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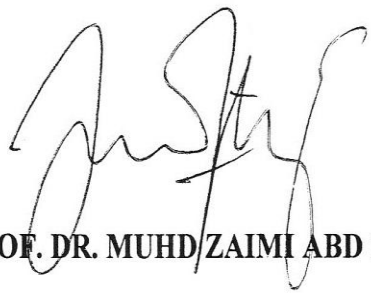
Signature : 

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A GREEN COST ALLOCATION MODEL FOR OFFICE AND COMMERCIAL BUILDINGS IN MALAYSIA

BEHZAD HAMIDI

A project report submitted in partial fulfillment of the requirements for the award of the degree of Master Science (Construction Management)

Faculty of Civil Engineering

Universiti Technologi Malaysia

November 2010

I declare that this Master Research Project Report entitled "A Green Cost Allocation Model for Office and Commercial Buildings in Malaysia" is the result of my own research and that all sources are acknowledged in the references. The Project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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To My Beloved Wife,

Parents, Siblings,

And my Friends

ACKNOWLEGEMENTS

First and foremost, grateful thanks to God for helping me throughout the completion of this dissertation.

I would like to extend my deepest appreciation and gratitude to my supervisor, Prof. Dr. Muhd. Zaimi Abd Majid for his unrelenting efforts, giddiness, encouragement and criticisms throughout the completion of this Master Project.

My special thanks to my beloved wife, parents and friends for their encouragement and supports during my study.

A token of appreciation to the director of sustainability of Ken Yeang company in Kula Lampur, Malaysia, Mr. Mitchell Gelber and GBI facilitators for their cooperation to collecting data and filling up the questionnaires throughout the completion of my master project

Last but not least, my gratitude to all fellow colleagues and classmates for their morale support and point of views, either directly or indirectly in the process of completing this research.

ABSTRACT

First issue often concerned a green building is its incremental costs as compared to a conventional building. Lack of data addressing this issue has discouraged the pursuant of green consideration including contractors and stakeholders to consider green goals in their projects. The aim of this study is to identify Green Building Index (GBI) criteria that contribute to optimum project costs as well as minimum design impacts. In addition, a green cost allocation model is developed to aid contractors and developers to not only fulfill the green criteria, but also allocate their budget appropriately. In order to achieve this aim, a 4-point Likert Scale questionnaire was designed and sent to green building experts. The purpose of the questionnaire was to obtain perceptions regarding cost and design impacts of GBI criteria on office and commercial buildings. In addition, the green building experts were interviewed and their points of views were gathered to develop a green cost allocation model. GBI criteria that contribute to lower cost and design impacts were identified with statistical tools while the green cost allocation model was developed based on interviews. In conclusion, this study has identified cost and design impacts of GBI criteria and developed a Green Cost Allocation Model whereby all parties including contractors, consultants, and developers can determine the optimum green cost allocation to the projects.

ABSTRAK

Isu yang berkaitan dengan bangunan hijau ialah kos pembinaannya berbanding bangunan konvensional dan bagaimana memperuntukkan bajet secara berkhemah bagi mencapai matlamat bangunan hijau. Kekurangan data dan maklumat dari kontraktor dan pemilik syarikat berkaitan isu ini telah merencatkan pembangunan bangunan hijau dalam projek mereka. Matlamat kajian ini adalah untuk mengenalpasti kriteria Indeks Bangunan Hijau (GBI) dalam menyumbangkan kepada kos pembinaan projek yang optimum dan impak rekabentuk bangunan hijau yang minimum. Sebagai tambahan, satu model kos bangunan hijau dibangunkan bagi membantu kontraktor dan pemaju untuk bukan sahaja hanya memenuhi kriteria hijau, malahan menyediakan bajet yang bersesuaian. Dalam usaha untuk mencapai matlamat ini, 4 mata skala dalam soalan kajiselidik telah diedarkan kepada mereka yang mahir dalam bangunan hijau. Tujuan utama soalan kajiselidik ini ialah untuk mendapatkan persepsi mengenai kos dan impak rekabentuk GBI pada bangunan bukan kediaman.Selain itu,mereka yang mahir dalam pembinaan bangunan hijau telah ditemubual dan maklumbalas mereka telah digunakan bagi membangunkan model kos hijau.Kriteria GBI yang menyumbangkan kepada kos yang rendah dan impak rekabentuk dikenalpasti melalui kaedah statistik dan model kos hijau dibangunkan berdasarkan temubual yang dijalankan. Kesimpulannya, kajian ini telah mengenalpasti kos dan impak rekabentuk berdasarkan criteria GBI dan membangunkan Model Kos Hijau yang mana melibatkan pihak kontraktor, perunding dan pemaju bagi menentukan kos hijau yang optimum untuk semua projek.

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CHAPTER 1

INTRODUCTION

1.1.Background of the Study

Despite the growing body of research detailing the environment and human health benefits of sustainable construction, the decision to design and construct a green building is still largely based on green cost. Peter Morris (2004) emphasized the incremental cost of making a building green as a very substantial and discussable issue faced by construction industry.

Cost for a green building can involve no additional cost depending on the building location, design factors and the level of efficiency targeted by the project brief. At the current time, higher rated buildings such as those targeting Green Building Index (GBI) gold or platinum ratings certainly will involve additional costs. However, it is theoretically possible to achieve GBI certification with no additional costs.

The two most important factors that affect the cost of a green building are 1) The coordination and experience of the project's consultant team, 2) Early adoption and implementation of a green design strategy in the building's design and planning stages. As many green features involve coordination between multiple consultants and team members, effective coordination of all parties (including clients, architects, engineers and contractors) is vital to keeping cost from escalating due to ineffective design and planning. In addition, many costs involved with GBI certification can be mitigated via the early adoption and implementation of a green design strategy. For example, green features and GBI items, which are captured in tender documents, can often be implemented at little to no additional cost as a function of the bidding process whereas implementation of these features at later stages of construction often incurs additional expense due to the necessity for variation orders and additional scope of work.

This study is important in order to identify points that contribute to higher project costs. The Green Building effort needs to prove to the industry and public that Sustainability can come with no additional costs. Past projects have shown the increase in cost for green buildings ranges from 8% to 15% (GBI, 2010) more than conventional buildings whilst in the USA the increase in cost is between 0-7% (Kats, 2003). This is partly due to availability of material, technology, and awareness.

There are also plenty of "hidden costs" in these tools such as Enhance Commissioning which is actually appointing another third party consultant on top of main consultant to check works especially by the M&E, which in many cases, causes an uncomfortable atmosphere when one professional critics or comments the work of another. The actual solution is to understand that green building will have lower running cost that will offset the considerably high initial cost for the green effort.

1.2.Issues and Problem Statement

The first questions often asked about a green building are, how much does "green" cost? Does it cost more? More than what? How can we optimize it? When and where does "green" cost should be allocated into the project? The answers to these questions have been thus far elusive because of the lack of hard data. Due to not being well aware of the answers of these questions, many stakeholders and developers are unwilling to pursue a green goal in their projects.

The foundation of this study is laid to analyze premium costs over starting budgets and to indentify the costs for different measures and technologies. Additionally, this study developed a green cost allocation model that provides guidelines for developing appropriate budgets to meet the building program goals.

This study tracks the construction costs and design impacts of GBI criteria. This includes quantitative measures of the buildings, as well as specific sustainability measures and GBI points targeted, or achieved by the buildings.

1.3.Aim and Objectives of the Study

The aim of this study is to develop a green cost allocation model for office and commercial buildings in Malaysia. To achieve this aim, the following objectives are identified:

i. To identify Green Building Index criteria that contribute to optimum project costs;

ii. To identify Green Building Index criteria that have minimum design impact; and;

iii. To develop a Green Cost Allocation Model for Office and Commercial Buildings.

1.4.Scope of the Study

This study looks only at construction cost. It is obvious that the cost and benefits of a green design should be analyzed holistically, including operation and maintenance implications, design and documentation fees, and user productivity and health. However, this is the construction costs drive decisions for green goals.

Furthermore, additional consultancy/time costs are generally limited to the GBI facilitator fees and consultancy fees for additional specialists and simulations (i.e. Commissioning Specialists (C&S) and advanced energy modeling simulations for EE5). As GBI processes become more mature, consultants, especially architects and M&E engineers may eventually consider additional fees for the additional scope of work required for GBI submissions however, at the moment this remains speculative.

In addition, this study only focuses on office and commercial buildings in Malaysia seeking green goals based on GBI. However, each green building project is unique and should be considered as such when addressing the cost and design impacts of GBI criteria. In general, Any assessment of the cost and design impacts for a particular building must be conducted with references to that building, goals, and its specific circumstances.

1.5.Significance of the Study

The importance of this study is divided into three directions as follow:

- The finding of the first objective is useful to identify the GBI criteria that contribute in optimum cost whereby the contractors and architects can readily recognize the GBI criteria which have lower cost impacts on their project costs.

- The finding of second objective is useful to identify the GBI criteria that have lower design impact whereby the contractors and architectures can readily recognize the GBI criteria which have lower design impacts on the project designs.

- Finally, the finding of the third objective is the developed green cost allocation model which boosts project team to follow their greenery goals step by step and stay on track throughout the whole life cycle of the green buildings.

1.6.Limitation of the Study

Green Building Index (GBI) is fairly a new rating system in Malaysia which published in 2009. Hence, there are a few numbers of green buildings certified by GBI and this issue limited this study in terms of experienced experts in green buildings.

On the other hand, the companies around Malaysia were very reticent to reveal their cost data and always afraid of sharing their knowledge to others. This issue was especially more tangible for me as a foreign student.

1.7.Research Methodology

An essential stage of the methodology was conducted to achieve the objectives of this study. The major process includes:

Stage 1: Preliminary Study
Stage 2: Data Collection
Stage 3: Data Analysis and Findings

1.7.1 Stage 1: Preliminary Study

This process includes identifying the problem, determining the problem and area of the research. This was done by doing preliminary literature review such as referring books, articles, reports, and journals. Then the aim and objectives of the study were indentified before the literature review conducted.

1.7.2 Stage 2: Data Collection

The data collection process involved two types of data that is primary and secondary data. The primary data was collected by questionnaires given to Green building experts. The responses of these questionnaires are covering cost and design impacts of GBI criteria on green projects in Malaysia. After analyzing the cost and design impacts of GBI criteria, a green cost allocation model has been developed. Finally, the Green building experts' points of views have been collected to support the developed green cost allocation model for Green Buildings in Malaysia. In addition, secondary data was gathered from books, articles, reports, journals and conference papers.

1.7.3 Stage 3: Data Analysis and Findings

All the data collected were scheduled and analyzed by using appropriate statistical tools such as SPSS. Then all the data analysis was summarized and the conclusion was made. Finally the recommendations for the futures are given.

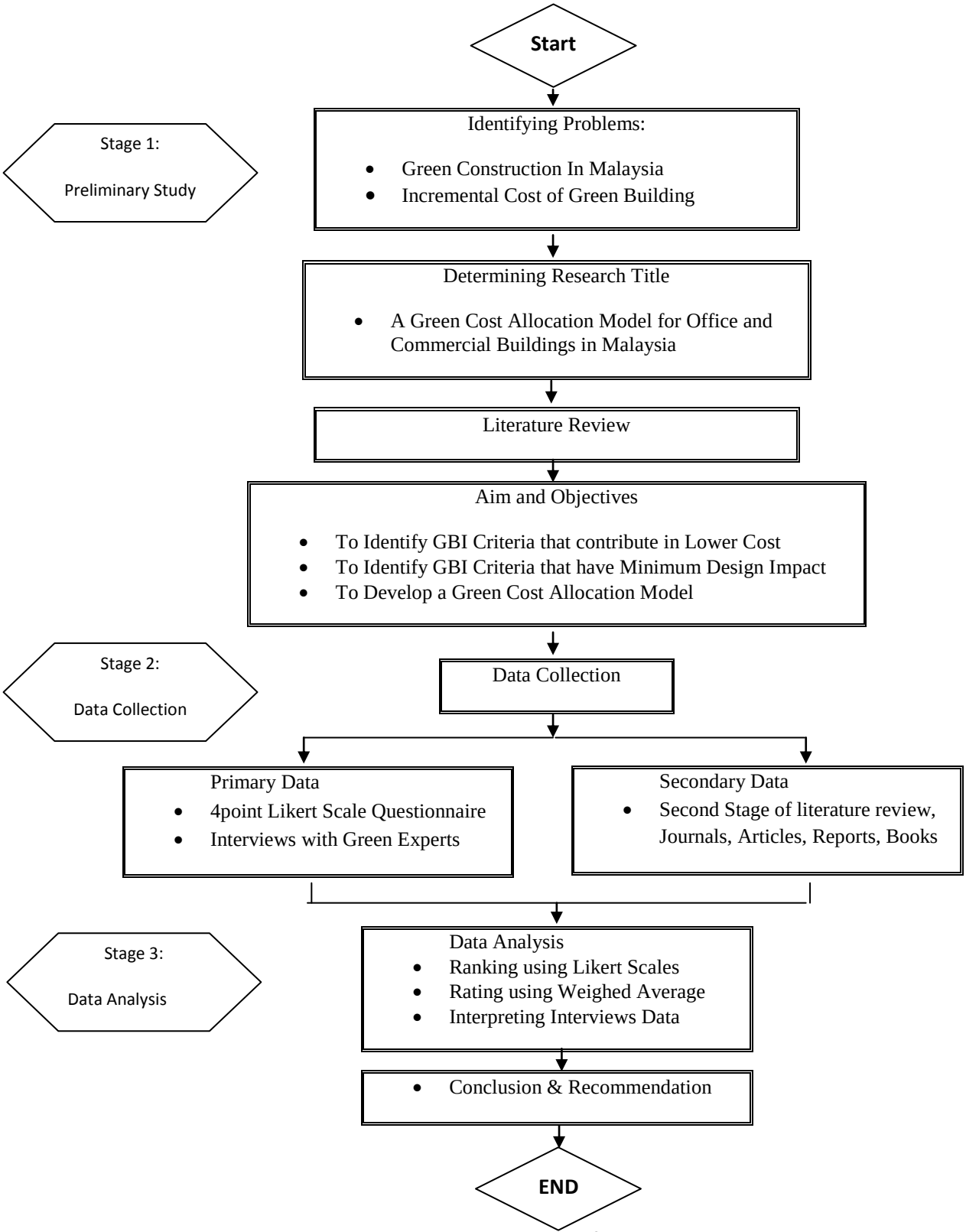

Figure 1.1: Flowchart Diagram of Research Methodology

1.8. Organization of the Thesis

The thesis contains five chapters. In chapter 1 introduction, background of the study, issues, problem statement, aim and objectives of the study, scope, and significant of the study, research methodology are discussed. Additionally, the author explains briefly the overall content of the thesis.

Chapter 2 is a literature review on different green rating Systems around the world and more specifically Green Building Index (GBI –Malaysia). The main green rating systems have been highlighted in brief including their history. An example for rating points has brought for each of green rating systems for office buildings. Finally, green cost have been highlighted in more specific details.

The research methodology of this study is explained in chapter 3. This chapter includes introduction, research methodology, and summary. The research methodology is divided into three main stages including preliminary study, data collection, and data analysis and report writing.

Chapter 4 contains introduction, data analysis, results, and summary. Data analysis consists of content analysis, and GBI criteria analysis in terms of cost and design impacts on office and commercial buildings in Malaysia. Finally, the green experts' points of views have been analyzed to develop a green cost allocation model.

At last, chapter 5 includes conclusion and recommendation. The main parts of this chapter are introduction, conclusion, and recommendations for future studies.