UNIVERSITI TEKNOLOGI MARA

OPTIMISING A MODULAR DESIGN FOR AFFORDABLE HOME

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ABSTRACT

The needs of the affordable houses amongst Malaysians are much more than the total amount of the house that has been built. Most affordable public housing schemes in Malaysia are built under PR1MA in which the construction is based on the Industrialized Building System (IBS). Adoption of Modular Construction System (MCS) to IBS is an innovative way to promote new technology in the Malaysian construction industry. Recent studies found that there are multiple issues faced by building industrial players in the Malaysian construction industry such as the lack of modular experts, technology and technical failures (manufacturing and construction). Therefore, the research aims to identify the perception of MCS technology by the industrial players and to analyse the existing combinatorial spatial planning for affordable home (modular pattern). The research methods focus more on qualitative methods where content analysis is derived from literature and an analysis of building case studies through structured questionnaire interviews with the building experts. It consists of 3 phases of data collection and analysis such as a) Preliminary phase (Desktop Study), b) Data Collection and Analysis Phase (Combinatorial Design Development and Design Proposal) and c) Data Collections from the View of Experts as Validation. The research objectives that are satisfied are: 1) Experts' suggestion of MCS as a three-dimension (3D) prefabrication modular model. Local industry players faced technical difficulties in utilizing IBS in the conventional construction cost of MCS due to competency issues despite high demand. In addition, MCS production qualities are much better than a conventional system with a consideration of culture, climate, and innovation in modular concepts. 2) Identifying the main three spatial patterns such as the professional spatial pattern, combinatorial spatial pattern and traditional spatial pattern. The professional spatial pattern that is applicable for affordable home planning such as PR1MA and MCS was identified. A combinatorial pattern refers to current research findings. A traditional spatial pattern describes the spatial planning that has been used in the past. The study found a square shape equation where n has been used for a combinatorial spatial pattern (Pattern B: $4n$) and was revealed as the most practical and feasible modular home pattern by the experts. As a result, the recommended shapes to be adopted in the modular spatial affordable home are square and rectangular with a standardized module generated by the square and rectangular ($n + 2n$). An interlocking combinatorics and data science of modular architecture would be able to improve the decision-making process and to drive industry players forward in the construction industry. The future research areas that should be considered include an algorithm language (computational design) in designing the spatial planning as a current professional practice as it is influenced by the digitalization of the construction industry.

Keywords: Affordable Home, Modular Construction System (MCS), Combinatorial Concept

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CHAPTER ONE
INTRODUCTION

1.1   Chapter Overview

This chapter will present an overview of the whole research studies. The study will be on Modular Construction System (MCS), affordable homes in Malaysia and design sustainability in terms of shape, especially towards Design Mathematics (DM) known as Combinatorial Concept (CC).

1.2   Introduction

IBS in Malaysia has already been introduced 30 years ago. The Malaysian government introduced several IBS development in recent years. However, building industrial players faced many issues regarding this system in construction. MCS is part of IBS as it is completed by the 3D module or compartment. It is an alternative way and fast construction in building a home or office. MCS also can be defined as the latest technology introduced in the IBS system in Malaysia. Current Malaysian construction, the cost of labour is cheaper to be used than.t using tools, machinery, and robot. Most of the labour was foreigners. Foreign laborers are typically connected with untalented specialists and in this way gave a negative impact on the profitability and nature of the building industry (Eric Lau, 2012).

Social problems associated with foreign workers have further aggravated the situation. The self-aggravated three-dimensional syndrome—dirty, difficult, and dangerous—distanced the local workforce and new graduates from participating in the industry (Lou & Kamar, 2012).

The productivity level of the industry experienced a 1.52% increase from the previous year, but the level of growth is relatively low compared with other industries in the country [Malaysian Productivity Corporation (MPC) 2009].

Occupational accidents and the death rate in the industry are among the highest in the country, amounting to a total of 72 reported cases in 2008 and 95 reported cases in 2007. These rates were on par with the number of cases in the manufacturing