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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

A PRELIMINARY EVALUATION  
OF PREFABRICATED BATHROOM  
FOR HIGH-RISE HOUSING SCHEMES  
IN MALAYSIA

BY

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INTERNATIONAL ISLAMIC  
UNIVERSITY MALAYSIA

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A PRELIMINARY EVALUATION OF  
PREFABRICATED BATHROOM FOR HIGH-RISE  
HOUSING SCHEME IN MALAYSIA

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ZULKEFLE BIN ISMAIL

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## ABSTRACT

The main objectives of this research are to investigate the significant factors of the implementation of prefabricated bathroom as part of Industrialized Building System (IBS), and the relationship between quality, cost and productivity. The preliminary idea to this research come from the national aspiration of Vision 2020 that is to transform and industrialized the Malaysian construction industry. The evolution of industrialization from craftsmanship into a developed process that eventually evolved to the production of bathroom is highlighted. A system architecture, which takes advantage of new technology, could change the entire construction industry. Most of housing industry in developing countries did not take the advantage of advancement in manufacturing industry especially the implementation of Industrialized Building System (IBS) such as prefabricated bathroom. Factory-manufactured components for example the prefabricated bathroom are easy to assembled on-site, use less labour, faster to construct and it has a high quality which will add value to the houses. The methodology used in this study are questionnaire, semi-structured interviews and observation. They are used to identify the status of implementation of prefabricated bathroom in Malaysia. The findings identified that architects and engineers tend to reject the implementation of prefabricated bathroom in Malaysia. The needs to cut cost and improvement in quality of prefabricated bathroom will give a greater drive to its usage in construction sites and achieved customer's satisfaction. The implementation of prefabricated bathroom could help to reduce construction time and site labour. It will also relieve the labour crisis, improved quality while keeping cost reasonable. Further development in prefabrication will also leads to closer integration between building services and manufacturing engineering without compromising the users preference. As a conclusion, to achieve the customer's needs and satisfaction, design guidelines need to be developing as a standard for construction practice in order to enhance the usage of prefabricated bathroom in Malaysia. The Malaysia government should play a greater role in exposing and encouraging the construction industry and the public to the next generation of prefabricated bathroom design and technology.

## ملخص البحث

تتمثل الأهداف الرئيسية لهذا البحث في فحص العناصر الهامة لأدوات الحمّام الجاهز كجزء من نظام المباني الصناعية (IBS)، وعلاقتها بين المظاهر العامة للنوعية والتكلفة ولمعدل الإنتاج. والفكرة المبدئية لهذا البحث تتمثل في الطموح الوطني من رؤية 2020 الذي يسعى إلى تحويل وتصنيع أعمال المباني الماليزية. وأصبح ارتفاع التصنيع من الحرفة إلى مرحلة التشييد المتطور بارزا من ناحية الابتكار الجديد للحمّام السكني. وباستطاعة النظام المعماري المطبق على التكنولوجيا الجديدة أن يغير التصنيع البنائي بأكمله. أغلب الصناعات السكنية في الدول النامية لم تنتهز فرص التقدّم الصناعي وخاصة من الناحية التطبيقية لنظام المباني الصناعية (IBS) مثل الحمّام الجاهز. الأجزاء المركبة التي تصنعها المصانع مثل أدوات الحمّامات الجاهزة تركيب بسهولة في مواقع البناء، وتحتاج إلى قليل من العمال إلى جانب سرعة الإنجاز والنوعية العالية والتقنية المتقدمة وكذلك زيادة في القيمة السكنية. المنهجيات المستخدمة لإجراء هذه الدراسة تتضمن الإستفتاء، والمقابلات والملاحظات لتمييز الطبيعة التطبيقية للحمّام الجاهز في ماليزيا. توصلت النتائج إلى أن المهندسين والمعماريين يميلون إلى رفض الأدوات المستعملة للحمّام الجاهز في ماليزيا. والحاجات إلى تخفيض الثمن وتحسين النوعية لأدوات الحمّام الجاهز ستعطي حيوية رفيعة في استخدامها في بناء القطع الأرضية وإرضاء الزبائن. وتصنيع الأدوات للحمّام الجاهز سيساعد في تقليل زمن البناء وتسهيل العمل على القطعة الأرضية. كما أنه سيخفف في أزمة العمل، ويحسن النوعية إلى جانب السعر المعقول. وسيؤدّي التطور المستمر في هذا التصنيع إلى تكامل أقرب بين خدمات البناء والهندسة الصناعية من دون شبهة في إرضاء المستخدمين. وفي الخلاصة نتلمس ضرورة إيجاد كل ما يحتاج إليه الزبائن ويرضونه وذلك عن طريق التخطيط لحلّ مشاكل التصميم وتطوير دليله كميّار ممارسة البناء نحو تحسين الحمّامات الجاهزة في ماليزيا. وعلى الحكومة الماليزية أن تؤدي دورا كبيرا في عرض وتشجيع التصنيع البنائي للجيل القادم في التصميم والتكنولوجيا الجديدة لأدوات الحمّام الجاهز.

## ABSTRAK

Objektif utama penyelidikan ini adalah untuk mengkaji faktor-faktor yang signifikan di dalam pelaksanaan bilik air pasang siap yang merupakan sebahagian daripada Sistem Binaan Berindustri (IBS) dan hubungannya dengan aspek-aspek kos, kualiti dan produktiviti. Aspirasi nasional Wawasan 2020 untuk merubah dan memajukan sector pembinaan negara ke arah berindustri menjadi idea awal penyelidikan ini. Evolusi perindustrian dari kerja-kerja ketukangan kepada proses pembangunan yang akhirnya berkembang hingga ke peringkat pengeluaran bilik turut diketengahkan. Senibina sistem yang memanfaatkan teknologi terkini dapat menukar seluruh industri pembinaan. Kebanyakan negara-negara sedang membangun kurang memanfaatkan kelebihan industri pembuatan Sistem Binaan Berindustri (IBS) terutamanya di dalam pelaksanaan bilik air pasang siap di dalam industri pembinaan mereka. Komponen yang dikilangkan seperti bilik air pasang siap mudah dipasang, menggunakan kurang pekerja, lebih cepat dibina dan ianya berkualiti tinggi di mana akan menambah nilai bangunan kediaman. Kaedah penyelidikan ini ialah borang kaji selidik, temuduga separa berstruktur, dan pemerhatian. Ianya telah dijalankan bagi mengenalpasti status pelaksanaan bilik air pasang siap di Malaysia. Hasil penyelidikan mendapati arkitek dan jurutera bangunan lebih cenderung kepada menolak pelaksanaan bilik air pasang siap di Malaysia. Keperluan mengurangkan kos serta meningkatkan kualiti bilik air pasang siap akan memberi daya penggerak yang besar terhadap penggunaan yang meluas di tapak pembinaan serta mencapai kepuasan pelanggan. Pelaksanaan bilik air pasang siap telah dikenalpasti dapat membantu mengurangkan masa pembinaan dan penggunaan tenaga buruh di tapakbina. Ini juga akan dapat mengurangkan krisis buruh, meningkatkan kualiti disamping mengekalkan kos yang munasabah. Pembangunan kaedah pasang siap akan membawa kepada integrasi yang baik antara kemudahan bangunan dan kejuruteraan pembuatan tanpa mengkompromi kecenderungan pengguna. Kesimpulannya, untuk memenuhi kehendak dan kepuasan pelanggan, garis panduan rekabentuk haruslah dibentuk sebagai piawaian untuk amalan pembinaan untuk meningkatkan penggunaan bilik air pasang siap di Malaysia. Kerajaan Malaysia perlu memainkan peranan menggalakkan orang ramai dan industri pembinaan negara kepada teknologi dan rekabentuk terkini bilik air pasang siap.

## APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Built Environment).

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## DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Zulkefle bin Ismail

Signature.....

Date.....

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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FOR HIGH-RISE HOUSING SCHEMES IN MALAYSIA**

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*In the name of God, Most Gracious, Most Merciful*

*“By (the Token of) Time (through the Ages), Verily Man is in loss,  
Except such as have Faith, and do righteous deeds, and (joint together)  
in the mutual teaching of Truth, and of Patient and Constancy.”*

*(Qur’an, Al ‘Asr: 1 – 3)*

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# **CHAPTER ONE**

## **INTRODUCTION**

This study investigates the factors and analyses the prospect of implementing prefabricated bathroom in Malaysia. The implementation of Industrialized Building System (IBS) in Malaysia and issues surrounding construction industry are discussed. This chapter starts with the background of the study, a brief review of the nature of problems, aims and objectives, scope of the study, overview of methodology and the significance of the study.

### **1.0 THE CURRENT SITUATION**

The needs for Malaysian construction industry to be competitive in the emerging global economy are crucial. Industrialization of high-rise residential building components is critical in order to be competitive. Besides new trend in design and construction, the high demand on housing due to increasing population makes the high-rise housing the best alternative to solve the housing problem given the limited space for such development especially in the city.

According to Construction Industry Development Board (CIDB), Malaysian construction industry is currently facing problems due to poor site condition, too much dependency on foreign workers, low productivity, poor quality, and high wastage. Some construction players have responded to this crisis by adopting prefabrication system i.e. Industrialized Building System (IBS) and by building a more uniform product (CIDB, 2005).

According to Thomas (2005), prefabricated bathroom is becoming more popular in some developed countries. It has become an important and cost effective concept in today's fast track construction culture (Percival, 2005; Ballard and Arbulu, 2004; Gibb, 1999; Bottom, et al., 1996). Prefabrication techniques transform some of the construction process to a controlled factory environment. A more uniform product has slightly increased the quality of bathroom and decreased the amount of learning required to construct a bathroom. However, bathroom manufacturers are still unable to provide a high quality bathroom or reduce the cost and time of manufacturing.

According to Sebestyén (1998), the efficiency in manufacturing give prefabricated bathroom a good reputation which is good for future development of its technology and innovation. Unfortunately, poor joint design and component integration have resulted in leakages that give negative image to the prefabricated bathroom in Malaysia (Chan, 2005). Therefore, there is a need to explore and enhance the present technology of prefabricated bathroom.

## **1.1 THE RESEARCH GOAL AND OBJECTIVES**

The goal of this research is to evaluate and to determine the impact of the application of prefabricated bathroom in Malaysia's construction industry. To address this goal, the research explores the benefits and advantages of prefabrication to construction industry, the requirements for its implementation, the factors to be considered in developing Industrialized Building System (IBS), and its maintenance. The characteristics of Singapore's construction industry and the contributing factors that lead to their success in implementing the prefabricated bathroom to their high-rise residential building are studied.

The Joint Committee on Standards for Educational Evaluation (1994) defined evaluation as “systematic investigation of the worth or merit of an object.” Accordingly, evaluation should be conducted for action-related reasons, and the information provided should facilitate the decision on course of action.

Evaluation was used firstly because evaluation provides information to help improve the research. Information on whether goals are being met and on how different aspects is working and essential for continuous improvement process. Secondly, evaluation provides information for communicating construction industry players. It allows research to enhance the analysis of the study and test the research hypothesis. In this study, the evaluation of prefabricated bathroom is based on observation, questionnaires and interviews.

A survey was conducted on the construction players to determine the success of implementing prefabricated bathroom in their project. Interviews were conducted to find out the problems and issue during its implementation. Finally, this research will come up with pertinent findings and recommendations on prefabricated bathroom implementation in Malaysia.

As a summary, the main objectives of this research are:

- To investigate the significant factors of implementing prefabricated bathroom as part of Industrialized Building System (IBS), and
- To investigate the relationship between quality, cost, design, and construction process of prefabricated bathroom.

## 1.2 STATEMENT OF THE PROBLEM

The research problems were identified in three (3) areas. The first area is Industrialized Building System (IBS) as a new construction system in Malaysia which is elaborated in Chapter 2. The second area is a subset of the first, which is prefabricated bathroom for high-rise residential buildings. This is discussed further in Chapter 2. The third area is construction players, who are the key-persons from who data is obtained. This is discussed further in Chapter 3. The intersection of these three areas is shown below in Figure 1.1:

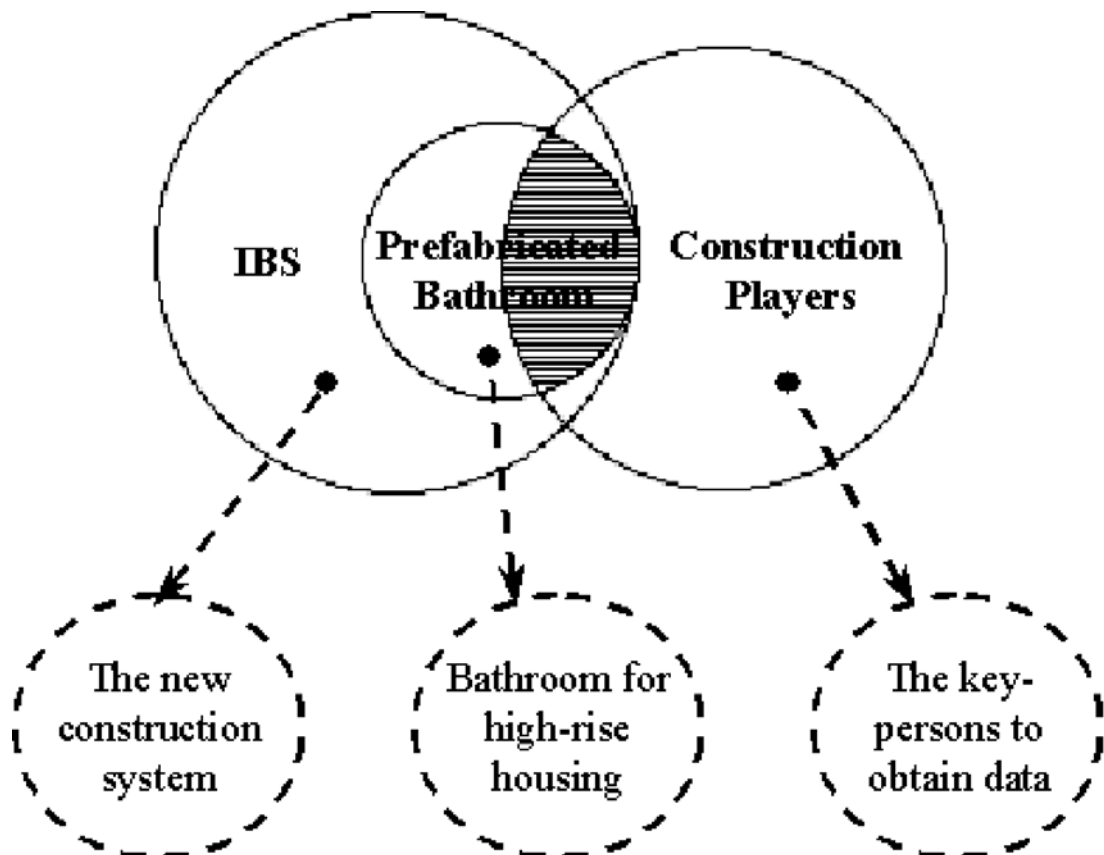


Figure 1.1: The intersections between Industrialized Building System (IBS) for Prefabricated Bathroom and Construction Players.

Most of the buildings in Malaysia are built in a craft manner almost the same way, as it was constructed hundred years ago. This lack of improvement in the construction process has severely limited the industry's ability to improve its product. According to Lawrence (2003), the cost of high-rise housing has continually risen, while the quality has fallen. Resources and labour have become more expensive, and the inefficient craft system is not well equipped to deal with these problems. According to CIDB (2003), IBS Roadmap 2003-2010 aims to reduce the dependency on foreign workers in stages from 75% in 2003 to 55% in 2005 and 15% in 2009. Lawrence (2003) claimed that on-site labour could account for up to 80% of the cost while only 20% is spent on materials produced off-site.

In a forum at Construction Industry Development Board (CIDB) key issues of prefabricated bathroom in order to create high-value housings have been raised. Two questions on the implementation of prefabricated bathroom were raised in this forum:

- How to develop prefabricated bathroom related to design, products (quality and cost), technologies (construction) and services (maintenance) for buildings?
- How to introduce the industry and public to the next-generation of prefabricated bathroom design and technology?

It is important to note that prefabricated bathroom is not a 'standard building modules', but it is used to achieve a variety of designs at reduced cost. The consumer demands personalized solutions, which are too expensive to be provided unless the manufacturers offer various designs of prefabricated bathrooms. The consumers also want to be able to modify their bathroom when their needs increased or according to their satisfaction. Therefore, the prefabricated bathroom should offer quality and variety in designs at a reasonable cost.