

SELECTION OF THE INDUSTRIALIZED BUILDING MATERIAL SUPPLIER BY  
ANALYTIC HIERARCHY PROCESS METHOD

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## DEDICATION

I would like to dedicate this Project Report to my beloved and kind parents, Ali Moravveji and Masoumeh Bastami, who always supported me to develop myself and motive me during my entire life, and my supervisor Assoc.Prof.Dr.Abdul Kadir Marsono who have been my great inspiration in completing this Project Report.

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## ABSTRACT

Industrialized Building system (IBS) aims to expedite the process of installation and construction at site. Industrialized Building System (IBS) is a construction system that is built using pre-fabricated components. The manufacturing of the components is systematically done using machine, formworks, and other forms of mechanical equipment. The components are manufactured off-site and once completed will be delivered to construction sites for assembly and erection so that it could be a area of concern to select the appropriate material from qualified supplier with consideration of critical factor. This project focuses on the issue of industrialized building material while it takes account of minimizing the cost and time of the purchasing and erection process. As the supplier selection is the multi criteria problem the research writer tend to use the Analytic Hierarchy Process which is the most popular decision making method to deal with the issue of IBS-M supplier selection. The imperative criteria for supplier selection problem have been identified to comply with the characteristics of Industrialized Building Material (IBM) Suppliers. A systematic approach has been developed by using Analytic Hierarchy Process method to facilitate the supplier selection taking into account of all identified criteria. Supplier Selection Model (SSM) is proposed to choose the best Industrialized Building Material (IBM) Suppliers for Industrialized Building System IBS companies. The practicability of the developed model has been proved through case study.

## ABSTRAK

Sistem Pembangunan Perindustrian - Industrialized Building system (IBS) bertujuan untuk mempercepat proses pemasangan dan pembinaan di tapak. Industrialized Building system (IBS) adalah satu sistem pembinaan yang dibina menggunakan komponen pra-fabrikasi. Pembuatan komponen secara sistematik dilakukan menggunakan mesin, formworks, dan lain-lain peralatan mekanikal. Komponen yang dibuat di luar tapak dan sebaik sahaja selesai akan dihantar ke tapak pembinaan untuk pemasangan dan pendirian supaya ia boleh menjadi kawasan berkaitan untuk memilih bahan yang sesuai dari pembekal yang berkeelayakan dengan pertimbangan faktor kritikal. Projek ini memberi tumpuan kepada isu bahan binaan industri manakala ia mengambil kira mengurangkan kos dan masa proses pembelian dan pembinaan. Pemilihan pembekal adalah pelbagai kriteria penulis penyelidikan cenderung untuk menggunakan Proses Hierarki Analisis yang membuat keputusan yang paling popular kaedah untuk berurusan dengan isu pemilihan pembekal IBS-M. Kriteria penting bagi masalah pemilihan pembekal telah dikenal pasti untuk mematuhi ciri-ciri Bahan Bangunan Pembekal (IBM) perindustrian. Satu pendekatan yang sistematik telah dibangunkan dengan menggunakan kaedah Proses Hierarki Analisis untuk memudahkan pemilihan pembekal mengambil kira semua kriteria yang dikenal pasti. Pembekal Model Pemilihan (SSM) adalah dicadangkan untuk memilih Bahan Bangunan Perindustrian (IBM) Pembekal Perindustrian Bangunan Sistem IBS syarikat. Kesesuaian model maju telah dibuktikan melalui kajian kes.

## TABLE OF CONTENTS

| CHAPTER  | TITLE  | PAGE |
|----------|--|------|
|          | <b>DECLARATION</b>   | ii   |
|          | <b>DEDICATION</b>  | iii  |
|          | <b>ACKNOWLEDGEMENT</b>   | iv   |
|          | <b>ABSTRACT</b>  | v    |
|          | <b>ABSTRAK</b>   | vi   |
|          | <b>TABLE OF CONTENTS</b>   | vii  |
|          | <b>LIST OF TABLES</b>  | x    |
|          | <b>LIST OF FIGURES</b>   | xi   |
|          | <b>LIST OF APPENDIX</b>  | xiii |
| <b>1</b> | <b>INTRODUCTION</b>  | 1    |
|          | 1.1 Introduction   | 1    |
|          | 1.2 Background   | 1    |
|          | 1.3 Problem Statement  | 4    |
|          | 1.4 Supplier Selection   | 4    |
|          | 1.5 Aims and Objectives of Study                                     | 6    |
|          | 1.6 Scope of Study   | 7    |
| <b>2</b> | <b>LITREATURE REVIEW</b>   | 8    |
|          | 2.1 Introduction to Life Cycle                                       | 8    |
|          | 2.2 Definition of Industrialized Construction<br>and Building System | 9    |
|          | 2.3 Existing Definition of IBS                                       | 10   |
|          | 2.4 IBS Classification   | 13   |

|          |  |           |
|----------|--|-----------|
| 2.5      | Cost Optimization in IBS                                 | 15        |
| 2.6      | Decision to Fine the Best Supplier                       | 18        |
| 2.7      | Supplier Selection                                       | 23        |
| 2.7.1    | Criteria Description of IBS-M Supplier Selection         | 26        |
|          | 2.7.1.1 Cost/Price                                       | 28        |
|          | 2.7.1.2 Quality  | 28        |
|          | 2.7.1.3 Delivery   | 29        |
|          | 2.7.1.4 Services   | 29        |
| 2.8      | The Analytic Hierarchy Process AHP and the other Methods | 29        |
| 2.8.1    | The Analytic Hierarchy Process                           | 31        |
| 2.8.2    | The AHP Applications                                     | 32        |
| <b>3</b> | <b>RESEARCH METHODOLOGY</b>                              | <b>33</b> |
| 3.1      | Introduction   | 33        |
| 3.2      | Applied Methodology                                      | 34        |
| 3.3      | Selecting the Appropriate Method                         | 34        |
| 3.4      | AHP Steps  | 36        |
| 3.5      | The Effective Criteria                                   | 37        |
| 3.5.1    | First Version of Supplier Selection<br>Frame work        | 38        |
| 3.5.2    | Refinements of Frame work                                | 40        |
| 3.6      | Establishment of Structural Hierarchy                    | 41        |
| 3.7      | Pair-Wise Comparison                                     | 44        |
| 3.8      | The Synthesis of Priorities                              | 46        |
| 3.9      | Designing Questionnaire                                  | 48        |
| 3.10     | Respondents to the Questionnaire Survey Method           | 49        |
| 3.11     | The Decision Support System                              | 50        |
| 3.12     | The Theory Behind Expert Choice                          | 51        |

|          |  |           |
|----------|--|-----------|
| 3.13     | Data Collection  | 51        |
| 3.14     | Data Analysis  | 52        |
| <b>4</b> | <b>DATA COLLECTION AND ANALYSIS</b>                              | <b>53</b> |
| 4.1      | Introduction   | 53        |
| 4.2      | Creating the Structure of AHP Model<br>in Expert Choice Software | 53        |
| 4.3      | Performing Pair-Wise Comparison                                  | 55        |
| 4.4      | Collecting Questionnaire from Respondents                        | 56        |
| 4.5      | Pair-Wise Analysis   | 57        |
| 4.6      | Final Weight of Criteria   | 58        |
| 4.7      | The Alternatives Pair-Wise Comparison                            | 59        |
| 4.8      | Synthesizing the Results   | 64        |
| 4.9      | Results and Discussion   | 67        |
| <b>5</b> | <b>CONCLUSION AND FUTURE WORK</b>                                | <b>68</b> |
| 5.1      | Introduction   | 68        |
| 5.2      | Major Findings   | 69        |
| 5.3      | Conclusion   | 72        |
| 5.4      | Future Research  | 72        |
|          | <b>REFERENCE</b>   | <b>74</b> |
|          | <b>APPENDIX A</b>  | <b>79</b> |
|          | <b>APPENDIX B</b>  | <b>80</b> |



**LIST OF TABLES**

| <b>TABLE<br/>NO.</b> | <b>TITLE</b>   | <b>PAGE</b> |
|----------------------|--|-------------|
| 2.1                  | Comparison of industrialized construction classification                 | 13          |
| 2.2                  | Supplier selection criteria  | 25          |
| 2.3                  | Supplier Criteria and Sub-Criteria                                       | 27          |
| 3.1                  | The elicited framework from literature review                            | 39          |
| 3.2                  | Total Scores for Sub-criteria  | 41          |
| 3.3                  | The definition and explanation of AHP 9-point Scale                      | 45          |
| 3.4                  | A Simple example of questionnaire  | 49          |
| 4.1                  | Priority weights for criteria and sub-criteria used<br>in the case study | 59          |
| 5.1                  | The Global Weights of Sub-Criterions                                     | 70          |

## LIST OF FIGURES

| <b>FIGURE<br/>NO.</b> | <b>TITLE</b>  | <b>PAGE</b> |
|-----------------------|---|-------------|
| 1.1                   | The Building System Classification. Badir et al. (1998)               | 3           |
| 3.1                   | The Analytic Hierarchy Process (AHP) Structure                        | 43          |
| 4.1                   | Hierarchy Structure of the Project                                    | 54          |
| 4.2                   | Pair-wise and priorities for Main Criteria                            | 57          |
| 4.3                   | Pair-Wise and Priorities for Delivery Criterion                       | 57          |
| 4.4                   | Pair-Wise and Priorities for Price Criterion                          | 58          |
| 4.5                   | Pair-Wise and Priorities for Quality Criterion                        | 58          |
| 4.6                   | Pair-Wise and Priorities for Percent Rejection                        | 60          |
| 4.7                   | Pair-Wise and Priorities for Reputation and<br>Position in the Market | 60          |
| 4.8                   | Pair-Wise and Priorities for Product Reliability                      | 61          |
| 4.9                   | Pair-Wise and Priorities for Total Cost                               | 61          |
| 4.10                  | Pair-Wise and Priorities for Quantity Discount                        | 62          |
| 4.11                  | Pair-Wise and Priorities for Payment Terms                            | 62          |
| 4.12                  | Pair-Wise and Priorities for Delivery Lead Time                       | 63          |

|      |  |    |
|------|--|----|
| 4.13 | Pair-Wise and Priorities for Delivery Speed                      | 63 |
| 4.14 | Pair-Wise and Priorities for Modes of<br>Transportation Facility | 64 |
| 4.15 | Synthesis with Respect to Goal (Vendor Selection)                | 65 |
| 4.16 | Synthesis with Respect to Quality                                | 65 |
| 4.17 | Synthesis with Respect to Price                                  | 66 |
| 4.18 | Synthesis with Respect to Delivery                               | 66 |

**LIST OF APPENDIX**

| <b>APPENDIX</b> | <b>TITLE</b>                      | <b>PAGE</b> |
|-----------------|-----------------------------------|-------------|
| A               | Sub-Criteria Rating Questionnaire | 79          |
| B               | Questionnaire Form                | 80          |

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

In most industries the cost of raw materials and component parts constitutes the main cost of a product, such that in some cases it can account for up to 70%. In high technology firms, purchased materials and services represent up to 80% of total product cost. Thus the purchasing department can play a key role in an organization efficiency and effectiveness because it has a direct effect on cost reduction, profitability and flexibility of a company. Selecting the right suppliers significantly reduces the purchasing cost and improves corporate competitiveness, which is why many experts believe that the supplier selection is the most important activity of a purchasing department.

#### **1.2 Background**

Over the past decade, the construction Industry has contributed significantly to the Malaysian economy. As Malaysian progressively marches towards industrialization, the role of the building is greatly enhanced, with the idea of

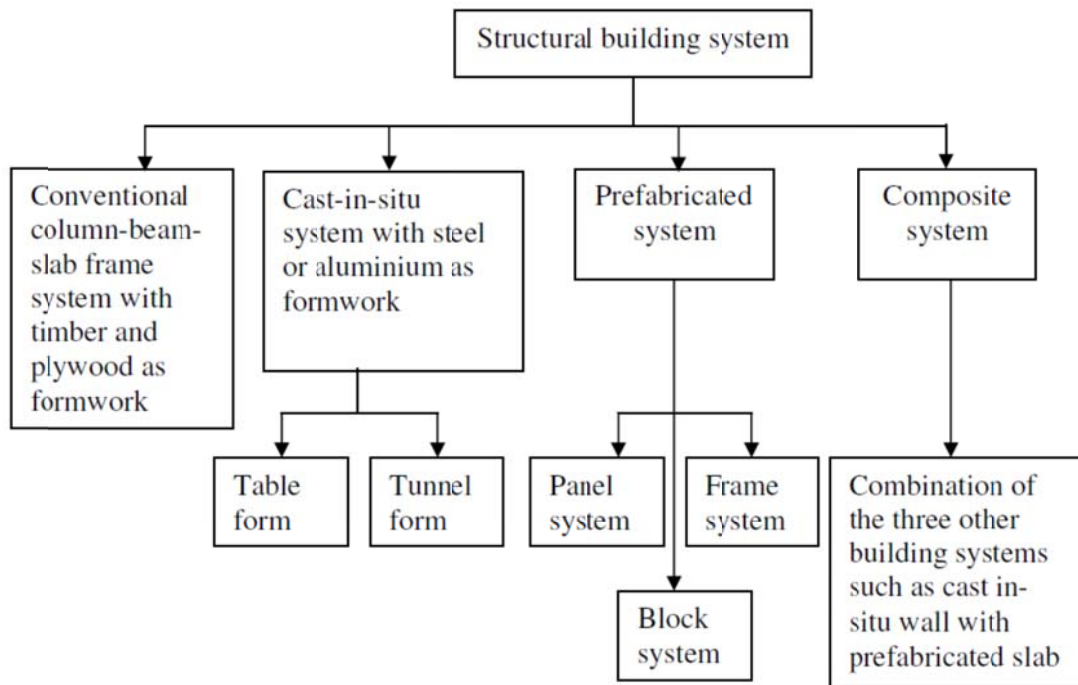
transforming the aspiration and needs of people into reality. There is thus an urgent need to mass-produce quality housing that is affordable to all Malaysians. New and innovative approaches and technology are needed in the design and construction of houses to enable the nation to achieve this target Ministry of Housing and Local Government (1997). In Malaysian context, the government's policy on housing is that, the traditional building practices must be replaced by Industrialized Building System (IBS), which could save on labor, cost and time of construction and confers quality and durability (Elias, 2000).

Industrialized Building System (IBS) is a construction system that is built using pre-fabricated components. The manufacturing of the components is systematically done using machine, formworks, and other forms of mechanical equipment. The components are manufactured off-site and once completed will be delivered to construction sites for assembly and erection. Junid (1986) expounded that an IBS in the construction industry includes the industrialized process by which components of a building are conceived, planned, fabricated, transported, and erected on site.

According to Badir et al. (1998) building system can be classified with four main categories:

1. Conventional building system
2. Cast-in-situ formwork system – table or tunnel formwork
3. Prefabricated system and
4. Composite system

The last three building systems are termed as IBS. (Figure 1.1) shows the Industrialized Building System (IBS) categories and their sub-categories according to the aforesaid statements and background.



**Figure 1.1:** The Building System Classification. Badir et al. (1998).

The IBS as mentioned above are not new in Malaysia. For example, precast wall system has been adopted in Malaysia as early in the late 60s. The government (Ministry of Housing and Local Government) in 1964 identified two pilot projects in order to try out the industrialized prefabricated system. The first of these projects was in KL. 22.7 acres of land along Jalan Tun Razak (Jalan Pekeliling) was acquired for the construction of 7 blocks of 17-storey flats, and 4 blocks of 4-storey flats comprising about 3000 units of low costs flats and 40 shop lots. The second pilot project was in Pulau Pinang with the construction of 6 blocks of 17-storey flats and 3 blocks of 18 storey flats comprising 3,699 units and 66 shop lots along Jalan Rifle Range (Harun Din, 1984)

### **1.3 Problem Statement**

On one hand different studies have been carried out regarding the material and supplier selection in order to aid the construction projects to have smooth process with respect to procurement stages.

On the other hand, Industrialized building systems attempts to expedite the execution of the project by providing the materials for the project to be produced and constructed readily at the optimum time.

Taking into consideration of both aforesaid statements, there are several criteria which need to be considered during the selecting of Industrialized Building Material (IBM) such as issue of cost management. This project aims to develop a method to assess the decision making process in optimizing the Industrialized Building System Material (IBS-M) supplier selection in term of Cost and time.

### **1.4 Supplier selection**

Supplier selection decisions are an important component of production and logistics management for many firms. Such decisions entail the selection of individual suppliers to employ, and the determination of order quantities to be placed with the selected suppliers. Selecting right suppliers significantly reduces the material purchasing cost and improves corporate competitiveness, which is why many experts believe that the supplier selection is the most important activity of a purchasing department Willis HT (1993) and Dobler DW (1990).



Many factors affect a supplier's performance. Dickson (1996) identified 23 criteria that have been considered by purchasing managers in various supplier selection problems. More recently, a review of supplier selection criteria and methods by Weber et al. (1991) found that 47 of the 76 articles reviewed addressed more than one criterion. Hence supplier selection problem (SSP) is a multiple criteria problem and it is necessary to make a trade-off between conflicting tangible and intangible factors to find the best suppliers.

Meanwhile the main issues which affect delays in these durations and their degree of importance and the possibility of reducing or eliminating them have not been addressed accordingly by the construction practitioners.

Supplier Selection Problem (SSP) is complicated by the fact that various criteria must be considered in the decision making process. SSP is further complicated by the fact that individual suppliers may have different performance characteristics for different criteria. For example, the supplier who can supply an item for the lowest per unit price may not have the best quality or service performance among the competing suppliers.

Supplier selection is therefore an inherent multi-objective decision that seeks to minimize procurement cost, maximize quality and service performance concurrently. Often complicating the SSP for the buyer is the presence of price discounts, offered by supplier, that depend on the total value of sales volume, not on the quantity or variety of products purchased over a given period of time. In traditional quantity discount pricing schedules, price breaks are a function of the order quantity which existed for each product, irrespective of the total purchasing volume over a given period of time.

In traditional quantity discount pricing schedules, price breaks are a function of the order quantity which existed for each product, irrespective of the total purchasing volume over a given period of time. With the advent of just-in-time (JIT) purchasing, the strategy that calls for ordering smaller lot-size is more practical and

feasible. So suppliers are finding it more meaningful to give discounts based on the total value of multi-product orders (i.e. total business volume) placed by a given buyer.

### **1.5 Aims and Objectives of Study**

Little attention is given in literature to decisions to the appropriate selection of suppliers. However in construction projects the cost of material constitutes the main cost of the project. It is worth to mention that there are multiple characteristics and criteria with respect to industrialized building materials in term of selection of them to be used in the project such as delivery time, logistic issues, erection process , cost of purchasing etc. The main aim of the study is to develop the Analytic hierarchy Process (AHP) with consideration of aforementioned criteria in order to select the best supplier of IBS-M. Taking into consideration of all criteria will lead the project to be done at the lowest price while the time of the process has been taken into account simultaneously which also has a big affect on overhead cost of execution of the project.

The aim of this study is to using the Analytic hierarchy Process method in order to select the best IBS-M supplier with consideration of relevant criteria related to application of IBM targeting minimizing the cost of project during procurement and erection process. Objectives of study are as following:

- 1) Determination of critical factor of IBS-M specification which influence procurement and erection time and cost.
- 2) Developing the decision making model to select the best choice with respect to outcome of aforementioned target.

### 3) Implementing the whole on a case study

This project aims to develop a method to assess the decision making process in optimizing the IBM supplier selection in term of Cost and time.

#### **1.6 Scope of Study**

The Scope of study of the research is targeting the construction projects in Malaysia which are using the Industrialized Building System. Industrialized Building Material which should be supplied for the project will be evaluated through the developed methodology for selecting the suppliers. Secondly, the research writer would like to focus his study on IBS, AHP Model IBS-M and Procurement section of construction projects.

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