significance of developing the construction industry since early days of her independence, hence has started to develop this industry progressively. In accordance with this, the Department of Statistics Malaysia (2015) claims that the population has increased to 30 million in 2015 compared to 2014 at only 28.3 million, of which creating more demand for building and infrastructure development in the construction industry (Asmah *et. al.*, 2015). However consequently, this development process has tolled the construction industry to the major impact of the environment.

Asmah *et. al.*, (2015) mention that in Malaysia, the Local Agenda 21 provides external driven factors for environmental reform. Agenda 21, a voluntarily implemented action plan of the United Nations, represents a significant agreement to make environmental development a global commitment. Other relevant instruments include the Malaysia's Environment

Quality Act 1974, which aims to control pollution levels. The Environmental Impact Assessment (EIA) process was also introduced as a proactive tool in the project planning and approval process to monitor environmental impacts and as a means of mitigation.

In response to the 11th Malaysian Plan (11MP) Agenda for sustainable development, Malaysia sees the needs to adopt the sustainable consumption and its production concept. As in 2014, Malaysia achieved 33 percent reduction in greenhouse gases emission intensity of GDP compared to 2005 level as in 2013. At the same time, Renewal Energy Act 2011 has been enforced to regulate the averaged homebuilder for delivering construction projects in coordinating to the environment. Furthermore, Malaysia like many other countries across the world is grappling with the challenge of balancing a growing population and demand incorporated with the environment that is increasingly under stress. In the global context of increasing intensity and frequency of extreme weather events, adopting green growth has now become an imperative for Malaysia. This represents the Malaysia's commitment to renew and increase its commitment to the environment and long-term sustainability.

According to the 11MP, a successful green growth trajectory will ensure detrimental impact of socio-economic activity on environmental systems to be reduced. It also ensures that natural capital, including forested areas, biodiversity and water resources as well as its ecosystems, is valued and sustainably managed. In addition, 11MP drafts that development gains are protected, thus ensuring wellbeing of people across generations. So with that, it is expected the energy use is efficient and renewable energy is widely used. Achieving these aspirations requires a fundamental shift away from a 'grow first, clean up later' development model towards one that views resilient, low-carbon, resource-efficient and socially inclusive development as an upfront investment that will yield future gains over multiple generations to come. This requires fundamental changes across every major dimension including how

policy is determined, how institutions are regulated, how responsibilities are shared and how people value their environment.

Thus, Malaysia is observed by this study as in a need of commitment to pursue development in a more sustainable manner from the start, rather than a more conventional and costly model referring to ‘grow first, clean up later’. A reinforced commitment to green growth will ensure that the Malaysian’s precious environment and natural endowment are conserved and protected for present and future generations. Although the issue of environment protection was introduced in Malaysia in the 1960s, it is only recent that the sustainable construction has become the center of attention among construction stakeholders in Malaysia. Hence, this study is carried out to focus on the implementation and guidelines for sustainable construction in delivering mixed development projects in Malaysia to support the Malaysian's sustainability goals and to discuss their influence on the directions and practices in the construction industry. This study thus provides insights into current practice and the implementation of the sustainable construction, especially in Malaysia.

1.2 Problem Statement

According to 2010 data, buildings use 45 percent of world energy and 50 percent of water. As for environmental effects; 23 percent of air pollution, 50 percent of greenhouse gas production, 40 percent of water pollution and 40 percent of solid waste in cities are environmental problems caused by buildings (Dixon, 2010). Glass (2012) mentions that previous research has tended to focus on the “endpoint”, namely built assets that use less energy and materials and which facilitate more sustainable ways of living. Nevertheless, the Building Energy Index (BEI) of the building is yet to achieve zero. Thus, up

until now, researches are still being carried out with the aim to increase the energy efficiency of the building (Chong, 2009).

Furthermore, everyone in the industry seems to disregard the fundamental principles of sustainable construction. The principles of sustainable development are not clearly understood by the average homebuilder (Heidi and Tomkiewicz, 2011). Current construction practices focus mostly on energy efficiency. Yet, the industry out of ignorance or misunderstanding has ignored other aspects of sustainability including reduced natural resources consumption and human health within the macro and microenvironments (Heidi and Tomkiewicz, 2011). For instance, Abu Hassan (2010) through the study on sustainable housing practices in the Malaysian housing development has only developed a framework for a rating system for building. In addition, Rahelah Rostami (2014) only studies on the construction industry's strategies, preparation and administration towards the agenda of the green and sustainability to Malaysia without focusing on mixed development projects.

In addition to that, developing countries with large emissions should have some responsibility although it is different from the industrialized world (Kataria *et. al*, 2013). While sustainable practices and products are perceived as counterproductive with the growth of Gross Domestic Product (GDP) that is not sustainable is not really grow (Kataria *et. al*, 2013). There is lack of institutional structures promoting green building; awareness on the part of clients, tenants, professionals in the built environment and other stake holders; professional capacity to incorporate green building issues and opportunities and; financial resources to undertake green building construction and upgrades (Nwokoro, 2011).

However, there is a need to develop framework and guidelines that will guide the construction stakeholders to produce environmental friendly

construction development (Mohd Bohari, 2015). In addition to that, authorities should provide incentives, motivations and regulations for construction industry to adopt sustainable development (Kataria, 2013). There is also a need to set up a sustainability policy, where such a policy would set the desired level of environmental performance, (Nwokoro, 2011). Marchman and Clarke (2011) mention that a research of construction industry best practice organization is paramount where currently there is no best practice guide for sustainability. Pietrosemol *et.al* (2012) on the other hand underline only on the important nexus existing among sustainable construction, knowledge management, renewable energy and sustainability and identify the energy infrastructure as a fundamental issue to facilitate the increase in the supply of renewable energy in the global markets in Venezuela. Lewis *et. al.*, (2015) develop only a framework for averaging schedule float and allocating equipment resources for activities that may have the greatest impact on the formation of ground-level ozone but not on the mixed development projects in particular.

It is obvious that sustainable construction is very new to the construction industry and has started a baby step towards the best practice. Can the implementation manage the issue faced in undertaking the reinforcement works in the construction industry? A positive answer to the said question will prove that the issues can be managed through better understanding towards the subject matter. Thus, this can improve the issue of quality and environmental factors in the construction industry. To reach the aim of this study, the next question will then be how applicable is the sustainable construction to be implement for Samsung C&T Corporation, do the case of this study Samsung C&T Corporation's professionals and subcontractors understand how important their knowledge is in the implementation of sustainable construction in the industry especially towards the activities at their construction site? Hence, this study is very substantial to be undertaken in answering all of the aforementioned questions.

1.3 Aim and Objectives of Study

The main aim for this study is to appraise sustainable construction for mixed development projects in the Malaysian construction industry. The study focuses on the implementation and guidelines for sustainable construction in delivering mixed development projects in Malaysia. With the abovementioned aim, the specific objectives of this study are as follows:

- i. To identify the sustainable construction projects principles, characteristics and implementation in delivering mixed development projects.
- ii. To examine current practice of sustainable construction in the Malaysian mixed development projects.
- iii. To assess the problems of sustainable construction in the Malaysian mixed development projects.
- iv. To investigate critical success factors that contributes to sustainable construction in the Malaysian mixed development projects.

1.4 Research Questions

The problem statement is further explicated In this section, the problem statement is further explicated. Research questions emerge from the problem statement and operationalize it in terms of specific variables and relationships to be examined and reported. Research questions also suggest

methodology for the study and serve as the basis for drawing conclusions in Chapter 5. Research questions for this research are as follows:

- i. What are the sustainability principles requirements are applied in delivering the mixed development projects in Malaysia?
- ii. How the current problems of sustainability in the Malaysian construction industry?
- iii. What are the problems of sustainable construction in the Malaysian mixed development projects?
- iv. What are the critical success factors that contribute to sustainable construction in the Malaysian mixed development projects?

1.5 Scope of Study

As a contractor, it is advisable for Samsung C&T Corporation the case of this study to ensure all of its projects to be completed within stipulated time frame given with acceptable quality and green requirements. However, due to the limitations of this study only surveys and feedbacks from the various stakeholders in the construction implementation, reports and records are used based on Samsung's Corporation construction sites in Kuala Lumpur. The study also revolves around all of the relevant parties at the said construction sites as they are involved directly in construction activities, especially the construction personnel such as Project Manager, Safety Officer, Engineer, Architect, Quantity Surveyor, Land Surveyor, Quality and Assurance Engineer and subcontractors. These targeted respondents revolve in the Planning and Contract Department, Construction Department, Quality Assurance/ Control (QA/QC) Department and Design Department.

1.6 Research Methodology

This study uses a mix of quantitative and qualitative approach conducted in four stages, namely literature review, data collection, data analysis and conclusion. Literature review is undertaken by reviewing various relevant studies using sources such as academic research journals, dissertations, textbooks, articles and the Internet. Primary data collection is executed through questionnaires and surveys gathered from respondents. The target respondents are among various construction parties, which involved directly and indirectly in the projects. They are Project Manager, Site Engineer, Architect, Site Coordinator, Quantity Surveyor, Safety Officer, and subcontractors. The next crucial steps are the analysis and synthesis of the collected data using Statistical Package for Social Science (SPSS) version 22.0 method in order to come out with final findings on the issue discussed. Finally, conclusion will be drawn to answer to each objective in this study.

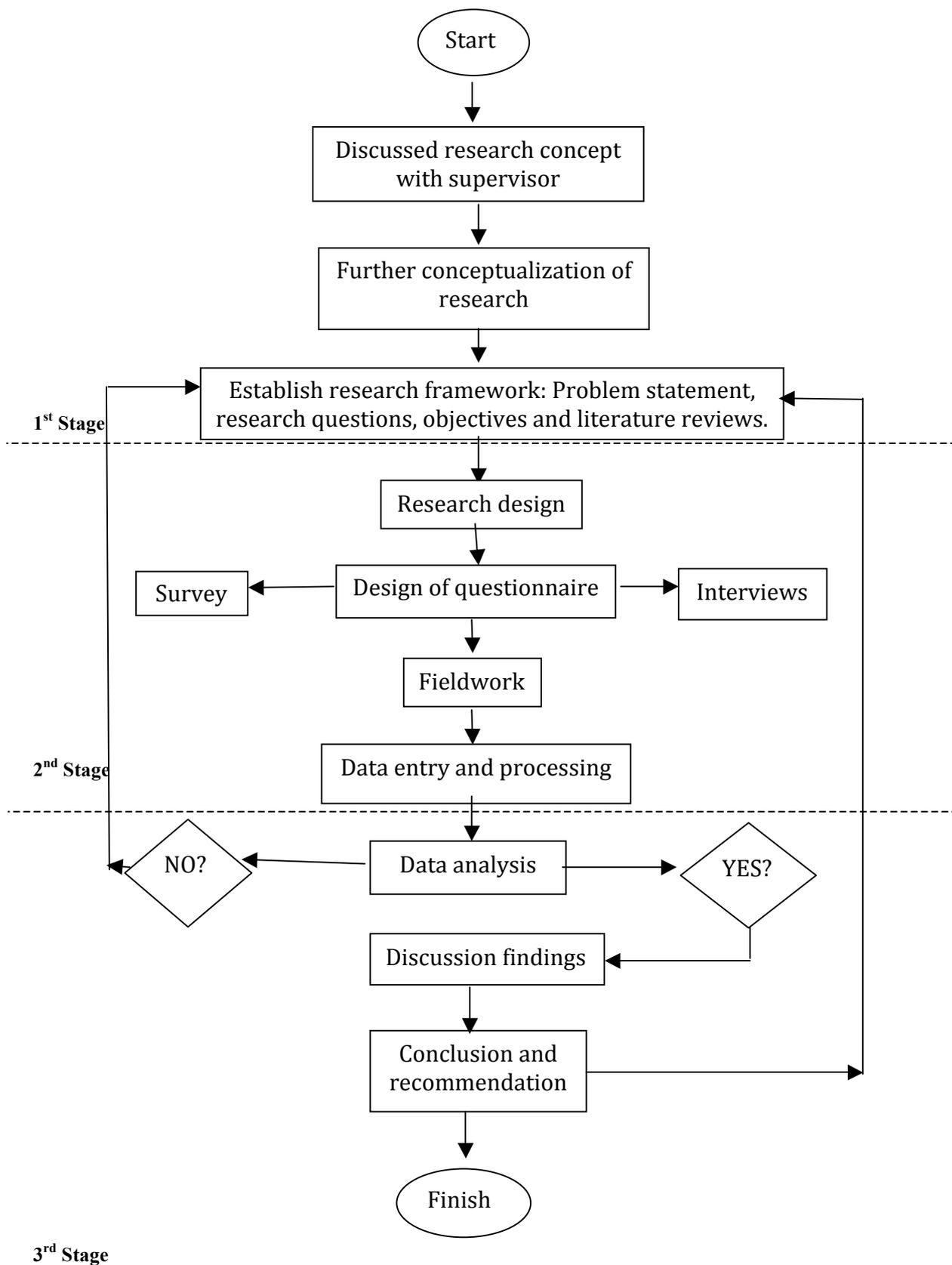


Figure 1.1 : Proposed Research Methodology

1.7 Significance of Research

Regardless the barriers of the implementation sustainable construction that have been highlighted by Oferi *et. al.* (2015), which include financial barriers, political barriers, management and leadership barriers, technical barriers, socio-cultural barriers and knowledge and awareness barriers, sustainable construction approach is achievable if all efforts on delivering the value are focusing on the integration of environmental, social and economic considerations into construction business strategies and practices.

It involves the application of the principles of sustainable development to the comprehensive construction cycle from the extraction of raw materials, through the planning, design and construction of buildings and infrastructure, until their final deconstruction and management of the resultant waste. This might not be easy to maintain and become an improvement factor to the construction industry. Hence, a proven case study via Samsung C&T Corporation would be a good start to prove that this approach is beneficial to the industry.

Thus, this study is valuable especially for the Main Contractors, particularly Tender and Procurement team and Construction team as well as clients in the construction industry in order for them to understand the critical factors contributing to the sustainable construction in delivering mixed development projects. Therefore, this study will indicate the main factors in terms of principles, characteristics and implementation of sustainable construction for their project site. Finally, the study is hoped to be able to gauge the construction parties in their construction field among other well established contractors in the country in terms of project deliverable and sustainable quality to the clients and customers.

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